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# Information asymmetry and investor trading behavior around bond rating change announcements

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# Information asymmetry and investor trading behavior around bond rating change announcements


## Abstract

This study examines stock market reactions to public announcements (corporate bond rating changes), including changes in stock prices and investor behavior in terms of trading volumes and patterns. Abnormal returns, abnormal volumes, and net order imbalances are estimated using high-quality stock transaction data from Korean firms, whose bonds were rated by Korea's leading credit rating agencies between 2000 and 2015. We find positive (negative) abnormal stock returns around upgrades (downgrades), although the stock price reactions to downgrades are more statistically significant than those to upgrades. Significant abnormal volumes and order imbalances are found around rating changes, and the extent to which each investor group (domestic individuals, domestic institutions, or foreign investors) reacts to a rating change varies. Our analyses also support that foreign and domestic institutional investors are better informed than individual investors.



*JEL classification*: G10, G15

*Keywords*: Abnormal return; Announcement effect; Bond rating change; Information asymmetry; Investor trading behavior

## 1. Introduction

In the field of financial economics, the issue of information asymmetry among investors has long been studied and documented, and evidence suggests that certain types of investors achieve superior investment performances and make better stock return predictions than others. Interestingly, however, empirical studies have provided mixed results. One group of studies finds that domestic investors outperform their foreign counterparts due to their greater access to information about local companies, that is, their familiarity and proximity (Bae, Stulz, and Tan, 2008; Chan, Menkveld, and Yang, 2007; Choe, Kho, and Stulz, 2005; Dvořák, 2005; Hau, 2001; Lee, Ryu, and Kutan, 2016). Another group of studies finds that foreign investors have an informational advantage over domestic traders due to their experienced trading skills and sophisticated trading strategies (Bae, Yamada, and Ito, 2006; Chung, Kim, and Ryu, 2017; Froot and Ramadorai, 2008; Grinblatt and Keloharju, 2000; Huang and Shiu, 2009; Kamesaka, Nofsinger, and Kawakita, 2003; Richards, 2005; Yang, Ryu, and Ryu, 2017). In the global stock markets, a majority of studies document an informational advantage of institutional investors over individual investors, and these findings are consistent with the perception that institutions are relatively more experienced and skillful than individuals, who tend to make irrational investment decisions (Barber, Lee, Liu, and Odean, 2009; Brandt, Brav, Graham, and Kumar, 2009; Chuang and Susmel, 2011; Dorn, Huberman, and Sengmueller, 2008; Ng and Wu, 2007; Nofsinger and Sias, 1999).

This study examines stock market reactions to corporate bond (credit) rating change announcements, including changes in stock prices and investor behavior in terms of trading volumes and trading patterns, in the Korean market, which has been shown to exhibit significant information asymmetry across different investor groups. This study particularly delves into the questions of whether information asymmetry across different investor groups exists around bond rating change announcements, and, if so, whether this informational advantage is utilized to achieve abnormal stock returns. The motivation of this study is threefold. First, a number of studies examine the effect of bond rating changes on stock market behavior (i.e., stock returns and trading volumes), but differences in investor behavior due to information asymmetry have been much less frequently explored. The Korean financial market has a distinct framework in that domestic individual investors, who are generally considered uninformed traders making noisy and speculative trades, are major market participants, whereas developed financial markets, such as the New York Stock Exchange, are mainly led by institutional investors. Figure 1 shows the trading activities of domestic individuals, domestic institutions, and foreigners in the Korea Composite Stock Price Index (KOSPI) equity market. According to the Korea Exchange (KRX), during the overall sample period (2000-2015), trades by domestic individuals account for 88.17% of total trades, whereas those by domestic institutions and

foreigners account for 5.58% and 6.00% of total trades, respectively.[1] This predominance of individual investors in the Korean market provides an ideal setting to discern information asymmetry among investor groups.

[Figure 1]

Second, although KRX has the fourth largest bond market in the world in terms of trading volume,[2] little attention has been paid to the behavior of emerging stock markets, including that of KRX, around rating change announcements. Furthermore, Korean credit rating agencies have consistently endeavored to enhance their rating quality through strategic alliances with the major international agencies, like Moody's and Fitch. Considering the size of the Korean stock and bond markets and the world-class standard rating quality of the rating agencies, it is worth examining the informational effect of bond rating changes on the Korean market, which is a leading and representative emerging market.

Another motivation is that a majority of event studies testing informational superiority focus on earnings announcements as scheduled announcements (Ali, Klasa, and Li, 2008; Barber and Odean, 2008; Battalio and Mendenhall, 2005; Bernard and Thomas, 1990; Bhattacharya, 2001; Campbell, Ramadorai, and Schwartz, 2009; Kaniel, Liu, Saar, and Titman, 2012; Kaniel, Saar, and Titman, 2008; Utama and Cready, 1997; Walther, 1997), whereas unscheduled announcements have received relatively little attention. As unscheduled announcements have no fixed timing or direction, it enables a clearer analysis of information asymmetry among investors through the differences in trading volume and patterns between informed and uninformed traders before and after unscheduled announcements. Therefore, we focus on bond rating change announcements as unscheduled announcements.

Credit risk refers to the likelihood that an issuer will fail to meet its financial obligations on its financial instruments (e.g., commercial papers and corporate bonds). The level of credit risk is usually indicated by "credit ratings," which are assigned and published by external companies called credit rating agencies. Credit ratings not only serve as an indicator of the issuer's capacity to make interest and principal payments on its bonds in accordance with the agreed terms, but they also convey information on an issuer's future cash flows, as the ability to repay the principal at maturity reflects the issuer's capacity to generate certain cash flows on a specific date in the future. Therefore, credit

[1] The dominance of domestic individual investors in the Korean market and their characteristics are also documented in the previous literature (Ryu, 2011; Ryu, Kang, and Suh, 2015; Ryu, Kim, and Yang, 2017; Webb, Ryu, Ryu, and Han, 2016). In the Korean market, foreign investors mostly consist of foreign institutions.

[2] World Federation of Exchanges Monthly Report – December, 2014

ratings provide a critical source of information about firms that stakeholders, including investors, can use to reduce the level of information asymmetry that they may otherwise potentially face. Hence, it is worth studying whether and to what extent bond (credit) ratings can be used by investors as reliable and informative instruments for investment decisions. Using the high-quality equity transaction data of Korean listed firms that experienced bond rating changes, we investigate how informative rating changes are by analyzing stock price responses. In addition, we examine the investor trading behavior in response to rating changes (i.e., changes in trading volumes and order imbalances), particularly focusing on the reactions of different investor groups classified as domestic individual, domestic institutional, and foreign investors.

Our contributions are as follows. First, we document not only the stock price responses to the information driven by the bond rating changes but also the differing trading patterns of investors by examining the abnormal trading volumes and net order imbalances of different investor groups. Second, the availability of high-quality trade data classified by investor type enables us to analyze the differing trading patterns of each investor group and to gain more insight into information asymmetry. Thus, we further examine whether any particular group of investors has realized capital gains through the information edge and carry out more sophisticated analyses differentiating the trading behavior of each investor group (i.e., domestic individuals, domestic institutions, or foreign investors) by examining each group's net order imbalance for individual stocks, which has not been covered in depth by existing studies owing to the limitation in their dataset.

We find the followings by the empirical analyses on the high-quality dataset. First, though abnormal stock returns are observed around both upgrade and downgrade (bond rating) announcements, stock price reactions to downgrade announcements are statistically more significant than those to upgrade announcements. This indicates that the stock market reacts more sensitively to rating downgrades than to upgrades.

Second, the trading volume generally reacts more strongly to downgrades than to upgrades. Through the analyses on the aggregate dataset, we find that downgrades are significantly associated with the abnormal trading volume behavior, whereas there is little evidence of a volume effect associated with upgrades. Investor type analyses indicate that upgrade announcements elicit significant increases in abnormal volumes for domestic institutions and foreign investors, whereas significant increases are observed for domestic individuals only when downgrade announcements take place. These suggest that trading responses towards identical event types (upgrades or downgrades) vary across investor groups, indicating the presence of information asymmetry among investors.

Third, an excess of sell orders is observed for domestic individuals around upgrades, whereas the opposite order imbalance is found for foreign investors, implying that foreign investors buy the stocks with upgrade announcements and anticipate capital gains over a longer time horizon. These support the relative information edge of foreign investors compared to domestic individual investors. On the

other hand, domestic institutions react to downgrades by placing more sell orders, whereas individuals place more buy orders; this result indicates that individual investors are likely to face impending capital losses and, thus, are disadvantaged by the downgrade announcements. Thus, domestic and foreign institutional investors have an informational advantage over the individual investors in the Korean market.

The rest of the paper is organized as follows. Section 2 presents a literature review. Section 3 explains the bond rating process in the Korean market, and Section 4 describes the sample data and methodology. Section 5 provides the main empirical results and discussions, and Section 6 concludes.

## 2. Literature Review

The prior literature has used various approaches to examine stock market reactions to rating changes. Holthausen and Leftwich (1986) and Stickel (1986) distinguish "uncontaminated" rating change announcements, which do not contain a potential confounding effect due to other concurrent news releases, from "contaminated" announcements,[3] and they demonstrate a significant stock price reaction to a rating change announcement *per se*. Dichev and Piotroski (2001) analyze the long-term price effect associated with credit rating changes. Their results, based on cumulative abnormal returns (CARs) and buy-and-hold abnormal returns that are estimated for periods of three and six months and one, two, and three years, respectively, show that downgraded firms have poor returns on average and across samples with different time horizons, implying that downgrades are expected to be detrimental to the future profitability of a firm. Jorion, Liu, and Shi (2005) examine the effect of fair disclosure regulation on the information content of credit ratings and show that the informational effects of both downgrades and upgrades are more pronounced during the post-fair disclosure sample period. Li, Shin, and Moore (2006) compare the stock price responses to credit rating changes made by global rating agencies to the responses of those made by local rating agencies in the Japanese stock market and find that credit downgrades are more significantly influenced by the evaluations of global raters than by those of local raters. Choy, Gray, and Ragunathan (2006) analyze Australian firms rated by Standard & Poor's and Moody's and find significant stock market reactions to downgrades only. They also document a substantial capital loss of downgraded firms, which verifies that credit ratings convey critical information content. Purda (2007) examines stock price reactions to anticipated and unanticipated rating changes and finds no significant difference between them. The regression results

[3] Stickel (1986) defines a contaminated (clean) announcement as a rating change announcement that is (not) accompanied by other concurrent firm-specific news released during days -1 to +1 (where day 0 is the rating change date) that may have an impact on the stock price. Such news can include major announcements, such as earnings performance and earnings forecasts; dividend changes; CEO changes; and mergers and acquisitions. Similarly, Holthausen and Leftwich (1986) define a rating-change announcement as "contaminated" if contaminating news occurred during days -1 to +2.

indicate significant negative reactions to both anticipated and unanticipated downgrades, but they provide no indication of significant reactions to upgrades. Moreover, Purda (2007) correctly predicts about 20% of rating downgrades, including the timing and direction of changes, using the financial information, market information, and publicly available information provided by Moody's and its competitors, which indicates that Moody's and Standard & Poor's provide a mutually strong signal of rating changes.

The prior literature has provided mixed evidence on stock price reactions to rating changes, depending on the sample composition and the methodology employed. In general, however, many studies have found significant stock price responses to downgrades but not to upgrades (Bissoondoyal-Bheenick, 2004; Choy, Gray, and Ragunathan, 2006; Cornell, Landsman, and Shapiro, 1989; Dichev and Piotroski, 2001; Griffin and Sanvicente, 1982; Hand, Holthausen, and Leftwich, 1992; Holthausen and Leftwich, 1986; Jorion and Zhang, 2007).[4] On the other hand, several studies examine stock market reactions after solicited and unsolicited announcements and find significant stock market reactions to announcements of new unsolicited ratings, implying that unsolicited ratings convey new information to equity markets (Behr and Güttler, 2008; Byoun, Fulkerson, Han, and Shin, 2014).

The recent literature includes studies of the information content of rating reviews, that is, Fitch's "Rating Alert," Moody's "Watchlist," and Standard & Poor's "CreditWatch". Rating reviews are intended to strongly signal a potential future rating change of an issuer. Using Moody's "Watchlist" data from 1982 to 2004, Bannier and Hirsch (2010) document differing roles of rating reviews pertaining to the issuer's creditworthiness. Rating reviews serve to maintain informational efficiency for highly rated issuers, whereas they are used to carry out implicit contracts for issuers with lower ratings. Chung, Frost, and Kim (2012) conduct an event study using Moody's press releases and demonstrate that rating reviews (i.e., credit watch actions) convey significant information.

Similarly, Grier and Katz (1976), Weinstein (1977), Hand, Holthausen, and Leftwich (1992), and May (2010) examine the bond market reaction to rating changes using the bond price, and they find mixed evidence that rating changes have an effect on the bond market, depending on the methodology used. Using monthly bond returns, Weinstein (1977) finds no significant abnormal returns around rating changes, whereas Grier and Katz (1976) find evidence of a significant negative reaction to downgrades. Steiner and Heinke (2001) examine daily Eurobond returns and find significant abnormal returns associated with announcements of downgrades and negative rating reviews (e.g., Watchlist) but little evidence of any effect of upgrade announcements or positive rating reviews. On

[4] Goh and Ederington (1993) argue that downgrades can actually be good news for stockholders if downgrades reflect expected wealth transfers from bondholders to stockholders due to an increase in the firm's leverage. They demonstrate that downgrades send negative signals to market participants and, thus, have significant negative effects on stock prices when a firm is downgraded because of its deteriorating financial outlook rather than because of increased leverage.

the other hand, using daily bond returns, Hand, Holthausen, and Leftwich (1992) document both significantly negative abnormal returns around downgrades and significantly positive abnormal returns, albeit to a lesser extent, around upgrades. May (2010) similarly finds significant reactions to both upgrades and downgrades. Kliger and Sarig (2000) examine whether rating information is valuable and show that if Moody's announces better-than-expected (worse-than-expected) ratings, the debt value increases (decreases) and the equity value falls (rises).

Finally, a different branch of the literature examines the credit default swap (CDS) market reaction to rating change announcements (Finnerty, Miller, and Chen, 2013; Galil and Soffer, 2011; Hull, Predescu, and White, 2004; Norden and Weber, 2004). Hull, Predescu, and White (2004) examine the dynamics of CDS spreads in relation to rating events, including rating change announcements, rating reviews, and outlooks, and find a significant relationship between negative rating events and CDS spread changes; moreover, negative rating events are much more significant than positive rating events. Galil and Soffer (2011) document a stronger CDS market response to bad news than to good news and find that good news is also more infrequent than bad news. Therefore, the residual contribution of a single positive rating announcement is still significant. Kiesel (2016) examines the CDS and stock market response to rating changes during the financial crisis and shows no significant CDS market reaction to rating announcements during the crisis.

**3. The credit rating process in the Korean market**

The history of credit rating agencies in Korea dates back to 1985, when the Korea Investors Service, Inc., Korea's first credit rating agency (established in February 1985), introduced credit rating services to local commercial paper markets in September 1985. NICE Investors Service Co., Ltd. (formerly National Information and Credit Evaluation, Inc.) began its rating service in September 1986, followed by Korea Ratings Co., Ltd. (formerly Korea Management Consulting Credit Rating Corporation) in November 1987. The credit evaluation system was first introduced to grant the entitlement of the issuance of commercial papers to issuers with a credit rating of B or above. Since then, credit rating schemes have been published to rate corporate bonds, such as straight bonds or convertible bonds, with requirements of issuance. The system authorizes issuers with a credit rating of A or above to issue straight bonds and those with a rating of BBB or above to issue convertible bonds. In May and July 1994, multiple credit ratings were required to issue commercial papers and unsecured bonds, respectively.

In Korea, the Asian financial crisis of 1997 saw the credit rating system grow in prevalence. In December 1997, the Korean government increased the issue limit of corporate bonds to aid firms in raising funds in the wake of the crisis. Meanwhile, the issue of unsecured bonds proliferated, and the issue of secured bonds ceased, as banks strove to avoid being the financial guarantors of corporate bonds, lest the capital-adequacy ratio stipulated by the Bank for International Settlement be

jeopardized. Additionally, the regimes of Korean credit rating agencies changed considerably in the wake of the Asian financial crisis. First, more stringent credit rating standards made it difficult for issuers to increase their ratings. Second, Korean credit rating agencies began to enhance their global competitiveness by forging alliances or business affiliations with leading international rating agencies; for example, Korea Investors Service, Inc. affiliated with Moody's in 1998, NICE Investors Service Co., Ltd. affiliated with DCR in 1998, and Korea Ratings Co., Ltd. affiliated with Fitch IBCA in 1999. Third, structured products, including asset-backed securities (ABS), which are specifically intended to enhance credit, entered the Korean market in 1999. Fourth, the implementation of a new advanced capital adequacy framework known as Basel II, which was adopted in 2007, forced banking institutions to rely more on assessments of credit risk by external rating agencies.

Korea Investors Service, Inc. provides independent opinions in three categories: long-term obligation ratings, short-term ratings, and issuer ratings. These ratings assess the creditworthiness of an issuer itself or of one of its debt issues and can be sector-specific. Long-term obligation ratings are opinions regarding the relative credit risk of financial obligations with an original maturity of one year or more. In general, long-term ratings are assigned to corporate bonds, ABS, and loans. Short-term ratings address the possibility that a financial obligation with a maturity of less than a year will not be honored as promised and are given to the commercial paper and asset-backed commercial paper.

The three major credit rating agencies in Korea rate long-term issues from AAA down to D (including 10 generic rating categories, e.g., AAA, AA, A, BBB,…, CC, C, and D) in the same manner as Standard and Poor's. The signal modifiers "+" and "–" can be appended to each generic rating classification from AA through B (e.g., AA+, AA, and AA–), for a total of 20 rating categories. The modifier "+" indicates that the obligation ranks in the higher end of its generic rating category, and the modifier "–" indicates a ranking in the lower end. Issues in the top four rating categories (e.g., BBB– and above) are referred to as investment grade, and issues rated BB+ and below are referred to as speculative grade. The threshold between investment-grade and speculative-grade ratings has significant market implications for issuers' default risk. The process for assigning a credit rating is as follows. "New Ratings" and "Preliminary Ratings" are conducted for an initial rating, followed by periodic "Annual Ratings" and "Reviews on Credit Event" processes.

The Korean agencies maintain a rating review (also called "Watchlist") scheme that updates the issuer's rating status in a timely manner. When an issuer is placed on the "Watchlist" for certain reasons, the agency gives an opinion as to whether the change in rating status likely to be a "possible upgrade," "possible downgrade," or "uncertain direction." The agencies also provide an "Outlook" index, which identifies any possible future rating change of an issuer by suggesting a medium-term outlook (with a two-year horizon) of one of four directions: positive, stable, negative, and

developing.[5]

## 4. Data and Methodology

### 4.1 Data and sample selection

This study uses daily stock transaction data from January 1, 2000 to December 31, 2015 for firms on the KOSPI that were rated by Korea Investors Service, NICE Investors Service, or Korea Ratings.[6] We obtain each individual firm's rating history from KIS-Value database provided by Korea Investors Service, including the date of any rating change, the corresponding rating class, rating reviews (e.g., Watchlist), rating outlooks, etc. To investigate the effects of rating changes on stock prices and trading volumes by investor type, we extract the stock prices and trading volumes (i.e., buy volumes and sell volumes) of each firm from FN-Guide.

The following filtering process is applied to construct the preliminary sample. First, during the sample period, firms should have bond issues rated by one of Korea's three rating agencies. A firm is then included in the sample only if its outstanding unsecured bond issues experience a rating change during the sample period. Second, the event date of the rating change is defined as the press-release date. In addition, if a firm experiences multiple rating assessments by the same rating agency within a short period of time, only the earliest press-release date and its corresponding rating are included. Third, if a firm's rating is assessed by more than one rating agency on the same day, the event observation of the firm is excluded, adhering to the requirement of multiple credit ratings. Lastly, the sample is restricted to firms listed on the KRX for which stock return data is available from the KIS-Value database. If the event date of the rating change falls outside of stock trading days, the event observation is excluded from the sample.

We define a contaminated announcement as a rating change announcement that meets either of the following two conditions: *i*) the rating change can be attributed to the prior rating review (i.e., "Watchlist") or *ii*) the rating change is followed by a further rating change announcement by one of the other rating agencies within seven days. Prior studies have shown that an issuer's placement on the "Watchlist" has such a signaling effect that market participants perceive the issuer's credit rating is highly likely to change (Hull, Predescu, and White, 2004; Norden and Weber, 2004; Purda, 2007). To this end, our "full sample" includes all rating events identified through the aforementioned filtering process, and the "uncontaminated sample" further excludes contaminated announcements.

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[5] The scale notations for Watchlist and Outlook vary across rating agencies, but in general, they all use three-item scales for Watchlist and four-item scales for Outlook. More details on the notation are provided by Korea Investors Service (http://www.kisrating.com), NICE Investors Service (http://www.nicerating.com), and Korea Ratings Corporation (http://www.rating.co.kr).

[6] Financial firms are excluded from our sample due to their high leverage ratios, and we confirm that the sample that includes financial firms generates biased results.

Table 1 shows the sample distributions of the full sample and the uncontaminated sample. Overall, the full sample identifies 963 bond rating change events: 583 upgrades and 380 downgrades. These events correspond to 234 firms, including 129 upgraded firms and 105 downgraded firms. Among all industries, the manufacturing industry accounts for more than 50% of all bond rating changes. The uncontaminated sample includes 703 bond rating changes: 448 upgrades and 255 downgrades. After excluding the contaminated events, the total sample size drops by 27%, and the number of upgrades (downgrades) decreases by 23% (33%). Panel A of Table 1 shows the sample distribution by calendar year and specifically that the greatest number of rating change events occurred in 2001 and 2015. According to a report provided by Korea Ratings, a number of investment-grade firms have enhanced their creditworthiness, which explains why upgrades outnumber downgrades in 2001. On the other hand, in 2015, global economic stagnation and parallel business inactivity harmed firms' performances, and, thus, downgrades are the predominant rating change. Furthermore, considering the size of the rating change (the number of modified grades by which the rating changes), changes of only one grade predominate. In addition, firms with an A rating experience the majority of rating changes.

[Table 1]

4.2 Methodology

This section describes how we estimate the abnormal returns (*AR*), abnormal volume (*AV*), and net order imbalance (*NOI*) around rating change announcements and identify the trading patterns of different investor groups. The stock price response to bond rating changes is estimated using the *AR* of individual securities based on the market-adjusted model. The average abnormal returns (*AAR*) are summed over a given period to yield cumulative average abnormal returns (*CAR*) in Equation (1).

$$\begin{aligned} AR_{i,t} &= R_{i,t} - R_{m,t}, \\ AAR_t &= \frac{1}{n}\sum_{i=1}^{n} AR_{i,t}, \\ CAR(t_1, t_2) &= \sum_{t=t_1}^{t_2} AAR_t, \end{aligned} \tag{1}$$

where $R_{i,t}$ and $R_{m,t}$ are the rate of return on stock *i* and of the KOSPI market index on event day *t*. $AAR_t$ is the average abnormal return on event day *t*, and *n* is the number of firms in the sample. The *CAR* examines the level of change in abnormal returns before and after the event day of the bond rating change and is computed using the *AAR* obtained above for a multiple-day window.

Chae (2005) shows that trading volume is a critical proxy for information asymmetry. Given the presence of information asymmetry in the financial market, we differentiate between informed and

liquidity trading by examining the trading volumes around the corporate announcement periods, during which information asymmetry tends to be maximized. To examine the trading volume effect associated with bond rating changes, the abnormal volume is analyzed following the time of event. *AV* is estimated following Harris and Gurel (1986), which suggest measuring the change in trading intensity by estimating the ratio of trading volumes during the event period to trading volumes during the pre-event period:

$$AV_{i,t} = \frac{V_{i,t}}{V_{m,t}} \times \frac{V_m}{V_i} \quad (2)$$

where $V_i$ and $V_m$ are the average trading volumes of stock *i* and of the total KOSPI index, respectively, for the 160 trading days from day -180 to day -21, with day 0 as the press-release date. $V_{i,t}$ and $V_{m,t}$ are the trading volumes of stock *i* and the total KOSPI index on event day *t*, respectively. The value of the measure is expected to be greater than 1 (with a statistically significant *t*-statistic) if there is an abnormal change in trading volumes. Using Equation (2), we can compute the abnormal volume by investor types (i.e., domestic individuals, domestic institutions, and foreign investors).

Equation (3) computes the daily *NOI* to analyze the trading patterns of domestic individuals, domestic institutions, and foreign investors:

$$NOI_{i,t} = \left[\frac{BV_{i,t}}{BV_{i,t} + SV_{i,t}}\right] - 0.5, \quad (3)$$

where $BV_{i,t}$ and $SV_{i,t}$ are the trading volumes of stock *i* on event day *t* for buy and sell orders, respectively. If $NOI_{i,t}$ is greater (less) than 0, then stock *i* is overbought (oversold) by a specific investor group on day *t*. These methods aim to examine whether certain types of investors can exploit their informational advantage to realize abnormal returns.

## 5. Empirical Findings

### 5.1 The stock market reaction to bond rating changes

To examine the impact of bond rating changes on stock prices, the CARs are estimated for the samples of upgrades and downgrades for the period from January 1, 2000 to December 31, 2015. Table 2 presents the mean and median CARs for upgrades and downgrades using the full sample. The *Across investment-grade* columns report the results for the sub-sample of rating changes from investment grade to speculative grade or vice versa. First, Panel A of Table 2 shows that stock returns respond positively to upgrade announcements. The CARs are statistically significant for both the pre-event and post-event periods. Around the event period (days -1 to +1), the CARs are relatively small but are statistically significant at the 1% level, which indicates that positive news is incorporated into

stock prices ahead of official announcements. Statistically significant CARs after the announcement day, on the other hand, suggest a lagged effect of upgrades on stock returns. Panel B of Table 2 shows that stock returns (CARs) respond negatively to downgrade announcements, and this result is statistically significant at the 1% level during the pre-event periods (days -20 to -11, days -10 and -2) and around the event period (days -1 to +1). Next, considering rating changes across the investment-grade boundary, upgrades (downgrades) from speculative (investment) grade to investment (speculative) grade have a more pronounced positive (negative) impact on CARs. A stronger market response to rating changes across the grade boundary reflects a significant difference in the credit risk between investment-grade and speculative-grade firms.

[Table 2]

Prior studies suggest that the differing stock return responses to upgrades and downgrades are for several reasons. First, Chambers and Penman (1984) find that firms tend to make relatively early announcements of good news, whereas announcements of bad news often experience reporting lags. In that context, the abnormal stock returns in response to an upgrade following good news are statistically insignificant around the announcement event period (days -1 to +1), as this information has already been reflected in stock prices prior to the announcement. In contrast, statistically significant negative abnormal returns are found around downgrades following bad news on days -1 to +1 due to the relative delay in reporting. Second, the presence of asymmetric volatility supports the assertion that the stock return volatility is higher in down markets (negative shocks) than in up markets (positive shocks). Therefore, the stock market reacts more sensitively to rating downgrades than to upgrades because rating downgrades indicate that the issuer has a higher credit risk, which sends negative signals to the market.

Table 3 presents the results of the stock market response to bond rating changes based on the uncontaminated sample. Statistically significant abnormal returns (CARs) are observed around the announcement event period (days -1 to +1) for both upgrades and downgrades, except when considering just the upgrades from speculative grade to investment grade. However, the returns are marginally smaller than those found using the full sample. Figure 2 presents the trajectory of CARs over time upon upgrades and downgrades for the event period using the uncontaminated sample (days -30 and 30). This figure highlights a stronger stock market reaction to downgrades than to upgrades on the day of the rating change announcement.

[Table 3]

[Figure 2]

Our sample period includes the recent 2008 global financial crisis (GFC) period.[7] Stock market reactions to downgrades are expected to be significantly more negative during boom and steady periods than during recessionary periods, when downgrades are more prevalent, which suggests that investors may overreact to downgrades during a boom period. Jorion, Liu, and Shi (2005) document weaker responses to downgrades during recessionary periods due to more frequent incidents of downgrades during a recession. In contrast, upgrades during a recession may lead to stronger positive returns, since they indicate that a firm remains financially strong despite the economic recession. We therefore explore the possibility of differing responses to rating changes across market booms and recessions. The sample period is split into *i*) recessionary periods, including the year 2001, when the market remained bearish, and the year 2008, when the market was in downturn following the GFC, and *ii*) other periods, including boom periods when the KOSPI trended upward and steady periods.

Table 4 provides evidence of abnormal stock returns in relation to differing market conditions using the uncontaminated sample. Out of 488 (255) incidents of upgrades (downgrades) in the uncontaminated sample, 199 (63) incidents of upgrades (downgrades) occur during the recessionary period (*Recession*). The CARs for upgrades during the boom and steady periods (*Other*) are positive and statistically significant for the pre-event windows (days -30 to -21 and -20 to -11), the event window around the announcement day (days -1 to +1), and the post-event window (days +2 to +10). Unlike the return responses in the boom and steady periods, the return responses to upgrades during the recessionary periods are relatively statistically insignificant. For downgrades, the CARs during the boom and steady periods are negative and statistically significant for the pre-event window (days -10 to -2) and the event window around the announcement day (days -1 to +1). CARs during the recession, on the other hand, exhibit marginal statistical significance only for the pre-event window (days -30 to -21). It is also noted that the reaction to downgrades is significantly more negative during the boom and steady periods prior to the announcement. Overall, we find that the stock market reacts positively (negatively) to upgrades (downgrades) with statistical significance during the boom and steady periods, but the stock market reaction to downgrades is statistically insignificant during the recessionary period. These results are consistent with findings in prior studies that neither upgrades nor downgrades have a significant impact on stock returns during periods of economic downturn (Bowen, Johnson, and Shevlin, 1989; Jorion, Liu, and Shi, 2005).[8]

[7] Other studies of the Korean market analyzing the GFC period recognize that investor behavior and market reactions during the crisis and recession periods can exhibit significantly different patterns from those during normal or boom periods (Han, Kutan, and Ryu, 2015; Kim and Ryu, 2015a, 2015b; Kim, Ryu, and Seo, 2015; Song, Ryu, and Webb, 2016).

[8] Bowen, Johnson, and Shevlin (1989) find an overall positive and statistically significant relationship between stock price performance and firm-specific earning announcements, but they find no such evidence for the sub-sample period of the 1987 stock market crash.

[Table 4]

5.2 Trading behavior in response to rating changes by investor type

The Korean stock market has a distinct framework in that domestic individual investors are major participants in the market. Individual investors are usually considered to be uninformed and make noisy and speculative trades, whereas institutional investors tend to be more informed and skillful. In this section, therefore, we examine the trading volumes and net order imbalances of each investor group around rating change announcements in order to determine whether information asymmetry exists across the different investor groups. In particular, we focus on whether this information asymmetry is utilized to realize capital gains.

First, abnormal trading volumes are observed around the announcements. Beaver (1968) and Karpoff (1987) find evidence for abnormal trading volumes around an event, which can be attributed to the likelihood that market participants have differing interpretations and, thus, differing expectations of the same event due to information asymmetry. If investors perceive the credit rating assigned to a firm as important to their investment decisions, investors' reactions to upgrades and to downgrades should be different. Therefore, to further document the differing trading patterns (i.e., trading volumes) of each investor group, the sample is categorized into the following groups: *i*) the market as a whole (investors in aggregate), *ii*) domestic individuals, *iii*) domestic institutions, and *iv*) foreign investors.

Table 5 presents the results of comparing the trading volume response to upgrades with that to downgrades using the uncontaminated sample to better understand investor behavior around rating change announcements. For the market as a whole (investors in aggregate), statistically significant *AV*s are observed following both upgrades and downgrades. Upgrades elicit *AV*s that are significant and greater than one but that are relatively small, which provides little evidence for a strong volume effect associated with upgrades. In contrast, downgrades are associated with significantly stronger *AV*s, around the announcement day (days -1 to +1) and for the post-event window (days +11 to +20 and +21 to +30). This result suggests that the abnormal volume reactions to downgrades are stronger than the reactions to upgrades, which is consistent with the former evidence that the stock price reacts more sensitively to downgrades than to upgrades.

[Table 5]

Next, we discuss the results of abnormal trading volume by investor type. First, for domestic individual investors, abnormal volumes are statistically significant (*AV* greater than 1) around upgrade announcements. Interestingly, downgrade announcements elicit statistically significant abnormal volumes in all event windows, and, in particular, the abnormal volumes appear to grow progressively

around the announcement day (days -1 to +1) and for the post-event window (days +11 to +20 and +21 to +30), implying that individual investors react more strongly to downgrades than to upgrades. Second, for domestic institutions, abnormal volumes exist (*AV* greater than 1) and are statistically significant both before and after upgrade announcements. It is noteworthy that although trading volumes greatly increase during downgrade announcements, they are statistically insignificant. Lastly, for foreign investors, *AV*s are statistically significant both before and after upgrade announcements, whereas they are statistically significant in response to downgrade announcements mainly during the post-event window. Overall, these results indicate that 1) the trading volume reacts more strongly to downgrades than to upgrades, which is consistent with the stock price reaction and 2) upgrade announcements elicit statistically significant increases in trading volumes (*AV*s) across all investor groups, whereas significant increases in trading volumes are observed only among domestic individuals when downgrade announcements take place. Thus, the results suggest that different types of investors have different reactions to identical events (upgrades or downgrades).

Second, to further investigate trading behavior, we calculate the net order imbalance of each investor group around rating change announcements. Table 6 reports that, in response to upgrade announcements, an excess of sell orders (negative *NOI*) is observed for domestic individuals and institutions, whereas the opposite order imbalance (an excess of buy orders, positive *NOI*) is recorded for foreign investors. Both the negative *NOI* for individual investors and the positive *NOI* for foreign investors are statistically significant. In particular, foreign investors place substantially more buy orders before an upgrade announcement than after the announcement. The rationale for these trading patterns associated with upgrades could be the abnormal positive stock returns around the upgrade announcement, as found earlier in this study. It appears that domestic individuals tend to place more sell orders during all of the observation windows and, thus, are disadvantaged by upgrade announcements, whereas foreign investors buy stocks following an upgrade anticipating capital gains over a longer time horizon, which indicates the information advantage (disadvantage) of foreign investors (domestic individual investors).[9]

[Table 6]

[9] Both the information edge of foreign investors and relative disadvantage of domestic individuals are observed in Korea's stock index derivatives markets, which exhibit the highest ranks among worldwide derivatives markets. For example, a series of studies, including Ahn, Kang, and Ryu (2008, 2010), Chung, Park, and Ryu (2016), Han, Hwang, and Ryu (2015), Ryu (2013, 2015), Sim, Ryu, and Yang (2016), and Yang, Choi, and Ryu (2017) report that foreign investors are informed and sophisticated, whereas domestic individuals are noisy and uninformed in Korea's stock index futures and options markets, which are one of the most liquid and representative derivatives markets in the world and whose underlying asset is the KOSPI200 stock index.

In response to downgrade announcements, domestic institutions and foreign investors react by placing more sell orders (negative *NOI*), which contrasts with individuals' tendency to place more buy orders (positive *NOI*). The negative *NOI*s for domestic institutions are statistically significant in the event windows both before and after the announcement, but for foreign investors, they are statistically insignificant. The positive *NOI* for individual investors is shown to be statistically significant before the announcement (days -30 to -21 and -20 to -11) and after the announcement (days +2 to +10). Taking into consideration abnormal negative stock returns around downgrade announcements, the trading pattern in which individuals tend to buy more whereas institutions and foreign investors prefer to sell more implies that individual investors are more likely to face impending capital losses and, thus, are disadvantaged by downgrade announcements.

Given the evidence of investors' differing trading patterns relative to the event, it can be concluded that rating changes have a significant impact not only on stock prices but also on investor behavior, as indicated by trading volumes and trading patterns.

5.3 Cross-sectional analysis of excess stock return

In this section, we examine the cross-sectional variation of abnormal returns around the rating change announcement dates using the following regression:

$$CAR(-1,1)_{i,t} = \beta_0 + \beta_1 \ RDiff_{i,t} + \beta_2 Grade_{i,t} + \beta_3 Recession_t + \beta_4 AV_{i,t}^{IND} + \beta_5 AV_{i,t}^{INS} + \beta_6 AV_{i,t}^{FOR} + \beta_7 NOI_{i,t}^{IND} + \beta_8 NOI_{i,t}^{INS} + \beta_9 NOI_{i,t}^{FOR} + \beta_{10} SIZE_{i,t} + \beta_{11} LEV_{i,t} + \beta_{12} CF_{i,t} + \beta_{13} ROA_{i,t} + \varepsilon_{i,t}, \quad (4)$$

where *CAR*(-1,1) represents the CARs around the announcement (event) period (days -1 to +1), and *CRDiff* denotes the absolute magnitude of the rating change. To estimate *CRDiff*, categorical rating grades are converted into cardinal variables measured on a 22-point scale (1 indicates an AAA rating, and 22 indicates a D rating). *Grade* is set equal to one if an upgrade (downgrade) occurs from speculative (investment) grade to investment (speculative) grade and zero otherwise. *Recession* is a dummy variable set equal to one if the rating change occurs during the recessionary period in our sample and zero otherwise. $AV^{IND}$, $AV^{INS}$, and $AV^{FOR}$ denote the abnormal volume for domestic individuals, domestic institutions, and foreign investors, respectively, around the announcement period (days -1 to +1). These variables are set equal to one if the *AV* is greater than one for the corresponding group and zero otherwise. $NOI^{IND}$, $NOI^{INS}$, and $NOI^{FOR}$ denote the net order imbalance for domestic individuals, domestic institutions, and foreign investors, respectively, around the announcement period (days -1 to +1). These variables are set equal to one if *NOI* is greater than zero for the corresponding group and zero otherwise. *SIZE*, *LEV*, *CF*, and *ROA* are control variables capturing firm-specific characteristics. *SIZE* denotes the firm size measured by taking the log of market capitalization, and *LEV* denotes the book leverage measured by dividing total debt by the book

value of total assets. *CF* is a ratio of the cash flow to the book value of total assets, and *ROA* is measured by dividing net income by the book value of total assets.

Table 7 reports the parameter estimates of the regression models examining the effect of the given set of variables on abnormal returns (CARs). First, around upgrade announcements (see *Upgrades*), $NOI^{IND}$ ($NOI^{FOR}$) has a statistically significant negative (positive) impact on abnormal returns. This result confirms that information asymmetry exists between different investor types, which is also supported by Table 6. Domestic individuals place more sell orders around the announcement, whereas foreign investors strategize to make capital gains by buying more. On the other hand, around downgrade announcements (see *Downgrades*), $NOI^{IND}$ ($NOI^{INS}$) has a statistically significant negative (positive) effect on abnormal returns. The result can be interpreted in line with the inference made from Table 6 that domestic individuals are likely to incur losses with their buy orders (positive *NOI*), whereas institutional investors are likely to achieve positive abnormal returns by selling (negative *NOI*) upon downgrade announcements. Second, a statistically significant size effect is documented around upgrade announcements (see *Upgrades*). The larger the firm, the greater the abnormal returns. However, similar evidence is not found for downgrade announcements, which suggests that the negative abnormal returns around downgrades are more likely to be influenced by investors' trading strategies than by firm-specific variables.

[Table 7]

**6. Conclusion**

This study investigates the behavior of the Korean stock market around bond rating change announcements by analyzing a unique stock trading dataset. To measure whether and to what extent information asymmetry exists between different investor groups, stock price reactions to rating changes and the trading behavior of different investor types around the rating changes (i.e., trading-volume responses and order-imbalance responses) are examined. The empirical results reveal that abnormal stock returns are significantly positive around upgrades and negative around downgrades. However, a closer look at the results suggests that the impact of rating changes on stock prices is stronger around downgrades. Furthermore, abnormal trading volumes are detected around rating changes, and net order imbalances are found to vary by investor type, both of which reflect differences in trading behavior by different types of investors in response to a rating change. In particular, foreign institutional investors make capital gains through buy (sell) orders around upgrade (downgrade) announcements, whereas domestic individuals exhibit a relatively inferior trading performance by placing more sell orders around both upgrade and downgrade announcements. These opposite trading patterns across distinct investor groups support the information superiority (inferiority) of institutional (individual) investors.

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**Figure 1.** Trading volumes and activities of the KOSPI spot market by investor types
*Note.* This figure depicts the yearly trading volume (*bar*) and the proportion of total volume (*line*) for each investor type over our sample period from 2010 through 2015.

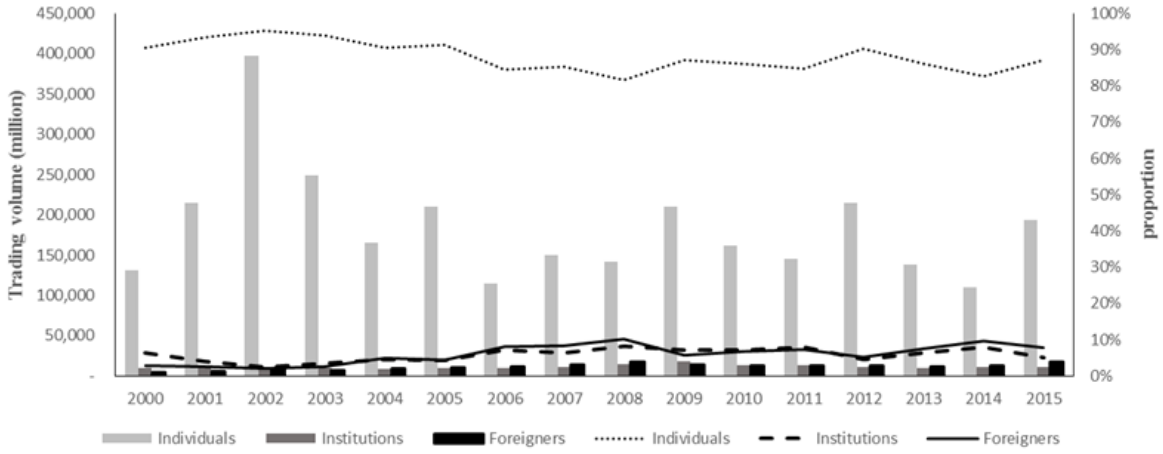

**Figure 2.** The time trend of CARs using the uncontaminated sample
*Note*. This figure presents the trajectory of CARs over time upon upgrades and downgrades for the event period (days -30 and 30).

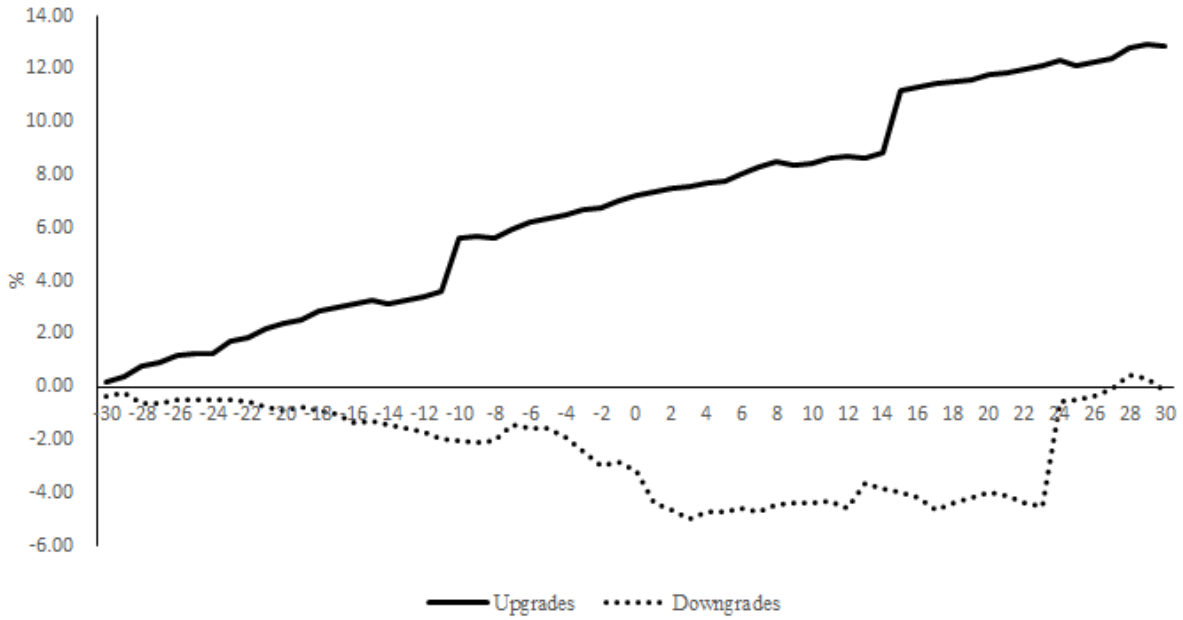

**Table 1**
Sample distribution

| | Full sample | | | Uncontaminated sample | | |
|---|---|---|---|---|---|---|
| | Upgrades | Downgrades | Total | Upgrades | Downgrades | Total |
| Panel A: Sample distribution by year | | | | | | |
| 2000 | 14 | 17 | 31 | 13 | 13 | 26 |
| 2001 | 71 | 33 | 104 | 56 | 30 | 86 |
| 2002 | 44 | 14 | 58 | 36 | 13 | 49 |
| 2003 | 50 | 8 | 58 | 39 | 6 | 45 |
| 2004 | 50 | 10 | 60 | 37 | 8 | 45 |
| 2005 | 54 | 7 | 61 | 41 | 7 | 48 |
| 2006 | 30 | 7 | 37 | 26 | 6 | 32 |
| 2007 | 39 | 8 | 47 | 29 | 4 | 33 |
| 2008 | 39 | 16 | 55 | 29 | 10 | 39 |
| 2009 | 35 | 11 | 46 | 27 | 6 | 33 |
| 2010 | 56 | 6 | 62 | 37 | 3 | 40 |
| 2011 | 23 | 7 | 30 | 20 | 4 | 24 |
| 2012 | 31 | 26 | 57 | 24 | 16 | 40 |
| 2013 | 18 | 55 | 73 | 11 | 30 | 41 |
| 2014 | 20 | 63 | 83 | 16 | 40 | 56 |
| 2015 | 9 | 92 | 101 | 7 | 59 | 66 |
| Panel B: Sample distribution by size of rating change | | | | | | |
| 1 grade | 530 | 294 | 824 | 408 | 214 | 622 |
| 2 grades | 25 | 51 | 76 | 14 | 25 | 39 |
| 3 grades | 15 | 9 | 24 | 14 | 5 | 19 |
| ≥4 grades | 13 | 26 | 39 | 12 | 11 | 23 |
| Panel C: Sample distribution by pre-downgrade or pre-upgrade letter rating class | | | | | | |
| AAA | 0 | 3 | 3 | 0 | 2 | 2 |
| AA | 56 | 35 | 91 | 42 | 22 | 64 |
| A | 264 | 145 | 409 | 197 | 108 | 305 |
| BBB | 220 | 133 | 353 | 175 | 81 | 256 |
| BB | 35 | 49 | 84 | 28 | 35 | 63 |
| B | 6 | 13 | 19 | 4 | 7 | 11 |
| ≤CCC | 2 | 2 | 4 | 2 | 0 | 2 |
| Panel D: Number of rating changes that cross the investment-grade boundary | | | | | | |
| Across investment-grade | 27 | 47 | 74 | 20 | 26 | 46 |
| Total | 583 | 380 | 963 | 448 | 255 | 703 |

*Note*. This table presents the sample distribution by rating change characteristics in *Full sample* (including all rating changes) and *Uncontaminated sample* (excluding announcements preceded by other rating announcements within seven days of the event day and pre-Watchlist). Panel A reports the distribution of ratings changes over time. Panel B reports the sample distribution by the size of the rating change. Panel C reports the sample distribution by pre-downgrade or pre-upgrade letter rating class. Panel D reports the numbers of downgrades and upgrades that moved the firm across the investment-grade boundary, where investment-grade refers to ratings of BBB– and above. The sample period of the data is from January 1, 2000 through December 31, 2015.

**Table 2**
Stock market responses to bond rating changes – Full sample

Panel A: Upgrades

| Event window | All (N=583) | | | | Across investment-grade (N=27) | | | |
|---|---|---|---|---|---|---|---|---|
| (days) | CAR(%) | *t*-stat | Med | WSR | CAR(%) | *t*-stat | Med | WSR |
| [-30, -21] | 2.37*** | 5.87 | 1.54*** | 48.5 | 1.57 | 0.88 | 0.84 | 2.5 |
| [-20, -11] | 1.37*** | 3.48 | 0.81** | 30.5 | 1.8 | 0.88 | -0.58 | -2.0 |
| [-10, -2] | 2.81* | 1.87 | 0.71** | 26.5 | 4.64** | 2.22 | 4.56 | 3.5 |
| [-1, 1] | 0.60*** | 2.95 | 0.39* | 23.5 | 2.35* | 1.81 | 1.32 | 2.5 |
| [2, 10] | 1.28*** | 3.19 | 0.70* | 22.5 | 0.9 | 0.53 | 0.29 | 0.5 |
| [11, 20] | 2.88* | 1.88 | 1.12** | 36.5 | 2.6 | 1.61 | 0.58 | 0.5 |
| [21, 30] | 1.09*** | 2.78 | 1.10** | 39.5 | 0.21 | 0.1 | -1.91 | -4.0 |

Panel B: Downgrades

| Event window | All (N=380) | | | | Across investment-grade (N=47) | | | |
|---|---|---|---|---|---|---|---|---|
| (days) | CAR(%) | *t*-stat | Med | WSR | CAR(%) | *t*-stat | Med | WSR |
| [-30, -21] | -0.87 | -1.38 | -1.38** | -20.0 | -4.04* | -2.1 | -2.48 | -5.0 |
| [-20, -11] | -2.27*** | -3.46 | -1.82*** | -34.0 | -1.23 | -0.7 | -1.17 | -5.0 |
| [-10, -2] | -2.20*** | -3.06 | -1.49** | -30.0 | -6.19** | -2.7 | -7.86*** | -12.0 |
| [-1, 1] | -2.48*** | -4.36 | -0.31* | -18.0 | -8.87*** | -3.6 | -3.90** | -9.0 |
| [2, 10] | 1.11 | 1.26 | -0.62 | -13.0 | 1.61 | 0.45 | -1 | -5.0 |
| [11, 20] | 0.21 | 0.17 | -2.12*** | -28.0 | 7.29 | 0.82 | -1.96 | -2.0 |
| [21, 30] | 2.11 | 0.67 | -0.23 | -7.0 | -2.62 | -1.2 | -1.77 | -2.0 |

*Note*. This table presents the stock market response to bond rating changes using the full sample. *N* denotes the number of observations. *CAR(%)* is the sum of the firm's daily average abnormal stock returns over the event window. *t-stat* is a *t*-statistic based on the cross-sectional standard error of *CAR*. *Med* is the median of *CAR*, and *WSR* is a Wilcoxon signed-rank test statistic of whether the median of *CAR* differs from zero. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 3**
Stock market responses to bond rating changes – Uncontaminated sample

Panel A: Upgrades

| Event window | All (N=448) | | | | Across investment-grade (N=20) | | | |
|---|---|---|---|---|---|---|---|---|
| (days) | CAR(%) | *t*-stat | Med | WSR | CAR(%) | *t*-stat | Med | WSR |
| [-30, -21] | 2.19*** | 4.75 | 1.64*** | 40.0 | 1.39 | 0.72 | 0.90 | 2.0 |
| [-20, -11] | 1.40*** | 3.10 | 0.76** | 24.0 | 1.40 | 0.60 | -0.67 | -2.0 |
| [-10, -2] | 3.21 | 1.65 | 0.63* | 18.0 | 4.83* | 1.78 | 5.49 | 3.0 |
| [-1, 1] | 0.55** | 2.29 | 0.37* | 18.0 | 2.31 | 1.36 | 0.99 | 1.0 |
| [2, 10] | 1.12** | 2.49 | 0.46 | 15.0 | 1.25 | 0.63 | 0.72 | 1.0 |
| [11, 20] | 3.34* | 1.69 | 0.79* | 21.0 | 1.54 | 0.84 | -0.99 | -1.0 |
| [21, 30] | 1.08** | 2.38 | 1.12*** | 31.0 | -1.91 | -0.82 | -2.57 | -4.0 |

Panel B: Downgrades

| Event window | All (N=255) | | | | Across investment-grade (N=26) | | | |
|---|---|---|---|---|---|---|---|---|
| (days) | CAR(%) | *t*-stat | Med | WSR | CAR(%) | *t*-stat | Med | WSR |
| [-30, -21] | -0.76 | -1.11 | -1.65** | -17.5 | -3.38 | -1.23 | -2.28 | -3.0 |
| [-20, -11] | -1.19* | -1.80 | -1.29* | -14.5 | 0.70 | 0.39 | -0.88 | -1.0 |
| [-10, -2] | -1.03 | -1.30 | -1.32* | -15.5 | -1.71 | -0.52 | -3.05* | -5.0 |
| [-1, 1] | -1.39** | -2.45 | -0.01 | -1.50 | -6.55** | -2.52 | -2.90 | -4.0 |
| [2, 10] | 0.00 | 0.00 | -0.77 | -12.5 | 3.14 | 0.65 | -0.55 | -2.0 |
| [11, 20] | 0.39 | 0.29 | -1.53 | -13.5 | 6.07 | 0.52 | -0.77 | 0.0 |
| [21, 30] | 3.80 | 0.82 | -0.31 | -7.5 | -0.44 | -0.20 | -1.65 | -1.0 |

*Note*. This table presents the stock market response to bond rating changes using the uncontaminated sample. *N* denotes the number of observations. *CAR(%)* is the sum of the firm's daily average abnormal stock returns over the event window. *t-stat* is a *t*-statistic based on the cross-sectional standard error of *CAR*. *Med* is the median of *CAR*, and *WSR* is a Wilcoxon signed-rank test statistic of whether the median of *CAR* differs from zero. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 4**
Stock market response to bond rating changes by market conditions – Uncontaminated sample

Panel A: Upgrades

| Event window | Recession (N=199) | | | | Other (N=249) | | | |
|---|---|---|---|---|---|---|---|---|
| (days) | CAR(%) | *t*-stat | Med | WSR | CAR(%) | *t*-stat | Med | WSR |
| [-30, -21] | 1.24* | 1.84 | 1.07** | 14.5 | 2.94*** | 4.69 | 2.02*** | 25.5 |
| [-20, -11] | 0.81 | 1.16 | 0.52 | 7.5 | 1.86*** | 3.16 | 1.00** | 16.5 |
| [-10, -2] | 0.3 | 0.52 | -0.26 | -7.5 | 5.53 | 1.59 | 1.43*** | 25.5 |
| [-1, 1] | 0.07 | 0.18 | 0.19 | 4.5 | 0.93*** | 3.09 | 0.40* | 13.5 |
| [2, 10] | 0.48 | 0.69 | 0.36 | 5.5 | 1.62*** | 2.82 | 0.65 | 9.5 |
| [11, 20] | 0.74 | 1.21 | -0.03 | -0.5 | 5.42 | 1.54 | 1.56** | 21.5 |
| [21, 30] | 1.38* | 1.81 | 1.61* | 13.5 | 0.85 | 1.54 | 0.8** | 17.5 |

Panel B: Downgrades

| Event window | Recession (N=63) | | | | Other (N=192) | | | |
|---|---|---|---|---|---|---|---|---|
| (days) | CAR(%) | *t*-stat | Med | WSR | CAR(%) | *t*-stat | Med | WSR |
| [-30, -21] | -2.98* | -1.85 | -4.16** | -8.5 | -0.03 | -0.04 | -1.08 | -9.0 |
| [-20, -11] | -2.33 | -1.47 | -2.00 | -4.5 | -0.81 | -1.15 | -1.15 | -10.0 |
| [-10, -2] | 3.29 | 1.36 | 1.72** | 11.5 | -2.45** | -3.7 | -2.35*** | -27.0 |
| [-1, 1] | -1.33 | -1.03 | -0.30 | -2.5 | -1.41** | -2.26 | 0.02 | 1.0 |
| [2, 10] | 3.12 | 1.41 | 0.20 | 1.5 | -1.03 | -0.93 | -1.25* | -14.0 |
| [11, 20] | 0.48 | 0.27 | -0.14 | -0.5 | 0.36 | 0.21 | -1.54** | -13.0 |
| [21, 30] | -2.3 | -1.36 | -1.77 | -3.5 | 5.8 | 0.94 | -0.07 | -4.0 |

*Note*. This table presents the stock market response to bond rating changes according to market conditions using the uncontaminated sample. *N* denotes the number of observations. *CAR(%)* is the sum of the firm's daily average abnormal stock returns over the event window. *t-stat* is a *t*-statistic based on the cross-sectional standard error of *CAR*. *Med* is the median of *CAR*, and *WSR* is a Wilcoxon signed-rank test statistic of whether the median of *CAR* differs from zero. *Recession* denotes periods of economic recession, including the 2008 global financial crisis. *Other* refers to the remaining sample period, excluding the recessionary period. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 5**
The trading-volume response to bond rating changes by investor type – Uncontaminated sample

Panel A: Upgrades

| Event window (days) | All | | Individuals | | Institutions | | Foreigners | |
|---|---|---|---|---|---|---|---|---|
| | AV | *t*-stat | AV | *t*-stat | AV | *t*-stat | AV | *t*-stat |
| [-30, -21] | 1.07** | -1.77 | 1.03 | -0.92 | 1.21*** | -3.64 | 1.49*** | -3.17 |
| [-20, -11] | 1.15** | -2.12 | 1.13 | -1.59 | 1.26*** | -4.04 | 2.09** | -2.22 |
| [-10, -2] | 1.08** | -2.02 | 1.06 | -1.44 | 1.29*** | -4.14 | 1.43*** | -2.86 |
| [-1, 1] | 1.13** | -2.48 | 1.12* | -1.93 | 1.26*** | -3.7 | 1.43*** | -3.51 |
| [2, 10] | 1.09* | -1.93 | 1.07 | -1.39 | 1.51** | -2.29 | 1.68*** | -3.14 |
| [11, 20] | 1.08* | -1.91 | 1.04 | -0.96 | 1.43*** | -2.96 | 1.59*** | -4.07 |
| [21, 30] | 1.09** | -2.35 | 1.06 | -1.41 | 1.33*** | -3.41 | 1.78*** | -3.27 |

Panel B: Downgrades

| Event window (days) | All | | Individuals | | Institutions | | Foreigners | |
|---|---|---|---|---|---|---|---|---|
| | AV | *t*-stat | AV | *t*-stat | AV | *t*-stat | AV | *t*-stat |
| [-30, -21] | 1.37** | -2.22 | 1.44** | -2.41 | 1.54 | 1.51 | 1.07 | 0.84 |
| [-20, -11] | 1.19*** | -2.69 | 1.24*** | -3.09 | 1.23 | 1.53 | 1.06 | 0.85 |
| [-10, -2] | 1.24*** | -3.16 | 1.33*** | -3.59 | 1.00 | 0.04 | 1.20** | 2.09 |
| [-1, 1] | 1.60*** | -3.54 | 1.68*** | -3.86 | 21.82 | 1.05 | 1.17 | 1.41 |
| [2, 10] | 4.53 | -1.23 | 4.79 | -1.27 | 130.41 | 1.00 | 1.49** | 2.38 |
| [11, 20] | 2.14* | -1.93 | 2.32** | -2.12 | 1.37 | 1.12 | 1.80* | 1.92 |
| [21, 30] | 2.21* | -1.75 | 2.38* | -1.91 | 29.24 | 1.02 | 1.40* | 1.90 |

*Note*. This table presents the trading-volume response to bond rating changes by each investor type using the uncontaminated sample, including investors in aggregate (*All*), domestic individuals (*Individuals*), domestic institutions (*Institutions*), and foreign investors (*Foreigners*). *AV* is the ratio of trading volumes during the event period to trading volumes during the pre-event period. *t-stat* is a *t*-statistic based on the cross-sectional standard error of *AV*. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 6**
The net-order-imbalance (NOI) response to bond rating changes by investor type – Uncontaminated sample

Panel A: Upgrades

| Event window (days) | Individuals | | | | Institutions | | | | Foreigners | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NOI | *t*-stat | Med | WSR | NOI | *t*-stat | Med | WSR | NOI | *t*-stat | Med | WSR |
| [-30, -21] | -0.16*** | -5.69 | -0.11*** | -46.0 | 0.02 | 0.37 | 0.12 | 16.5 | 0.16** | 2.42 | 0.10** | 23.5 |
| [-20, -11] | -0.16*** | -5.83 | -0.08*** | -48.0 | 0.04 | 0.68 | 0.03 | 2.0 | 0.25*** | 3.61 | 0.24*** | 39.0 |
| [-10, -2] | -0.11*** | -4.26 | -0.07*** | -37.5 | 0.02 | 0.36 | 0.03 | 6.5 | 0.16** | 2.48 | 0.02 | 15.5 |
| [-1, 1] | -0.04*** | -3.72 | -0.01* | -19.5 | -0.03 | -1.06 | -0.02 | -12.5 | 0.07** | 2.26 | 0.01** | 22.0 |
| [2, 10] | -0.13*** | -5.13 | -0.07*** | -31.5 | -0.08 | -1.38 | -0.04 | -10.5 | 0.17*** | 2.78 | 0.10** | 21.0 |
| [11, 20] | -0.12*** | -4.20 | -0.04* | -20.0 | -0.04 | -0.63 | -0.02 | -4.0 | 0.14** | 2.01 | 0.09** | 21.0 |
| [21, 30] | -0.18*** | -5.99 | -0.10*** | -42.5 | -0.05 | -0.74 | -0.03 | -9.5 | 0.17** | 2.50 | 0.05* | 18.0 |

Panel B: Downgrades

| Event window (days) | Individuals | | | | Institutions | | | | Foreigners | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NOI | *t*-stat | Med | WSR | NOI | *t*-stat | Med | WSR | NOI | *t*-stat | Med | WSR |
| [-30, -21] | 0.06** | 2.56 | 0.02*** | 29.0 | -0.39*** | -4.45 | -0.49*** | -32.5 | -0.02 | -0.31 | 0.00 | -5.0 |
| [-20, -11] | 0.07*** | 2.67 | 0.03*** | 29.5 | -0.58*** | -5.98 | -0.50*** | -42.0 | -0.03 | -0.39 | 0.00 | 2.0 |
| [-10, -2] | 0.03 | 1.14 | 0.01** | 18.0 | -0.46*** | -5.29 | -0.50*** | -29.5 | 0.03 | 0.37 | 0.00 | -2.5 |
| [-1, 1] | 0.00 | 0.39 | 0.00** | 18.5 | -0.20*** | -5.02 | -0.12*** | -24.5 | 0.00 | 0.10 | 0.00 | 0.5 |
| [2, 10] | 0.05* | 1.94 | 0.01*** | 21.5 | -0.58*** | -6.44 | -0.45*** | -38.0 | -0.10 | -1.40 | -0.05 | -14.0 |
| [11, 20] | 0.02 | 0.80 | 0.01** | 20.0 | -0.72*** | -7.82 | -0.50*** | -49.0 | -0.04 | -0.47 | 0.00 | -8.5 |
| [21, 30] | -0.01 | -0.26 | 0.00 | 8.50 | -0.56*** | -5.90 | -0.40*** | -26.5 | -0.01 | -0.13 | 0.00 | -5.0 |

*Note.* This table presents the net-order-imbalance (NOI) response to bond-rating changes by investor types using the uncontaminated sample, including investors in domestic individuals (*Individuals*), domestic institutions (*Institutions*), and foreign investors (*Foreigners*). *NOI* is the net order imbalance, measuring the excess of buy orders or sell orders for a given stock. *t-stat* is a *t*-statistic based on the cross-sectional standard error of NOI. *Med* is a median of *CAR* and *WSR* is a Wilcoxon signed rank test statistic as to whether the median *CAR* differs from zero. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 7**
Cross-sectional regression analyses

| | Upgrades | | | | Downgrades | | | |
|---|---|---|---|---|---|---|---|---|
| | Model1 | Model2 | Model3 | Model4 | Model1 | Model2 | Model3 | Model4 |
| Intercept | -7.25* | -8.43** | -8.31* | -8.13* | 8.39 | 9.26 | 9.06 | 8.45 |
| | (-1.75) | (-2.00) | (-1.93) | (-1.78) | (1.25) | (1.37) | (1.35) | (1.29) |
| CRDiff | -0.22 | -0.14 | -0.11 | -0.10 | 1.18 | 1.12 | 1.14 | 1.20 |
| | (-0.91) | (-0.58) | (-0.36) | (-0.34) | (0.99) | (0.99) | (0.99) | (1.03) |
| Grade | -0.87 | -0.98 | -1.06 | -1.08 | -5.35 | -5.57* | -5.63* | -5.74* |
| | (-0.86) | (-0.98) | (-0.94) | (-0.94) | (-1.58 | (-1.67) | (-1.66) | (-1.69) |
| Recession | 4.20** | 3.70** | 3.58** | 3.57** | -2.80 | -3.13 | -3.10 | -3.07 |
| | (2.50) | (2.13) | (2.05) | (2.03) | (-0.99) | (-1.01) | (-1.02) | (-0.99) |
| $AV^{IND}$ | 0.41 | 0.41 | 0.56 | 0.56 | 0.37 | 0.23 | 0.21 | 0.14 |
| | (0.87) | (0.86) | (1.17) | (1.16) | (0.41) | (0.24) | (0.23) | (0.14) |
| $AV^{INS}$ | -0.95* | -0.90* | -0.98* | -0.10* | -1.60 | -1.56 | -1.60 | -1.52 |
| | (-1.88) | (-1.76) | (-1.92) | (-1.92) | (-1.37) | (1.30) | (-1.32) | (-1.26) |
| $AV^{FOR}$ | 0.73 | 0.74 | 0.69 | 0.70 | -2.92*** | -3.05*** | -3.06** | -2.89** |
| | (1.45) | (1.46) | (1.29) | (1.31) | (-2.85) | (-2.6) | (-2.55) | (-2.41) |
| $NOI^{IND}$ | -2.56*** | -2.46*** | -2.45*** | -2.43*** | -3.04*** | -3.07*** | -3.10*** | -3.10*** |
| | (-5.38) | (-5.08) | (-4.98) | (-4.91) | (-2.72) | (-2.66) | (-2.65) | (-2.69) |
| $NOI^{INS}$ | 0.64 | 0.69 | 0.71 | 0.71 | 2.92*** | 3.00*** | 3.07*** | 3.01*** |
| | (1.25) | (1.33) | (1.33) | (1.34) | (2.61) | (2.68) | (2.70) | (2.69) |
| $NOI^{FOR}$ | 1.42*** | 1.29** | 1.32** | 1.32** | -0.20 | -0.25 | -0.14 | -0.21 |
| | (2.65) | (2.46) | (2.42) | (2.43) | (-0.19) | (-0.22) | (-0.13) | (-0.18) |
| SIZE | 0.38** | 0.45** | 0.45** | 0.43** | -0.21 | -0.27 | -0.26 | -0.26 |
| | (1.99) | (2.3) | (2.24) | (2.02) | (-0.7) | (-0.87) | (-0.85) | (-0.85) |
| LEV | | -0.00*** | -0.00*** | -0.00*** | | 0.00 | 0.00 | 0.00 |
| | | (-2.9) | (-2.99) | (-3.00) | | (1.36) | (1.34) | (1.16) |
| CF | | | -0.00 | 0.01 | | | -0.02 | 0.15 |
| | | | (-0.10) | (0.21) | | | (-0.29) | (1.19) |
| ROA | | | | -0.02 | | | | -0.19 |
| | | | | (-0.31) | | | | (-1.51) |
| Adj. $R^2$ | 0.125 | 0.129 | 0.125 | 0.123 | 0.232 | 0.234 | 0.229 | 0.232 |

*Note*. This table presents the estimated coefficients of the following regression: $CAR(-1,1)_{i,t} = \beta_0 + \beta_1 \ RDiff_{i,t} + \beta_2 Grade_{i,t} + \beta_3 Recession_t + \beta_4 AV_{i,t}^{IND} + \beta_5 AV_{i,t}^{INS} + \beta_6 AV_{i,t}^{FOR} + \beta_7 NOI_{i,t}^{IND} + \beta_8 NOI_{i,t}^{INS} + \beta_9 NOI_{i,t}^{FOR} + \beta_{10} SIZE_{i,t} + \beta_{11} CF_{i,t} + \beta_{12} ROA_{i,t} + \varepsilon_{i,t}$, where *CAR*(-1,1) represents the CARs around the announcement event period (days -1 to +1) and *CRDiff* denotes the absolute magnitude of the rating change. To estimate *CRDiff*, categorical rating grades are converted into cardinal variables measured on a 22-point scale (1 for an AAA rating, 22 for a D rating). *Grade* is set equal to one if an upgrade (downgrade) occurs from speculative (investment) grade to investment (speculative) grade and zero otherwise. *Recession* is a dummy variable set equal to one if the rating change occurs during the recessionary period in our sample and zero otherwise. $AV^{IND}$, $AV^{INS}$, and $AV^{FOR}$ denote abnormal volumes for domestic individuals, domestic institutions, and foreign investors, respectively, around the announcement period (days -1 to +1). These variables are set equal to one if *AV* is greater than one for the corresponding group and zero otherwise. $NOI^{IND}$, $NOI^{INS}$, and $NOI^{FOR}$ denote the net order imbalance for domestic individuals, domestic institutions, and foreign investors, respectively, around

the announcement period (days -1 to +1). These variables are set equal to one if *NOI* is greater than zero for the corresponding group and zero otherwise. *SIZE*, *LEV*, *CF*, and *ROA* are control variables capturing firm-specific characteristics. *SIZE* denotes the firm size measured by taking the log of market capitalization, and *LEV* denotes the book leverage measured by dividing total debt by the book value of total assets. *CF* is the ratio of the cash flow to the book value of total assets, and *ROA* is measured by dividing net income by the book value of total assets. The numbers in parentheses are t-statistics. *Adj*. $R^2$ indicates the adjusted $R^2$. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

## Highlight

- We examine the stock market and investor trading behaviour in response to corporate bond-rating change announcements.
- We analyse the unique transaction data of Korean market, which provides the information non investor types.
- We find the positive (negative) abnormal stock returns around upgrades (downgrades).
- The stock-price reactions to downgrades are more significant than those to upgrades
- Our results provide an evidence for the information superiority of institutional investors