

Do Equity Short Sellers Anticipate Bond Rating Downgrades?

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Abstract

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Abstract

In the month preceding a credit rating downgrade, equity short interest is 40% higher than one year prior and short selling returns to normal levels following a downgrade. Short interest is higher for downgrades with higher negative equity announcement returns and for more severe downgrades (e.g., to speculative grade). Short selling also facilitates price discovery in equity markets around rating downgrades. Abnormal returns following downgrades are smaller when short selling is higher prior to the downgrade and when the costs of short selling are smaller. Short selling also increases before bond prices anticipate the downgrade.

1. Introduction

Significant research documents that short sellers anticipate major negative equity events and returns.¹ Previous research however has not examined whether short sellers anticipate major bond events, particularly rating downgrades, which may affect equity returns.² Examining these events not only offers a new setting to test whether short sellers are sophisticated investors, but also whether sophisticated equity investors anticipate negative bond events earlier than bond investors. Further, since equity returns exhibit negative post announcement drift following rating downgrades, these events present a unique laboratory to explore whether short selling aids in price discovery. In particular, we investigate whether short sellers provide an efficiency role in identifying firms likely to be downgraded, in advance of potentially slower action by the rating agencies.

Our first set of tests examines whether short selling increases prior to credit rating downgrades. We test the hypothesis that short sellers are sophisticated investors who can accurately predict rating downgrades. Consistent with this hypothesis, we find that short interest increases significantly prior to downgrades. For example, in the month before a rating downgrade, short selling is 40% higher than twelve months prior. Results from a probit model also show that short interest levels predict rating downgrades. We then examine whether this short selling aids in price discovery and whether short sellers anticipate rating downgrades before the bond market. We find that increased equity short selling precedes changes in bond spreads prior to a downgrade.

¹ Christophe, Ferri and Angel (2004) find that short selling is significantly linked to post earnings announcement stock returns, Christophe, Ferri, and Hsieh (2010) find that short selling increases prior to equity analyst downgrades, and Karpoff and Lou (2010) find that increased short selling precedes SEC enforcement action on financial statement misrepresentation. Short sellers also appear to use fundamental analysis to predict abnormally negative equity returns generally (Desai et al. (2002), Dechow et al. (2001), and Cao et al. (2007)).

² See Griffin and Sanvicente (1982), Holthausen and Leftwich (1986) and Goh and Ederington (1993) for evidence of negative equity returns following credit rating downgrades.

Although both bond and equity markets largely anticipate rating downgrades before they occur, for the average downgraded firm abnormal short selling begins twelve months prior to the downgrade, whereas bond spreads don't materially change until three months prior. We also provide evidence that pre-downgrade short selling is related to post-downgrade equity return drift. Dichev and Piotroski (2001) document persistent negative abnormal returns in the year following a downgrade, which they interpret as underreaction to the downgrade announcement. We find that abnormal returns following a downgrade dissipate faster for firms with higher levels of abnormal short interest. We also find that the underreaction to a downgrade is larger when the cost of short selling is higher (proxied by a firm not having actively traded options or having low levels of institutional ownership). We conclude that short selling aids in price discovery for negative bond events, and short sellers provide an efficiency role that precedes the bond market's reaction.

Some of these results have alternate interpretations, so we undertake several additional tests designed to distinguish between different explanations. For example, the increased short selling before downgrades could be due to coincident factors, such as deteriorating fundamentals for the firm, a coincident negative earnings announcement, or a major merger announcement. We match downgraded firms to non-downgraded firms with similar fundamentals (including previous returns), we eliminate observations with "contaminating" events, and we examine abnormal short interest levels, such that each firm's short interest is normalized by its previous short interest. We also examine short selling at the daily level, and see no evidence of increased short selling in the days before a downgrade. This result contradicts the possibility that short selling increases because short sellers are given inside information regarding a downgrade. Rating agencies might also use the level of short interest to determine whether they should downgrade a firm, or perhaps short sellers

try to manipulate rating agencies into downgrading a firm. We instrument the level of short selling using options trading to test for such reverse causality, but we are unable to identify a significant causal link from the level of short interest to a downgrade.

We also examine short selling prior to downgrades that are more “severe”. Generally we find that short interest increases more significantly for rating downgrades that are followed by more negative equity returns. We also find that short interest increases more when the firm is rated BBB- prior to the downgrade, the lowest investment grade rating. If the increased short selling prior to a downgrade is due to deteriorating fundamentals of the firm, the distinction between BBB- and BB+ should be irrelevant. But a downgrade from investment grade to speculative grade is likely to have a significant impact on bond prices, both for regulatory as well as fundamental reasons (Kisgen and Strahan (2010)). We also find that abnormal short selling is higher prior to other more severe rating downgrades, including downgrades that span several ratings categories and for downgrades across a rating category (e.g., AA- to A+) compared to within a rating category (e.g., AA to AA-). These results support the conclusion that the increased short selling is directly credit rating related.

We also explore whether short sellers make use of bond rating specific information to anticipate downgrades. Credit rating downgrades have been shown to experience momentum (Altman and Kao (1992) and Lando and Skodeberg (2002)). Short sellers might therefore use a previous downgrade as an indication of a likely subsequent downgrade. Consistent with this, we find that abnormal short selling is higher for downgraded firms in cases in which the firm was previously downgraded in the last 12 months. This result supports our previous evidence indicating that short sellers are informed traders who anticipate rating downgrades.

Our paper contributes to several distinct literatures. First, our paper contributes to the rich literature on short selling and price discovery. Diamond and Verrecchia (1987) establish the theoretical framework for how short selling can make prices more efficient by incorporating news into prices more quickly. Bris, Goetzmann and Zhu (2007), Chang, Cheng and Yu (2007), and Boehmer and Wu (2009) provide some empirical evidence on short selling and price efficiency. We add to this literature by showing that short sellers can mitigate equity return drift following downgrade announcements. Secondly, our paper contributes to the literature examining the timing of information efficiency. Hotchkiss and Ronen (2002) find that stocks do not lead bonds in reflecting firm-specific information, whereas Kwan (1996) finds that stocks do lead bonds in firm-specific information. Our results provide an important case study consistent with the Kwan (1996) results. Finally, our paper contributes to the literature examining whether short sellers are informed investors, including Boehmer, Jones, and Zhang (2008), Karpoff and Lou (2010), and Christophe, Ferri, and Hsieh (2010). We expand those findings to a setting where short sellers are potentially at a disadvantage, since a rating downgrade is a bond event. Nevertheless, we find that short sellers can anticipate these events as well.

The rest of the paper is organized as follows. Section 2 discusses related research and our hypotheses. Section 3 describes the data and empirical methodology. The empirical results are discussed in Section 4, and Section 5 concludes.

2. Hypothesis development

Credit rating changes impact equity returns (Griffin and Sanvicente (1982), Holthausen and Leftwich (1986) and Goh and Ederington (1993)). In particular, credit rating downgrades by Moody's or S&P correspond to decreases in stock prices, but upgrades have little impact on share prices. These studies indicate that the negative stock returns following downgrades persist after excluding observations with contaminating events, such as earnings announcements or mergers. Short sellers may therefore reasonably attempt to anticipate potential bond downgrades.

We consider several hypotheses related to potential short selling prior to rating downgrades. Our primary hypothesis is that short sellers are informed investors who are able to anticipate credit rating changes for profit. The model of Diamond and Verrecchia (1987) describes short sellers as informed traders who profit from their negative private signals. Previous empirical literature indicates that short sellers make informed trades, such that firms with higher short selling have lower subsequent abnormal returns.³ Short sellers have also been shown to anticipate other announcements that affect equity prices, such as earnings announcements (Christophe, Ferri and Angel (2004)), announcements of SEC sanctions related to financial misrepresentation (Karpoff and Lou (2010)), and earnings restatement announcements (Desai, Krishnamurthy and Venkataraman (2006), Efendi and Swanson (2009)). This hypothesis implies not only that short selling will increase prior to a downgrade, but also that short selling will increase particularly when such a strategy is more likely to be profitable, whereby the announcement of the downgrade affects equity prices negatively. Conversely, short selling should not be abnormally high in firms for which rating downgrades are not followed by negative equity returns.

³ See Asquith and Meulbroek (1996), Desai et al. (2002), and Asquith, Pathak and Ritter (2005) for results using monthly short interest. See Boehmer, Jones and Zhang (2008), and Diether, Lee and Werner (2009) for results using daily shorting volume.

Alternatively, short selling may increase prior to a rating downgrade if short sellers, rather than being sophisticated investors that skillfully identify future downgrades, obtain inside information regarding upcoming downgrades through information leakage. Other studies provide evidence consistent with “tipping” of inside information in other contexts, such as Irvine, Lipson and Puckett (2007) with respect to equity analyst initial buy recommendations, and Christophe, Ferri and Hsieh (2010) with respect to equity analyst downgrades. This hypothesis has similar implications to the “informed” hypothesis, since it implies increases in short selling prior to rating downgrades with abnormally negative returns. However, we attempt to identify if tipping occurs specifically by examining daily short selling around the downgrade (similar to Christophe, Ferri and Hsieh (2010)). We propose that if tipping occurs, short selling will increase significantly prior to the exact date of the downgrade (for example, in the Irvine, Lipson and Puckett (2007) study, abnormal trading volume was observed beginning five days prior to the event). We also examine short selling around downgrades for each rating agency separately (Moody’s, S&P and Fitch). We propose that if tipping occurs, it is unlikely to occur in all three rating agencies, so we might see higher levels in a particular rating agency.

We also consider that bond market investors might use the equity market to hedge against downgrades. Although shorting a bond is possible, the market is less liquid so bond investors might use the equity market for short-term hedging. On the other hand, credit default swaps provide an alternate market for hedging (Acharya and Johnson (2007) argue that banks use the CDS market to hedge their own loan portfolios). Further, bond investors have the option of selling the bond outright, but the illiquid market for bonds may make this option less appealing for an investor that wishes to hold the bond long-term. The “hedging” hypothesis argues that short selling will increase

prior to a downgrade, but the strategy need not be profitable. The hedging hypothesis further implies that short selling increases more for firms whose bonds would be most affected by a downgrade, even if the firm is not ultimately downgraded. We examine the hedging hypothesis by evaluating short interest levels particularly around the investment grade distinction.

Finally, we consider the possibility of reverse causality. Our implicit assumption in the previous hypotheses is that the direction of causality is from the likelihood of a downgrade to increased short selling. However, it is possible that causality is in the other direction, such that the short selling itself causes the downgrade. Rating agencies might use short selling levels to determine rating changes. Further, short sellers might deliberately try to manipulate rating agencies into downgrading a firm. We consider these stories less plausible, but for thoroughness we include them in our empirical testing as well. This hypothesis does not imply differential effects for severe rating changes or surprises, so these interaction tests help distinguish this hypothesis from the informed hypothesis. We also directly test this hypothesis using an instrumental variable for short selling levels.

Once we have examined these hypotheses, we then examine whether short selling aids in price discovery. Short selling could make prices more efficient by incorporating news into prices more quickly (Diamond and Verrecchia (1987)).⁴ With regard to rating downgrades, previous literature indicates that stock prices underperform for 12 months following a downgrade (Dichev and Piotroski (2001)), suggesting that equity markets underreact to the rating downgrade. To the

⁴ See Bris, Goetzmann and Zhu (2007), Chang, Cheng and Yu (2007), Boehmer and Wu (2009) for empirical evidence on short selling and price efficiency.

extent short selling increases in anticipation of a downgrade (and immediately following a downgrade), short selling might move prices more quickly to their appropriate level.

We test this directly by first examining subsequent underperformance for downgraded firms with high or low levels of pre-downgrade short interest. If short selling provides a price discovery role, post-downgrade drift will be reduced for firms with higher short interest before the downgrade. We also test the price discovery hypothesis by examining firms that are costly to short sell compared to those that are not. If short selling aids in price discovery, we expect that post-downgrade drift will be reduced for firms where short selling is least costly, and will persist for firms where short selling is expensive. And finally, we examine the timing of short selling relative to changes in bond spreads. For short selling to be most impactful, short selling levels should increase prior to changes in bond spreads, which would indicate that short sellers anticipate downgrades prior to the bond market. Short sellers however could be at an informational disadvantage relative to bond investors, since a rating downgrade is a bond event.

3. Empirical Methodology

3.1 Data

Our primary focus is to examine abnormal short interest prior to rating downgrades. Downgrades differ from other corporate events such as earnings announcements, in that the date of the event (the rating downgrade) is unknown to a short seller (unless they receive inside information about the date). Our analysis is similar to Karpoff and Lou (2010) who examine short selling prior

to SEC action on financial statement misrepresentation, an event for which the date is also unknown. Like their study, we primarily focus on monthly short interest, since short selling might increase prior to a predicted downgrade well in advance of the actual downgrade date.

We obtain monthly short interest data from Compustat (after 2003) and from the market centers (e.g., NYSE, Amex, and Nasdaq) prior to 2003. A firm's short interest is a snapshot of the total number of outstanding short positions each month, so it is stock, rather than flow, data.⁵ Our sample is from April 1995 to December 2007. We scale each firm's monthly short interest by its total shares outstanding. Since short interest is persistent, we subtract from a stock's monthly short interest its moving average over the past three months to represent the shock to a firm's short interest.⁶ This adjustment also corrects for time invariant omitted variables that might lead to higher short interest and higher probabilities of downgrades generally. A large increase (decrease) suggests abnormally high (low) short interest relative to its own recent shorting activity.

After these adjustments, we match each downgraded firm to a benchmark portfolio of non-downgraded firms, using two different methods. First, we match a downgraded firm to a benchmark portfolio based on size, book-to-market and momentum (prior literature shows that short interest is related to these firm characteristics (Duarte, Lou, and Sadka (2006))). Specifically, we construct 27 (3x3x3) portfolios at the beginning of each month by independently sorting stocks on

⁵ Ideally, we would like monthly short sale volume, but shorting flow data are not available over a long time series. Therefore, many of our tests use monthly short interest as an empirical proxy for monthly short selling. Short interest is certainly an imperfect proxy for shorting demand, as has been well discussed in the literature (see Cohen, Diether and Malloy (2007) for a discussion of this issue). For this reason, we examine daily short sale volume data over a shorter time series to test specifically for tipping. During our sample period, the exchanges collect short interest data on the fifteenth day of the month (if it is a trading date), which represent the short positions that had settled by this date. Since trades settle $t+3$ after June 1995, these short positions are those that were outstanding on the trade date three days prior. We account for this timing when matching short interest observations to credit rating changes.

⁶ We also use moving averages over 6 or 12 months and the results are not sensitive to the choice on the length of moving windows.

market capitalization, book-to-market, and momentum, all measured at the end of the prior month (excluding event firms when forming benchmark portfolios). Book equity is defined to be stockholder's equity plus any deferred taxes and any investment tax credit, minus the value of any preferred stock as in Daniel and Titman (1997). Momentum is defined as a stock's cumulative returns over the past 12 months. We use other criteria for matching in robustness tests. The second method is to use propensity score matching to identify the benchmark portfolio.⁷ The matching begins with a Probit regression of a downgraded dummy variable on market capitalization, book-to-market, momentum, 4-digit SIC code, and credit rating level (all of which are lagged by one month). We then use the propensity scores from this Probit estimation and match each downgraded firm to the ten nearest neighbor non-downgraded firms (with replacement). This procedure ensures that a downgraded firm is paired with ten non-downgraded firms with statistically the same market capitalization, book-to-market, momentum, industry, and credit rating. For both matching procedures, abnormal short interest (ABSI) of an event firm is the difference between the above short interest measure and that of its benchmark portfolio.

We obtain daily short selling data directly from the Self Regulatory Organizations (SROs) that were required to publish these data under the SEC-mandated Regulation SHO (RegSHO).⁸ We collect these transaction level data for the period January 1, 2005 through December 31, 2006. The data include (for every transaction that included a short sale) ticker, date, trade time, price, total volume, short sale volume, and an indicator to denote trades that are exempt from certain short-sale rules. We aggregate the short sale volume by date and firm. This leaves us with a dataset of daily

⁷ For a detailed description of the benefits of propensity score matching in corporate finance applications, see Li and Prabhala (2005), Drucker and Puri (2005), and Hellman, Lindsey and Puri (2008).

⁸ The SROs include NYSE, Nasdaq, Amex, NASD ADF, National Stock Exchange, Boston Stock Exchange, Chicago Stock Exchange, Philadelphia Stock Exchange, and Archipelago Exchange (ArcaEX).

short sale volume for each firm in our sample. We divide daily short sale volume by daily total trading volume from CRSP to construct a measure of relative short sale volume. We calculate abnormal short selling volume (ABSS) on day t as the event firm's relative short sale volume minus the mean relative short sale volume of its benchmark portfolio as described above.

Data on credit rating changes are obtained from the Mergent Fixed Investment Securities Databases (FISD). We use similar procedures as Jorion, Liu and Shi (2005) to construct our sample, which includes all U.S. domestic corporate bonds, excluding convertible or exchangeable bonds, Yankee bonds, and bonds issued through private placement. Ratings include those from all three major credit rating agencies (S&P, Moody's and Fitch) from April 1995 to December 2007. We treat each bond rating change from one credit rating agency as one event. We assign a cardinal value to the credit ratings that account for both the rating class (e.g., AA, A, etc.) and any rating modifier (e.g., plus or minus). Details of the cardinal scale are contained in the Appendix. The rating change is computed as the current rating value minus the prior rating value by the same credit rating agency. In cases of multiple rating changes on the same day, we retain the largest magnitude rating change.⁹ These events are more likely to generate the strongest market reactions. In cases where rating changes are made consecutively by the credit rating agencies on separate days within the same month, we retain the one with the earliest date, due to the monthly frequency of short interest data. When matching monthly short interest observations to credit rating changes, we account for the timing issues related to short interest data collection by the exchanges that are discussed in footnote 5. For example, when a credit rating announcement in a given month occurs after the short interest collection date, we match the following month's short interest to this event.

⁹ This could occur when a single bond issue from an issuer receives a rating change from multiple rating agencies, or when several bond issues from the same issuer receive rating changes of different magnitudes from the same rating agency.

Since our objective is to identify whether short sellers anticipate credit rating changes and not other corporate events, we “decontaminate” the credit rating announcement by eliminating any observation with a concurrent non-rating related material announcement (e.g., earnings or a merger). We first exclude rating changes that are coded in the FISD data as being due to “mergers and acquisitions” or “market conditions”. We then exclude rating changes that occur within the same week of a firm’s quarterly earnings announcement. Excluding these observations helps isolate the information content of the rating change specifically. We also cull news announcements around the time of the rating change and remove observations which have concurrent events. We also require at least six monthly observations both before and after each rating change event to examine how short interest varies around rating changes, and we exclude firms with a share price less than \$5 in the month prior to the rating changes.¹⁰ Our final sample consists of 1,463 downgrades and 1,175 upgrades.

Corporate bond yield data come from the trades reporting and compliance engine (TRACE) database, which is disseminated by the Financial Industry Regulatory Authority (FINRA). The TRACE data are available beginning in July 2002. The dissemination of these data occurred in phases, whereby 95% of the U.S. corporate bond market was included after 2004 (see Edwards, Hanley, and Piwowar (2007) for further details).

We perform several filters on the TRACE data before calculating our bond yield measures. We include only regular trades with non-special conditions. We correct misreported trades as

¹⁰ This data filter is common in the short sale literature, since D’Avolio (2002) documents that many stocks with a price below \$5 are nearly impossible to short.

identified by TRACE, and eliminate cancelled trades and duplicate inter-dealer trades. Finally, to exclude potential data entry errors, we eliminate “reversal” trades using the price filter of Bessembinder, Maxwell, and Venkataraman (2006). After these data-cleansing filters, we calculate the equal-weighted average daily bond yield for the bonds in the sample. We then match the TRACE data to the FISD credit ratings data to construct rating and maturity-based bond benchmarks. To create the benchmarks, we follow the procedure of Covitz and Harrison (2003) and form 56 daily yield indices according to rating and maturity. There are seven ratings categories: AAA, AA, A, BBB, BB, B, and CCC or less.¹¹ The eight maturity categories are determined by whether the bond’s maturity is closest to 1, 2, 3, 5, 7, 10, 15, or 20 years. We average the daily yields of each index over the month, giving us a monthly benchmark yield for each index.

Once we have constructed the bond yield benchmarks, we calculate a monthly yield spread for the bonds in our downgrade sample, by matching each bond to one of the 56 indices. The yield spread is the difference between the average monthly yield of the downgraded firm and the monthly yield of the matched benchmark index, based on the bond’s rating and maturity in the month prior to the downgrade. Finally, we calculate the *change* in yield spread for our downgraded firms in the months leading up to the credit rating change. Our primary interest is whether the change in yield spreads is related to abnormal short selling activity. Any relation between the two may provide evidence of price discovery across markets.

3.2 Summary Statistics

¹¹ We form a composite rating by using the average rating of all three rating agencies, where available. The composite rating is rounded down to the lower rating category when in between categories. We compute the composite rating at each point in time.

Figure 1 shows the distribution of abnormal announcement returns (measured as raw returns minus CRSP-value-weighted market returns) for credit rating downgrades in our sample (1995-2007). While announcement returns are negative on average for credit rating downgrades (the average 3-day CAR is -1.12% in our sample), the distribution includes a significant number of positive or near zero announcements. In some non-negative cases, the downgrade could have been anticipated due to a deterioration of other firm fundamentals. In other non-negative cases, a downgrade could be good for shareholders, if the downgrade occurs due to an increase in firm value volatility or if increases in leverage are perceived to be value enhancing. For example, Maxwell and Stephens (2003) find that bonds are twice as likely to be downgraded rather than upgraded after the announcement of share repurchase programs, which are generally followed by positive abnormal stock returns. Our study therefore differs from many other studies of short selling around corporate events (e.g., in their study of short selling around SEC enforcement actions, Karpoff and Lou (2010) note that 98.5% of firms with SEC enforcement actions have negative abnormal announcement returns). This distinction aids in our identification of the causal relationship of interest. We conduct falsification tests using firms that are downgraded but that did not have negative announcement returns for the downgrade. Informed short sellers trading for profit should increase their short selling in the instances where the downgrade leads to negative returns.

Table 1 shows summary statistics for rating changes in our sample. Approximately 75% of downgrades in our sample are one notch downgrades (e.g., from BBB to BBB-). In our empirical tests, we examine whether short sellers are better at predicting rating changes that are more than one notch, since these multi-notch rating changes might be particularly appealing for profitable short selling (3-day CARs for multi-notch downgrades average -1.9%). Panel B indicates that

approximately 11% of our sample had downgrades across the investment grade boundary (e.g., from BBB- to BB+). We also test whether short sellers can predict these particular changes in ratings, which have more severe effects on stock and bond prices (3-day CARs for downgrades in this set of firms average -2.2%). Panel C shows downgrades by year. Downgrades were highest in 2001 and 2002, reflective of overall poor economic conditions. A lower number of downgrades in 1995 and 1996 reflects the fact that Mergent did not incorporate all rating events until later years.¹²

Table 2 presents summary statistics for downgraded firms compared to firms that have a credit rating but were not downgraded. Downgraded firms have substantial negative stock returns for the 12 months prior to being downgraded. This negative stock performance most likely reflects deteriorating fundamentals which could lead to short selling regardless of whether the firm was downgraded. For this reason, some of our tests exclude firms with negative abnormal stock returns prior to the downgrade. This approach is a more conservative way to control for confounding events, since any other events which lead to negative stock returns are thereby excluded. All of our main tests also match against firms with similar stock price performance. Downgraded firms also have higher book to market ratios than rated firms in general. Our matching strategy for the empirical tests accounts for these factors (in addition to other factors, such as size, and momentum).

4. Results

4.1 Main tests

¹² There are fewer events in 2007 due to our requirement of six monthly returns after the event, which effectively ends our sample in June 2007.

We first examine how abnormal short interest varies around rating changes for the whole sample of firms. Figure 2 and Table 3 show abnormal short interest for 18 months prior to and after a rating upgrade or downgrade. Column 1 reports the abnormal short interest relative to a benchmark portfolio matched on size, book-to-market, and momentum. The benchmark portfolio used in Column 2 (3) additionally matches on Earnings/Price (Cash Flow/Price). We match using these additional characteristics because Dechow et al. (2001) and others document that short selling is related to these firm characteristics and consequently, to subsequent returns. The sample for all tests is also decontaminated, such that firms with significant coinciding events (e.g., earnings announcements, mergers, etc.) within 3 days of the event are removed.

For rating downgrades, Figure 2 and Table 3 (Panel A) show that short interest is abnormally high beginning 12 months prior to the downgrade, peaking one month before the downgrade. Panel B of Figure 2 shows the same graph but with propensity score matching benchmarks and the results are similar. The increased short interest is therefore independent of short sellers trading based on other fundamental strategies identified in previous studies. These results suggest that short sellers are able to anticipate rating downgrades.

The abnormal short interest also declines following the downgrade, such that it is no longer significant three months following the downgrade. However, short interest remains abnormally high for two months after the downgrade. This short selling may reflect a strategy to profit off of momentum in rating changes. Previous studies indicate that firms that are downgraded are more likely to be downgraded again (Altman and Kao (1992) and Lando and Skodeberg (2002)). Further, Dichev and Piotoski (2001) show that downgraded firms have negative stock returns of in the first

year following a downgrade. Short sellers may deliberately short firms after a downgrade to take advantage of these conditions. We examine whether short sellers adopt this momentum strategy directly in a subsequent section.

Short interest is also abnormally low preceding upgrades (Table 3, Panel B); however this result is less robust. Four months prior to an upgrade, abnormal short interest is actually significantly higher than normal, but this reverses such that one month prior to the upgrade short interest is abnormally low. This result is consistent with evidence indicating that short sellers know which stocks to avoid, in addition to which stocks to short (Boehmer, Huszar, and Jordan (2010)).

These results are for the full sample, which includes firms with significant negative stock returns preceding the downgrade. To the extent that short sellers make use of return momentum strategies, we would expect increased short selling in these firms regardless of whether the firm was ultimately downgraded.¹³ In an effort to further decontaminate our sample, we conduct additional tests excluding firms whose 12-month cumulative (abnormal) stock returns prior to the downgrade are negative. Within this sub-sample, some downgrades are associated with negative announcement returns and some are associated with zero or positive announcement returns. If short sellers are anticipating downgrades for profit, they should be increasing their short selling in cases in which the downgrade is associated with negative announcement returns. Downgrades for which the announcement return is not negative therefore provide a useful falsification sample.

¹³ Dieter, Lee and Werner (2009) identify an opposite strategy when focusing on short-term strategies, where short sellers seem to exploit mean reversion in equity prices with respect to past few days returns.

Figure 3 and Table 4 show results for the sample that excludes firms with negative stock returns preceding the downgrade. Within this group, we contrast short interest when announcement returns for the downgrade are negative against events that have non-negative announcement returns. These results show that abnormal short interest is high only in cases where the announcement CAR is negative, indicating that short sellers are effective at predicting downgrades which were a negative surprise. Short interest increases abnormally for these firms four months prior to the downgrade. Short interest is not significantly different from normal when the downgrade is not associated with a negative announcement return. These results support a scenario where informed short sellers accumulate positions prior to ratings downgrades that are unanticipated by the market. These results are also inconsistent with reverse causality. If abnormally high short selling causes rating downgrades because rating agencies pay attention to short selling, we would not expect these differences. Abnormal short selling would not cause a rating downgrade to be more likely to have a negative announcement return. As the results using portfolio matching and propensity score matching are similar to this point, we only report portfolio matched results hereafter for space considerations.

4.2 Which types of downgraded firms attract short sellers?

In this section we explore further which types of downgraded firms are associated with more or less short selling. Figure 4 and Table 5 show how short interest differs between different groups according to downgrade severity. We examine single notch versus multi-notch downgrades, BBB-downgrades versus all other downgrades, and within class versus across class downgrades. Panel A of Figure 4 shows that short interest increases substantially for firms that have a multi-notch

downgrade relative to those with only a single notch downgrade. Table 5 shows that abnormal short interest is 2.9 times higher for firms with a multi-notch downgrade the month before the downgrade (and the difference is statistically significant). Given the larger abnormal return for this subset of events, this result underscores that short sellers are trading specifically in anticipation of severe credit rating downgrades, where profiting from the trade is more likely.

Panel B of Figure 4 shows that short interest increases substantially more for firms with BBB- ratings that are downgraded compared to all other downgraded firms. Table 5 shows that BBB- firms have abnormal short interest 3.2 times higher than all other downgraded firms the month before the rating change. A downgrade from BBB- implies that a firm has moved from investment grade to speculative grade. This particular change in rating has a significant impact on a firm's access to capital and third-party relationships (Kisgen (2006)). The evidence for BBB- firms therefore reinforces that the increased short selling is due to the rating itself.

While this result indicates the increased short selling is rating specific, the result is also consistent with other hypotheses for increased short selling. In particular, this result seems to reinforce the hedging hypothesis. While the credit default swap (CDS) market provides an alternate vehicle for shorting, previous studies show that a firm's bond yields change around the investment grade distinction not only due to changes in default probabilities, but also due specifically to regulations on bond investment around that distinction (Kisgen and Strahan (2010)). If a bond investor is using the equity market to hedge against a possible downgrade, we would expect to see increased short selling activity for these firms in particular, whether or not they receive a subsequent downgrade. However, Table 6, which displays short interest by credit rating for all

rated firms, illustrates that short interest for all BBB- firms is not abnormally large. While the table shows a general increase in short interest as credit quality decreases, there is no obvious break at the BBB- versus BB+ distinction. The two pieces of evidence for short selling of BBB- firms are therefore generally more consistent with informed short selling (or tipping), rather than hedging.

Panel C of Figure 4 shows that short interest is higher for ratings changes across ratings categories (e.g., BB- to B+) than within a category (e.g., BB to BB-). Most regulations pertain only to the level of a rating as opposed to making any distinction for the modifiers within a rating category, so regulations based on ratings will only affect yields across ratings categories. So the higher short selling for these rating agencies also supports a ratings specific effect. To some extent, this result might be related to the BBB- results, so we examine these results in a multivariate setting in Section 4.5.

Given momentum in rating downgrades documented by Altman and Kao (1992) and Lando and Skodeberg (2002), we consider the sub-sample of firms that do and do not have rating downgrades in the 12 months preceding the downgrade. Informed short sellers might make use of this momentum to identify firms that are more likely to be downgraded. Figure 5 shows results for these subsamples. The sub-sample of firms that had a credit rating downgrade in the 12 months previous to the current downgrade have higher levels of abnormal short interest than those firms that did not have a recent downgrade. Abnormal short interest is statistically significant in the 13 months prior to the current downgrade for those firms recently downgraded. For those not recently downgraded, abnormal short interest is significant in the six months prior to the downgrade (tabulated results available upon request). These results illustrate two points. First, short sellers

appear to be trading based on momentum in credit rating changes. We also confirm that this is a reasonable strategy, as abnormal returns are still on average negative for downgrades in this subset of firms (the average CAR is slightly more negative than for the full sample). Second, short sellers are still able to anticipate the downgrades of firms that did not have a recent downgrade. So, the full sample results are not driven solely by firms that have had multiple downgrades. We also apply our matching approach on other dimensions, including rating availability, industry, and year. Results are robust to these alternate matches.

4.3 Does short selling predict rating downgrades?

The evidence in Tables 3, 4, and 5 indicates that short sellers detect future downgrades before the downgrades are announced, and that the extent of short selling is sensitive to the severity of the downgrade. These results are for the sample of firms that are downgraded, and do not directly address whether short selling generally predicts subsequent downgrades. To explore this, we examine whether high levels of abnormal short interest are related to subsequent downgrades, using all firms for which we have short interest data. Table 7 reports these results.

In Panel A of Table 7, firms with abnormal short interest above the 90th percentile are identified as “high short interest firms”, while those below the 10th percentile are “low short interest firms” (we follow Karpoff and Lou (2010) who use similar classifications).¹⁴ We then examine whether these two sets of firms are subsequently downgraded in the next 12 months. We create a 2x2 matrix using downgraded versus non-downgraded firms along one axis and the short interest distinction on the other. Most firms are not downgraded in a given 12 month period, so we would

¹⁴ We conduct these tests using a 95th percentile cutoff as well, and the results are similar.

expect to see higher concentrations of firms along the non-downgraded dimension. But if short interest tends to be high prior to downgrades, we expect to see a higher than random concentration along the diagonal. This is exactly what we find. For any given 12-month period, 11.42% of firms are downgraded, but among the high short interest category, that percentage is 12.94%. A Chi-squared test rejects the null hypothesis that the short interest and downgrade categories are unrelated. This test indicates that short interest is a predictor of subsequent downgrades. In unreported tests, we also examine this relationship in a multivariate setting with additional control variables, and the results are similar.¹⁵

In Panel B of Table 7, we regress monthly (abnormal) short interest on a dummy variable indicating whether or not a firm is downgraded in the following month. In these tests we also include the subsequent monthly return to control for any short selling based on fundamentals or the anticipation of negative stock returns generally. For firms that were downgraded in the following month, this subsequent monthly return is net of the downgrade announcement return. A similar regression setup is used by Christophe, Ferri, and Angel (2004) and Christophe, Ferri, and Hsieh (2010) to test for anticipatory short selling prior to earnings and analyst downgrade announcements. The negative and significant coefficient on the return variable confirms previous findings that short selling levels predict negative returns generally (e.g., Desai et.al (2002)). The positive and statistically significant coefficient on the downgrade variable indicates that short selling predicts downgrades, even after controlling for short selling due to non-downgrade related subsequent returns.

¹⁵ We also instrument abnormal short interest with an options dummy variable. In these tests, we find that abnormal short interest is only marginally significant (10% level). This suggests that although higher short interest predicts a rating downgrade, the short interest itself does not cause the downgrade.

Next, we estimate a probit model by regressing a downgrade indicator variable on ABSI over the prior 12 months. The regression controls for other variables that have been shown to be related to downgrades, and includes year fixed effects. The results of the probit regression are in Panel C of Table 7. The estimate for ABSI is statistically significant, confirming that ABSI significantly improves the fit of the model. The marginal effect of an increase in ABSI from the 10th percentile to the 90th percentile (holding all other variables constant) is associated with a 0.6% increase in the probability of a downgrade. This marginal increase in ABSI accounts for 23% of the unconditional probability of a downgrade (2.6%). This result provides evidence that lagged short interest is incrementally informative about subsequent downgrades, beyond what is conveyed by other conditioning variables.

Finally, we sort firms into two groups based on whether or not they are downgraded in the following month, and then sort (within group) into five quintiles based on the subsequent monthly return. Again, the subsequent return is net of the announcement return for the firms that are downgraded. Figure 6 displays these results. For all five return quintiles, ABSI is much higher for the group of firms that are downgraded in the following month. The difference in ABSI across downgrade groups is significant for four of the five quintiles. This result supports our previous finding that short selling predicts subsequent downgrades, independent of subsequent non-downgrade related returns.

4.4 Timing of short selling around downgrades

We also examine how close to the downgrade short selling increases, using daily data from 2005-2006. In these tests we are particularly interested in identifying any potential evidence of “tipping”, whereby short sellers receive inside information regarding an impending downgrade. If short sellers are given such information, we propose that the information would not only include the coming downgrade, but also the date of the downgrade. In this regard, short sellers acting on inside information would be better able to time the downgrade than other sophisticated investors who would not be aware of the date of any rating change.

Table 8 shows daily short selling around credit rating changes, beginning 30 trading days prior to the downgrade. ABSS is the measure of daily abnormal short selling. Contrary to our monthly results, the daily data do not indicate significant increases in short selling prior to (or following) a downgrade. This result, combined with our monthly results, suggests that while short sellers are able to anticipate downgrades, they are unable to do so with precision regarding the *timing* of the actual downgrade. In unreported tests, we also examine abnormal short interest around rating changes for each rating agency separately (Moody’s, S&P, and Fitch) to identify if a single rating agency is leaking information. We find no evidence that short interest is higher for any particular rating agency. This evidence contradicts the hypotheses that short sellers are receiving inside information. These results are consistent with other papers that demonstrate short sellers are unable to anticipate the timing of unscheduled corporate announcements, such as SEO announcements (Henry and Koski (2010)) and earnings restatement announcements (Drake et al. (2009)). However, Christophe, Ferri and Hsieh (2010) use similar data to show that short sellers do anticipate the announcements of equity analyst downgrades, which they attribute to information leakage. This difference may be explained by the fact that rating agency analysts do not face the

same incentives as sell-side equity analysts with regards to tipping off institutional traders (Irvine (2004), Irvine, Lipson and Puckett (2006)).

The daily data do indicate that short sellers are able to avoid upgraded firms however. Short selling is abnormally lower for firms that are upgraded, and this abnormally low short selling begins at least 30 days prior to an upgrade. This result reinforces the monthly results which indicated abnormally low short selling on a monthly basis. Short sellers seem to be able to predict accurately which firms to avoid short selling, consistent with Boehmer, Huszar and Jordan (2010). These results are a bit puzzling however, since prior literature has not shown positive abnormal returns around credit rating upgrades.

4.5 Multivariate tests

To verify our matched sample interaction results, we also examine abnormal short selling in a multivariate regression analysis. Using the sample of all downgraded firms, we regress a firm's abnormal short interest prior to a credit rating downgrade on a rating interaction variable (e.g., downgraded from BBB-) and control variables that have been shown to be related to short selling in previous literature. In these tests we control for a firm's size, book-to-market ratio, momentum, institutional ownership, residual return volatility, and total accruals. Institutional ownership proxies for the supply of lendable shares, since borrowing to short is easier when institutional ownership is high (D'Avolio (2002), Nagel (2005)). We obtain institutional ownership data from Thompson Financial 13F, which is calculated as shares owned by institutions as a percentage of shares outstanding. Volatility is used to control for limits to arbitrage. Short sellers face higher arbitrage

risk when volatility is high (Duan, Hu, and McClean (2010)). Volatility is the standard deviation of residual returns from a market model estimated over the one year ending one week before the rating announcement. Total accruals from the most recent fiscal year end are included to control for fundamentals that short sellers use to build their positions (Desai et al. (2002)). It is defined as earnings before extraordinary items minus cash flow from operations minus cash flow from investments, deflated by average total assets.

Table 9 reports the results of these regressions. In Panel A the dependent variable is the ABSI for the one month prior to the downgrade, and in Panel B the dependent variable is the mean ABSI over the twelve months prior to the downgrade. In Models 1 through 5, we include one variable related to downgrade activity or severity, in addition to the control variables. These tests are consistent with the previous results that abnormal short interest is higher for: firms downgraded to speculative grade; firms downgraded several notches; firms that have a surprise downgrade; firms that are downgraded across a rating category; and firms that have received a downgrade within the previous 12 months. In Model 6 we include all of the downgrade related variables simultaneously. In at least one of the two panels, each of the five downgrade variables is significant with the exception of the across rating category variable. Since this variable is related to the speculative grade variable (BBB-), these results indicate that the only across rating category of significance is the change from investment grade to speculative grade. Overall, these results indicate that short sellers actively trade for reasons specific to a rating downgrade, even when controlling for well-known determinants of short interest.

Some interesting differences emerge depending on whether the short interest window is twelve months or one month. The BBB- variable is significant only in the one month case, and the recently downgraded variable is significant only in the twelve month case. A recently downgraded firm is defined as one that was downgraded in the previous twelve months, so we would expect that the increased short selling strategy would be implemented as much as twelve months prior to the downgrade; the results confirm this. Based on the lower R^2 coefficients in the one month regressions generally, explanatory power in these regressions is not as strong as when ABSI is measured over a 12 month interval. The lower power reinforces the view that short sellers build up their positions over several months in anticipation of a downgrade, but have difficulty trading based on the timing of the actual downgrade announcement. One exception however seems to be downgrades of BBB- firms. For these firms, the timing appears to be more predictable.

4.6 Short selling and price discovery

Dichev and Piotroski (2001) find that negative abnormal returns persist after credit rating downgrades for as much as a year following a downgrade. They conclude that the post-announcement drift reflects an underreaction to the downgrade, suggestive of pricing inefficiencies. Table 10, Panel A shows results replicating their study, with post-announcement BHARs for several time horizons following a credit rating downgrade. Consistent with Dichev and Piotroski (2001), we find evidence of underperformance following downgrades, although the magnitudes we document are smaller in some cases.

We then test whether short selling mitigates this post downgrade drift. Diamond and Verrecchia (1987) argue that short selling provides an important market function by incorporating news into prices more quickly. Recent empirical research suggests that short sellers contribute to the price discovery process by enhancing price efficiency (for example, Karpoff and Lou (2010) find that short sellers mitigate mispricing prior to announcements of financial misconduct). Similarly, we investigate whether short sellers provide a comparable role in a new setting, ratings downgrades. We examine this question by testing the impact of pre-announcement short selling on post-announcement returns.

Panel B of Table 10 shows how abnormal returns following a downgrade vary with short selling intensity prior to the announcement. We define high (low) short selling intensity as those events with mean abnormal short interest above the 90th percentile (below the 10th percentile) in the 12 months prior to the downgrade. We find that following a downgrade, negative abnormal returns in the high short interest intensity group are concentrated in the first three months, while they persist for 12 months in the low short interest intensity group. Downgraded firms with low amounts of pre-downgrade short selling underperform by 9.62% in the year following the downgrade, compared to an insignificant 1.47% underperformance for firms in the high ABSI group. We also define the high and low ABSI firms using short selling windows that include the announcement month (e.g., t-12 to t+2), and the results are similar (results not reported). These results are consistent with short sellers helping prices adjust to efficient levels more quickly.

To address concerns about the endogeneity of short interest levels, we use an instrumental variable for ABSI. This allows us to isolate and more formally test the independent effect of ABSI

on the post-announcement returns. Following Karpoff and Lou (2010), our instrument for ABSI is a dummy variable indicating the availability of options in month t for the firm. This instrument is motivated by the finding that short selling volume is positively related to the availability of options (Diether, Lee, and Werner (2009)), as listed options reduce the cost of hedging short positions. The results from the instrumental variable analysis are shown in Panel C of Table 10. This panel shows results from a regression of the post-announcement BHAR on the fitted value from the first stage regression of mean ABSI (over the prior 12 months) on our instrument. For all three post-event holding periods, the coefficient estimate on the fitted value (ABSI_IV) is positive and significant, indicating short selling mitigates negative drift.¹⁶ The intercept is negative and significant, showing that without abnormal short interest, post downgrade drift remains. These results show that short sellers play an important role in price discovery for downgraded firms.¹⁷

4.7 Short selling and bond spreads

Our results suggest that equity short sellers anticipate credit rating downgrades. Bond traders might be similarly informed and also trade in anticipation of credit events. Several papers find evidence that bond prices move in advance of credit rating downgrades (Grier and Katz (1976), Hite and Warga (1997), Covitz and Harrison (2003)). Other papers also investigate the relationship between equity returns and bond returns. Kwan (1996) and Downing, Underwood, and Xing (2009) show that stock returns lead bond returns in incorporating firm specific information. Hotchkiss and Ronen (2002), on the other hand, do not find evidence of such a relationship. Considering our

¹⁶ This result is robust to the inclusion of other control variables, such as size, book-to-market, and prior 12 month returns. However, our measure of ABSI implicitly controls for these variables through our matching procedures.

¹⁷ In unreported tests, we find that the post-announcement drift is higher for firms with greater constraints on short selling (proxied by institutional ownership or options availability), suggesting that high shorting constraints hinder price discovery around downgrades.

previous results in the context of these two streams of the literature, we examine whether equity short selling leads changes in bond yield spreads (or vice versa) prior to downgrades. Since rating downgrades are primarily bond events, bond traders may have a relative informational advantage over equity traders in this setting.

Panel A of Table 11 reports the average abnormal short interest and the average change in bond spread (Δ Spread) in the 12 months prior to a downgrade, for the sample of firms that had both short interest and bond yield data. Δ Spread is calculated as the change in a firm's average monthly bond yield minus the average monthly yield of a matched benchmark based on the maturity and rating of the firm the month prior to the downgrade. While short interest is abnormally high in all 12 months prior to the downgrade, the bond yield spread does not materially widen until three months prior to the downgrade. This suggests that equity short sellers trade in anticipation of a downgrade earlier than bond traders.

To formally study the lead-lag relation between abnormal short selling and bond yield change, in Panel B of Table 11, we regress a firm's change in bond spread on lagged abnormal short interest (Model 1). Similarly, we regress a firm's abnormal short interest on lagged change in bond spread (Model 2). In these regressions, we also include lagged stock returns to control for the relationship between equity returns and bond returns (Downing, Underwood, and Xing (2009)). To be consistent with Table 9, we also control for size, book-to-market, institutional ownership, return volatility, and total operating accruals. In Model 1, Δ Spread is positively associated with lagged ABSI. For the average downgraded firm, a one percent increase in lagged abnormal short interest is associated with a 1.55 basis point increase in bond spread, during the 12 months prior to the

downgrade. In Model 2, there is no statistically significant relationship between ABSI and lagged Δ Spread. The results of these two regressions are consistent with the results in Panel A.

Although these tests document relative differences in timing between short selling and changes in bond spreads around rating downgrades, the results do not prove causality between the two. Bond traders could be reacting specifically to increases in equity short selling, or bond traders could be slower than short sellers to react to the same information. Regardless, combined with our other empirical evidence regarding price discovery, these results indicate that short sellers provide a price discovery role around rating downgrades, and short sellers are able to anticipate rating downgrades before bond investors.

5. Conclusions

This paper is the first to examine whether equity short sellers anticipate bond rating downgrades. We find that short interest increases prior to rating downgrades, and this result is independent of coincident corporate events (e.g., earnings announcements) and firm fundamentals (e.g., decreasing stock prices). Abnormal short interest is greater for firms at the investment grade threshold, and for firms that receive multi-notch downgrades. Additionally, short interest is higher for unanticipated downgrades that have pre-event positive returns but surprise negative announcement returns. These results are consistent with informed trading by short sellers prior to rating downgrades. However, short sellers do not appear to be privy to information related to the timing of credit rating downgrades, which is inconsistent with a tipping hypothesis. This result is in

contrast with the abnormally high short selling before equity analyst downgrades (Christophe, Ferri and Hsieh (2010)), which may be related to different analyst incentives.

Anecdotal and empirical evidence suggests that credit rating agencies are sometimes slow to react to new information. Our results add to this evidence by illustrating the ability of short sellers to predict rating downgrades. We show that short sellers start to build up their positions several months ahead of a downgrade, and short interest contains incremental information for predicting rating changes beyond other known factors. Furthermore, our findings suggest that abnormal short interest can be a useful tool for assessing credit risk on a more timely basis. Finally, we find evidence that short sellers provide a useful market function, facilitating the timely incorporating of information into market prices. Stock underperformance following downgrades is significantly reduced when short selling is higher prior to the downgrade, and abnormal short interest leads widening bond spreads prior to rating downgrades.

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Appendix: Classification of Cardinal Scale by Credit Ratings

| Explanation | Standard & Poor's (modifiers) | Moody's (modifiers) | Fitch (modifiers) | Cardinal Scale |
|-----------------------------|----------------------------------|------------------------|----------------------|----------------|
| <i>Investment grade</i> | | | | |
| Highest grade | AAA | Aaa | AAA | 1 |
| High grade | AA (+, none, -) | Aa (1,2,3) | AA (+, none, -) | 2,3,4 |
| Upper medium grade | A (+, none, -) | A (1,2,3) | A (+, none, -) | 5,6,7 |
| Medium grade | BBB (+, none, -) | Baa (1,2,3) | BBB (+, none, -) | 8,9,10 |
| <i>Speculative grade</i> | | | | |
| Lower medium grade | BB (+, none, -) | Ba (1,2,3) | BB (+, none, -) | 11,12,13 |
| Speculative | B (+, none, -) | B (1,2,3) | B (+, none, -) | 14,15,16 |
| Poor standing | CCC (+, none, -) | Caa (1,2,3) | CCC (+, none, -) | 17,18,19 |
| Highly speculative | CC | Ca | CC | 20 |
| Lowest quality, no interest | C | C | C | 21 |
| In default | D | D | DDD/DD/D | 23 |

Table 1: Rating Changes Summary

The sample consists of 1463 downgrades and 1175 upgrades of U.S. domestic non-convertible corporate bonds from April 1995 to December 2007. Panel A reports the sample distribution by absolute magnitude of rating changes. The magnitude of rating changes is the cardinal value of the new rating minus the previous cardinal value of the old rating. Panel B reports the sample distribution by a breakdown into three categories. Within class refers to rating changes within the same letter class. Across class refers to rating changes from one letter class to the other. Across investment grade is a subgroup of across class where rating changes are from investment (speculative) to speculative (investment) grade. Panel C reports the sample distribution by year.

Panel A: Sample distribution by absolute magnitude of rating changes

| | Downgrades | | Upgrades | |
|-------|------------|------|----------|-------|
| | # | % | # | % |
| 1 | 1115 | 75.5 | 974 | 82.4 |
| 2 | 259 | 17.3 | 147 | 12.9 |
| 3 | 64 | 5.0 | 38 | 3.4 |
| 4+ | 25 | 1.7 | 16 | 1.4 |
| Total | 1463 | 99.5 | 1175 | 100.0 |

Panel B: Sample distribution by within class, across class, and across investment grade

| | Downgrades | | Upgrades | |
|-------------------------|------------|-------|----------|-------|
| | # | % | # | % |
| Within class | 858 | 58.6 | 731 | 62.2 |
| Across class | 444 | 30.3 | 316 | 26.9 |
| Across investment grade | 161 | 11.0 | 128 | 10.9 |
| Total | 1463 | 100.0 | 1175 | 100.0 |

Panel C: Sample distribution by year

| Year | Downgrades | | Upgrades | |
|-------|------------|------|----------|------|
| | # | % | # | % |
| 1995 | 1 | 0.1 | 1 | 0.1 |
| 1996 | 23 | 1.6 | 58 | 4.9 |
| 1997 | 47 | 3.2 | 95 | 8.1 |
| 1998 | 103 | 7.0 | 95 | 8.1 |
| 1999 | 110 | 7.5 | 81 | 6.9 |
| 2000 | 127 | 8.7 | 81 | 6.9 |
| 2001 | 201 | 13.7 | 81 | 6.9 |
| 2002 | 222 | 15.2 | 58 | 4.9 |
| 2003 | 172 | 11.8 | 82 | 7.0 |
| 2004 | 122 | 8.3 | 113 | 9.6 |
| 2005 | 126 | 8.6 | 133 | 11.3 |
| 2006 | 158 | 10.8 | 216 | 18.4 |
| 2007 | 51 | 3.5 | 81 | 6.9 |
| Total | 1463 | 100 | 1175 | 100 |

Table 2: Summary Statistics for Downgraded and All Rated Firms

This table compares the means and medians between downgraded firms and firms with ratings but not downgraded in a particular month. Size is the market capitalization. B/M is the book-to-market ratio. Abnormal Ret_12_1 is the cumulative abnormal returns over the previous 12 months prior to the event month. Accruals is the total operating accruals from the most recent fiscal year-end, defined as earnings before extraordinary items minus cash flow from operations minus cash flow from investments, deflated by average total assets. Earnings/Price ratio is operating income after depreciation divided by the product of common shares outstanding and the firm's fiscal year-end price. Cash flow/ Price ratio is cash flow divided by the produce of common shares outstanding and the firm's fiscal year-end price, where cash flows are measured as earnings minus accruals. Sales growth index is defined as $Sales_t/Sales_{t-1}$. ***, **, * represents significant differences between downgraded firms and rated firms overall at 0.01, 0.05 and 0.1 level. T (Wilcoxon rank-sum) test is used for significance between means (medians).

| Variable | | Downgraded | Rated but not downgraded | |
|--------------------|--------|-------------------|---------------------------------|-----|
| Size (\$mil) | Mean | 5736.2 | 7529.73 | *** |
| | Median | 1667.53 | 1581.38 | |
| B/M | Mean | 1.01 | 0.57 | *** |
| | Median | 0.78 | 0.46 | *** |
| Abnormal Ret_12_1 | Mean | -13.87% | 8.94% | *** |
| | Median | -15.1% | 0.1% | *** |
| Accruals | Mean | 0.048 | 0.069 | *** |
| | Median | 0.024 | 0.034 | *** |
| Earnings/Price | Mean | 0.140 | 0.141 | |
| | Median | 0.118 | 0.114 | |
| CF/P | Mean | 0.241 | 0.193 | *** |
| | Median | 0.182 | 0.144 | *** |
| Sales growth index | Mean | 1.198 | 1.228 | |
| | Median | 1.060 | 1.101 | |

Table 3: Abnormal Short Interest Around Credit Rating Changes

This table reports average abnormal short interest (ABSI) and average raw short interest (SI) around credit rating changes. Raw short interest is calculated as total short interest divided by shares outstanding. In column 1, ABSI is the event stock's relative short interest in excess of the mean relative short interest of a portfolio benchmarked on size, book-to-market, and momentum, where relative short interest refers to a stock's monthly short interest minus its moving average over the past 3 months. Column 2 (3) additionally matches on earnings/price (cash flow/price). Column 4 is raw short interest. The sample consists of credit rating changes of U.S. domestic non-convertible corporate bonds from April 1995 to December 2007.

Panel A: Downgrades

| Relative Month | Column 1 Match on Size, B/M, Mom | | Column 2 Additional match on E/P | | Column 3 Additional match on CF/P | | Column 4 Raw SI |
|----------------|-------------------------------------|--------|-------------------------------------|--------|--------------------------------------|--------|--------------------|
| | ABSI | t-stat | ABSI | t-stat | ABSI | t-stat | SI |
| -18 | -0.01% | -0.29 | -0.01% | -0.39 | 0.00% | -0.11 | 2.82% |
| -17 | 0.04% | 1.25 | 0.04% | 1.24 | 0.04% | 1.25 | 2.89% |
| -16 | 0.04% | 1.29 | 0.04% | 1.26 | 0.03% | 0.80 | 2.91% |
| -15 | 0.02% | 0.67 | 0.01% | 0.33 | -0.01% | -0.34 | 2.95% |
| -14 | 0.00% | 0.14 | 0.01% | 0.24 | 0.00% | -0.14 | 2.98% |
| -13 | 0.04% | 1.34 | 0.03% | 1.19 | 0.01% | 0.27 | 3.04% |
| -12 | 0.08% | 2.58 | 0.08% | 2.69 | 0.05% | 1.61 | 3.12% |
| -11 | 0.08% | 2.25 | 0.07% | 2.07 | 0.06% | 1.44 | 3.19% |
| -10 | 0.09% | 2.53 | 0.08% | 2.13 | 0.07% | 1.64 | 3.28% |
| -9 | 0.08% | 2.28 | 0.05% | 1.56 | 0.06% | 1.70 | 3.34% |
| -8 | 0.10% | 2.90 | 0.09% | 2.66 | 0.10% | 2.66 | 3.43% |
| -7 | 0.11% | 2.81 | 0.10% | 2.54 | 0.12% | 2.74 | 3.52% |
| -6 | 0.16% | 4.12 | 0.15% | 3.87 | 0.15% | 3.57 | 3.64% |
| -5 | 0.18% | 4.55 | 0.16% | 4.05 | 0.20% | 4.60 | 3.77% |
| -4 | 0.19% | 4.98 | 0.18% | 4.76 | 0.20% | 4.82 | 3.89% |
| -3 | 0.21% | 5.07 | 0.19% | 4.86 | 0.19% | 4.63 | 4.04% |
| -2 | 0.24% | 5.94 | 0.22% | 5.54 | 0.21% | 4.86 | 4.20% |
| -1 | 0.24% | 5.42 | 0.21% | 4.85 | 0.21% | 4.50 | 4.35% |
| 0 | 0.21% | 4.36 | 0.19% | 4.05 | 0.22% | 4.02 | 4.48% |
| 1 | 0.19% | 3.97 | 0.18% | 3.88 | 0.20% | 3.70 | 4.58% |
| 2 | 0.11% | 2.53 | 0.09% | 2.12 | 0.10% | 2.07 | 4.65% |
| 3 | 0.03% | 0.69 | 0.02% | 0.49 | 0.06% | 1.12 | 4.68% |
| 4 | 0.05% | 1.08 | 0.04% | 0.88 | 0.05% | 1.03 | 4.75% |
| 5 | 0.02% | 0.36 | 0.01% | 0.31 | 0.01% | 0.29 | 4.78% |
| 6 | 0.06% | 1.33 | 0.05% | 1.23 | 0.07% | 1.51 | 4.84% |
| 7 | 0.01% | 0.31 | 0.02% | 0.41 | 0.01% | 0.29 | 4.86% |
| 8 | 0.03% | 0.62 | 0.03% | 0.52 | 0.02% | 0.31 | 4.82% |
| 9 | 0.00% | 0.08 | -0.01% | -0.23 | 0.01% | 0.19 | 4.80% |
| 10 | -0.07% | -1.67 | -0.07% | -1.68 | -0.06% | -1.36 | 4.70% |
| 11 | -0.04% | -0.91 | -0.04% | -1.01 | -0.02% | -0.35 | 4.65% |
| 12 | -0.02% | -0.42 | -0.02% | -0.52 | -0.02% | -0.42 | 4.64% |
| 13 | -0.04% | -0.90 | -0.05% | -1.11 | 0.00% | -0.06 | 4.56% |
| 14 | -0.08% | -1.78 | -0.10% | -2.12 | -0.05% | -0.97 | 4.54% |
| 15 | -0.08% | -1.91 | -0.10% | -2.42 | -0.05% | -0.94 | 4.34% |
| 16 | -0.06% | -1.47 | -0.06% | -1.48 | -0.03% | -0.65 | 4.31% |
| 17 | 0.05% | 1.10 | 0.05% | 0.99 | 0.06% | 1.08 | 4.38% |
| 18 | 0.07% | 1.57 | 0.06% | 1.28 | 0.08% | 1.54 | 4.42% |

Panel B: Upgrades

| Relative Month | Column 1 | | Column 2 | | Column 3 | | Column 4 |
|----------------|-------------------------|--------|-------------------------|--------|--------------------------|--------|----------|
| | Match on Size, B/M, Mom | | Additional match on E/P | | Additional match on CF/P | | Raw SI |
| | ABSI | t-stat | ABSI | t-stat | ABSI | t-stat | SI |
| -18 | 0.01% | 0.18 | 0.01% | 0.37 | 0.01% | 0.20 | 3.52% |
| -17 | 0.05% | 1.26 | 0.05% | 1.41 | 0.06% | 1.34 | 3.57% |
| -16 | -0.02% | -0.55 | -0.01% | -0.25 | -0.02% | -0.50 | 3.54% |
| -15 | -0.03% | -0.76 | -0.02% | -0.54 | -0.02% | -0.45 | 3.55% |
| -14 | -0.03% | -0.77 | -0.04% | -1.01 | 0.00% | -0.09 | 3.57% |
| -13 | -0.03% | -0.56 | -0.03% | -0.55 | 0.00% | -0.08 | 3.56% |
| -12 | 0.02% | 0.37 | 0.02% | 0.47 | 0.02% | 0.35 | 3.63% |
| -11 | -0.01% | -0.18 | -0.01% | -0.16 | -0.02% | -0.38 | 3.63% |
| -10 | -0.02% | -0.47 | -0.01% | -0.36 | -0.02% | -0.44 | 3.62% |
| -9 | 0.05% | 1.24 | 0.05% | 1.36 | 0.09% | 1.72 | 3.71% |
| -8 | 0.04% | 0.89 | 0.06% | 1.18 | 0.06% | 0.99 | 3.71% |
| -7 | 0.03% | 0.62 | 0.03% | 0.67 | 0.03% | 0.53 | 3.77% |
| -6 | 0.07% | 1.38 | 0.07% | 1.46 | 0.04% | 0.67 | 3.86% |
| -5 | 0.06% | 1.24 | 0.06% | 1.17 | 0.01% | 0.28 | 3.89% |
| -4 | 0.09% | 2.06 | 0.09% | 2.02 | 0.06% | 1.14 | 3.99% |
| -3 | -0.02% | -0.52 | -0.02% | -0.45 | -0.01% | -0.27 | 3.94% |
| -2 | -0.06% | -1.33 | -0.05% | -1.21 | -0.05% | -0.92 | 3.93% |
| -1 | -0.11% | -2.22 | -0.11% | -2.19 | -0.07% | -1.22 | 3.89% |
| 0 | -0.10% | -2.09 | -0.09% | -1.76 | -0.14% | -2.49 | 3.89% |
| 1 | -0.11% | -2.40 | -0.09% | -1.86 | -0.15% | -3.08 | 3.85% |
| 2 | -0.02% | -0.36 | 0.00% | -0.10 | -0.04% | -0.82 | 3.94% |
| 3 | -0.03% | -0.74 | -0.02% | -0.48 | 0.01% | 0.26 | 3.94% |
| 4 | 0.01% | 0.17 | 0.01% | 0.36 | 0.04% | 0.84 | 3.98% |
| 5 | 0.01% | 0.31 | 0.01% | 0.13 | 0.04% | 0.87 | 4.04% |
| 6 | 0.05% | 1.34 | 0.06% | 1.59 | 0.07% | 1.51 | 4.09% |
| 7 | 0.01% | 0.36 | 0.02% | 0.56 | 0.07% | 1.47 | 4.13% |
| 8 | 0.02% | 0.54 | 0.02% | 0.55 | 0.06% | 1.24 | 4.16% |
| 9 | 0.07% | 1.15 | 0.06% | 0.99 | 0.00% | 0.07 | 4.22% |
| 10 | 0.01% | 0.29 | 0.01% | 0.29 | 0.02% | 0.32 | 4.13% |
| 11 | 0.00% | 0.09 | 0.00% | -0.04 | 0.00% | 0.03 | 4.14% |
| 12 | 0.01% | 0.20 | 0.00% | -0.11 | -0.02% | -0.57 | 4.19% |
| 13 | 0.05% | 1.08 | 0.05% | 1.04 | 0.04% | 0.78 | 4.28% |
| 14 | 0.06% | 1.25 | 0.06% | 1.26 | 0.04% | 0.78 | 4.33% |
| 15 | -0.06% | -1.10 | -0.06% | -1.23 | -0.05% | -0.98 | 4.03% |
| 16 | -0.01% | -0.16 | -0.02% | -0.38 | 0.01% | 0.19 | 4.10% |
| 17 | 0.01% | 0.13 | 0.00% | 0.07 | 0.01% | 0.22 | 4.13% |
| 18 | -0.01% | -0.18 | -0.02% | -0.44 | -0.08% | -1.40 | 4.10% |

Table 4: Abnormal Short Interest Around Downgrades with Non-Negative pre-event BHARs

This table reports average abnormal short interest (ABSI) and abnormal returns (ABRET) around credit rating changes which have non-negative pre-event buy-and-hold abnormal returns. This sample is split into two subsamples, those that had negative announcement window CARs, and those with positive announcement window CARs. ABSI is the event stock's relative short interest in excess of the mean relative short interest of a portfolio benchmarked on size, book-to-market, and momentum, where relative short interest refers to a stock's monthly short interest minus its moving average over the past 3 months. Abnormal returns are raw returns minus value-weighted market returns.

| Relative month | Announcement CAR <0 (N=257) | | | | Announcement CAR >=0 (N=225) | | | |
|----------------|-----------------------------|--------|--------|--------|------------------------------|--------|--------|--------|
| | ABSI | t-stat | ABRET | t-stat | ABSI | t-stat | ABRET | t-stat |
| -18 | -0.05% | -0.76 | -0.40% | -0.61 | 0.07% | 1.08 | -2.08% | -2.73 |
| -17 | 0.00% | 0.01 | -0.89% | -1.35 | 0.06% | 1.00 | -0.36% | -0.44 |
| -16 | 0.09% | 1.54 | -0.19% | -0.24 | 0.06% | 0.88 | -1.43% | -1.94 |
| -15 | 0.07% | 1.03 | -0.35% | -0.49 | -0.03% | -0.60 | -0.76% | -0.73 |
| -14 | 0.06% | 0.98 | -0.23% | -0.30 | -0.09% | -1.37 | 0.05% | 0.07 |
| -13 | 0.02% | 0.31 | -1.37% | -1.84 | -0.06% | -0.95 | 0.19% | 0.23 |
| -12 | 0.07% | 1.35 | 3.43% | 3.82 | -0.05% | -0.72 | 1.63% | 2.00 |
| -11 | 0.04% | 0.49 | 3.38% | 3.96 | 0.05% | 0.77 | 2.80% | 3.50 |
| -10 | 0.06% | 0.70 | 2.35% | 3.07 | 0.16% | 2.19 | 2.71% | 3.45 |
| -9 | 0.04% | 0.68 | 2.75% | 3.87 | 0.04% | 0.38 | 3.18% | 3.57 |
| -8 | -0.04% | -0.78 | 1.58% | 2.43 | -0.03% | -0.38 | 2.75% | 3.61 |
| -7 | 0.03% | 0.46 | 1.22% | 2.00 | 0.02% | 0.26 | 1.71% | 2.65 |
| -6 | 0.10% | 1.65 | 1.10% | 1.73 | 0.06% | 0.96 | 3.50% | 5.09 |
| -5 | 0.05% | 0.86 | 3.23% | 3.87 | 0.04% | 0.55 | 2.54% | 3.82 |
| -4 | 0.15% | 2.54 | 2.49% | 3.03 | -0.04% | -0.54 | 1.22% | 1.83 |
| -3 | 0.22% | 3.13 | 2.76% | 3.90 | -0.06% | -0.70 | 3.73% | 4.77 |
| -2 | 0.13% | 2.38 | 3.89% | 4.32 | -0.02% | -0.26 | 1.43% | 2.02 |
| -1 | 0.23% | 2.61 | 2.78% | 4.25 | -0.07% | -0.94 | 3.64% | 4.92 |
| 0 | 0.03% | 0.30 | -3.84% | -4.78 | 0.03% | 0.31 | 3.57% | 5.28 |
| 1 | -0.04% | -0.38 | 0.74% | 1.08 | 0.03% | 0.29 | 0.88% | 1.20 |
| 2 | -0.01% | -0.15 | 1.52% | 1.73 | 0.08% | 0.97 | 0.61% | 1.02 |
| 3 | 0.01% | 0.07 | 0.49% | 0.71 | 0.16% | 2.05 | 0.40% | 0.64 |
| 4 | 0.11% | 1.18 | 1.06% | 1.34 | 0.00% | 0.04 | -0.32% | -0.47 |
| 5 | 0.13% | 1.19 | 0.81% | 1.18 | 0.09% | 0.92 | 1.31% | 1.64 |
| 6 | 0.11% | 1.10 | 0.73% | 1.06 | 0.15% | 1.57 | 1.03% | 1.55 |
| 7 | 0.07% | 0.68 | 0.22% | 0.35 | 0.13% | 1.65 | 0.70% | 1.06 |
| 8 | 0.15% | 1.38 | 0.42% | 0.60 | 0.21% | 1.89 | 0.34% | 0.48 |
| 9 | 0.07% | 0.64 | -1.31% | -2.17 | 0.00% | -0.03 | 0.56% | 0.89 |
| 10 | 0.06% | 0.80 | -0.49% | -0.68 | 0.00% | 0.04 | -0.57% | -0.74 |
| 11 | 0.00% | -0.05 | 0.04% | 0.05 | 0.07% | 0.63 | 0.27% | 0.34 |
| 12 | -0.03% | -0.29 | 0.05% | 0.07 | 0.03% | 0.26 | -0.34% | -0.48 |
| 13 | -0.02% | -0.23 | 0.48% | 0.70 | -0.06% | -0.63 | 0.56% | 0.72 |
| 14 | -0.05% | -0.48 | -0.24% | -0.33 | -0.10% | -1.15 | 0.27% | 0.37 |
| 15 | -0.02% | -0.21 | -0.96% | -1.13 | -0.06% | -0.91 | 1.80% | 3.00 |
| 16 | -0.01% | -0.13 | -0.38% | -0.48 | 0.05% | 0.44 | -0.02% | -0.03 |
| 17 | 0.01% | 0.11 | -0.83% | -1.03 | 0.17% | 1.63 | 0.41% | 0.59 |
| 18 | 0.11% | 0.91 | 1.12% | 1.57 | 0.17% | 1.69 | 0.82% | 1.20 |

Table 5: Abnormal Short Interest by Severity of Downgrade

This table reports abnormal short interest by downgrade severity. Downgrades are grouped by notch, BBB-rating and within vs. across class downgrades. Abnormal short interest is the event stock's relative short interest in excess of the mean relative short interest of a portfolio benchmarked on size, book-to-market, and previous 12-mo returns. Single (multi) Notch refers to downgrade by one (≥ 2) notch(es). BBB- refers to events where the rating level prior to downgrade is BBB-. Within class refers to rating changes within the same letter class. Across class refers to rating changes from one letter class to the next (including across the investment grade boundary). Numbers in boldface are significantly different from zero at the 0.05 level. ***, **, * represents significant differences across the two groups at the 0.01, 0.05 and 0.1 level, respectively.

| Relative Month | By Notch | | BBB- vs. Other | | Within vs. Across class | | |
|----------------|---------------|---------------|----------------|--------------|-------------------------|--------------|----|
| | Single | Multi | Non BBB- | BBB- | Within | Across | |
| N | 1115 | 348 | 1334 | 129 | 858 | 605 | |
| -18 | 0.00% | -0.05% | -0.02% | 0.08% | -0.01% | -0.01% | |
| -17 | 0.05% | -0.02% | 0.03% | 0.06% | 0.02% | 0.06% | |
| -16 | 0.08% | -0.09% | ** 0.04% | 0.08% | 0.04% | 0.04% | |
| -15 | 0.04% | -0.05% | 0.02% | 0.07% | 0.01% | 0.04% | |
| -14 | 0.02% | -0.04% | 0.00% | 0.06% | -0.02% | 0.05% | |
| -13 | 0.02% | 0.09% | 0.03% | 0.09% | 0.05% | 0.02% | |
| -12 | 0.07% | 0.09% | 0.09% | -0.03% | 0.09% | 0.05% | |
| -11 | 0.06% | 0.15% | 0.08% | 0.10% | 0.09% | 0.06% | |
| -10 | 0.06% | 0.20% | 0.07% | 0.31% | * 0.04% | 0.17% | * |
| -9 | 0.06% | 0.13% | 0.06% | 0.21% | 0.05% | 0.11% | |
| -8 | 0.09% | 0.12% | 0.09% | 0.12% | 0.09% | 0.10% | |
| -7 | 0.10% | 0.15% | 0.11% | 0.06% | 0.10% | 0.13% | |
| -6 | 0.15% | 0.18% | 0.16% | 0.11% | 0.11% | 0.23% | |
| -5 | 0.16% | 0.25% | 0.18% | 0.25% | 0.14% | 0.25% | |
| -4 | 0.17% | 0.27% | 0.18% | 0.28% | 0.19% | 0.19% | |
| -3 | 0.19% | 0.25% | 0.19% | 0.34% | 0.20% | 0.21% | |
| -2 | 0.21% | 0.32% | 0.23% | 0.37% | 0.21% | 0.28% | |
| -1 | 0.16% | 0.47% | *** 0.20% | 0.64% | *** 0.17% | 0.32% | * |
| 0 | 0.09% | 0.61% | *** 0.18% | 0.50% | * 0.13% | 0.33% | ** |
| 1 | 0.12% | 0.42% | *** 0.19% | 0.22% | 0.12% | 0.29% | * |
| 2 | 0.08% | 0.20% | 0.12% | -0.06% | 0.09% | 0.14% | |
| 3 | 0.04% | 0.01% | 0.03% | 0.01% | 0.02% | 0.05% | |
| 4 | 0.07% | -0.01% | 0.04% | 0.15% | 0.00% | 0.13% | |
| 5 | 0.00% | 0.08% | 0.02% | 0.00% | -0.02% | 0.07% | |
| 6 | 0.07% | 0.02% | 0.07% | -0.01% | -0.01% | 0.16% | |
| 7 | 0.01% | 0.03% | 0.01% | 0.04% | -0.06% | 0.12% | |
| 8 | 0.03% | 0.03% | 0.01% | 0.20% | -0.02% | 0.10% | |
| 9 | -0.03% | 0.12% | 0.00% | 0.09% | 0.02% | -0.02% | |
| 10 | -0.10% | 0.01% | -0.05% | -0.26% | -0.04% | -0.12% | |
| 11 | -0.03% | -0.08% | -0.03% | -0.11% | 0.00% | -0.10% | |
| 12 | -0.01% | -0.07% | -0.03% | 0.03% | -0.01% | -0.04% | |
| 13 | 0.01% | -0.20% | ** -0.04% | 0.01% | -0.01% | -0.08% | |
| 14 | -0.04% | -0.23% | -0.09% | -0.04% | -0.03% | -0.17% | |
| 15 | -0.09% | -0.07% | -0.07% | -0.23% | -0.05% | -0.13% | |
| 16 | -0.14% | 0.17% | *** -0.07% | 0.02% | -0.10% | 0.00% | |
| 17 | -0.03% | 0.29% | *** 0.03% | 0.29% | * -0.03% | 0.17% | |
| 18 | 0.04% | 0.17% | * 0.04% | 0.35% | * 0.03% | 0.14% | |

Table 6: Short Interest By Credit Rating for All Rated Firms

This table reports the median monthly short interest for all rated firms, by rating level. Short interest is the total short positions outstanding divided by shares outstanding, for each firm-month observation. When a firm has split ratings across rating agencies, the highest rating is used for classification. The sample consists of all U.S. domestic non-convertible corporate bonds from April 1995 to December 2007.

| Rating | N | Median Short Interest |
|---------------|----------|------------------------------|
| AAA | 1061 | 0.66% |
| AA+ | 431 | 0.77% |
| AA | 2568 | 0.90% |
| AA- | 3909 | 1.04% |
| A+ | 7266 | 1.27% |
| A | 10906 | 1.40% |
| A- | 9245 | 1.50% |
| BBB+ | 10803 | 1.80% |
| BBB | 12275 | 2.05% |
| BBB- | 8451 | 2.56% |
| BB+ | 4716 | 2.63% |
| BB | 4508 | 2.84% |
| BB- | 6198 | 3.40% |
| B+ | 7202 | 2.84% |
| B | 7870 | 2.45% |
| B- | 3851 | 3.00% |
| CCC+ | 822 | 2.10% |
| CCC | 290 | 3.63% |
| CCC- | 123 | 2.65% |
| CC | 241 | 5.98% |
| C | 53 | 3.07% |
| D | 31 | 3.88% |

Table 7: Abnormal Short Interest and the Presence or Absence of Rating Downgrades

This table examines abnormal short interest for all firms that have a credit rating. Panel A investigates whether short selling predicts rating downgrades by grouping all firm months into four cells based on a two-way classification: whether the amount of abnormal short interest is high or low, and whether the firm month is identified as having downgrades in that month. Downgrades refer to the twelve months prior to (but not including) the month of the downgrade. A firm-month is put into the high abnormal short interest (ABSI) group if the firm's abnormal short interest in that month is above the 90th percentile of ABSI in the cross-section of firms for that month. Panel B reports results from monthly Fama-MacBeth regressions of lagged short interest (SI_t) or abnormal short interest ($ABSI_t$) on subsequent monthly returns (Ret_{t+1}) and an indicator variable for firms that received a downgrade in that month ($Downgrade_{t+1}$). For firms with a rating change in a given month, the market adjusted monthly return is net of the 3-day announcement CAR. Panel C reports results from a multivariate probit regression of the downgrade indicator variable on ABSI and other control variables. ABSI is the mean abnormal short interest over the prior 12 months. D/TA is long-term debt over total assets. ROA is earnings before extraordinary items over total assets. Δ represents changes between the most recent fiscal year and the prior fiscal year. Year fixed effects are included. The sample includes all firms with a credit rating.

Panel A: High ABSI (\geq 90th percentile) and Downgrade Frequency

| | | No downgrades | Downgrades | Total |
|------------------------|---------------------------------------|---------------|------------|----------------|
| Low ABSI | Frequency | 110868 | 14289 | 125157 |
| | Percent of Total Observations | 79.68 | 10.27 | 89.95 |
| | Percent of Low ABSI Observations | 88.58 | 11.42 | |
| | Percent of (No)Downgrade Observations | 90.1 | 88.75 | |
| High ABSI | Frequency | 12182 | 1811 | 13993 |
| | Percent of Total Observations | 8.75 | 1.3 | 10.05 |
| | Percent of High ABSI Observations | 87.06 | 12.94 | |
| | Percent of (No)Downgrade Observations | 9.9 | 11.25 | |
| Total | | 123050 | 16100 | 139150 |
| | | 88.43 | 11.57 | 100 |
| Chi-squared statistics | | | 28.62 | p-value 0.0001 |

Panel B: Fama MacBeth regressions of Short Interest on Subsequent Monthly Return and Downgrade Indicator

| Dependent Variable = Variable | ABSI _t | | | SI _t | | |
|----------------------------------|-------------------|--------|---------|-----------------|--------|---------|
| | Coef | t-stat | p-value | Coef | t-stat | p-value |
| Intercept | 0.0002 | 4.52 | 0.00 | 0.0298 | 35.39 | 0.00 |
| Ret _{t+1} | -0.0013 | -1.91 | 0.06 | -0.0100 | -2.55 | 0.01 |
| Downgrade _{t+1} | 0.0016 | 4.09 | 0.00 | 0.0148 | 10.27 | 0.00 |
| Adj R ² | 0.55% | | | 1.59% | | |

Panel C: Probit regression of Downgrade Indicator on Abnormal Short Interest

Dependent Variable = Downgrade Indicator

| | Estimate | StdErr | ProbChiSq |
|-----------------------|------------------|----------|-----------|
| Intercept | -2.747 | 0.140 | 0.000 |
| ABSI | 22.522 | 2.990 | 0.000 |
| LogME | -0.079 | 0.012 | 0.000 |
| B/M | 0.031 | 0.007 | 0.000 |
| 12 month prior return | -1.753 | 0.065 | 0.000 |
| $\Delta D/TA$ | 0.754 | 0.207 | 0.000 |
| ΔROA | -1.101 | 0.291 | 0.000 |
| year dummies = yes. | | | |
| | Test | ChiSq | ProbChiSq |
| | Likelihood Ratio | 2163.583 | 0.000 |
| | Score | 2698.823 | 0.000 |
| | Wald | 2187.764 | 0.000 |

Table 8: Abnormal Daily Short Selling Around Downgrades and Upgrades

Average abnormal short selling (ABSS) and average abnormal returns (ABRET) around credit rating changes. Abnormal return is raw return in excess of CRSP VW return. Abnormal short selling on day t equals the event stock's relative short sale volume in excess of the mean relative short sale volume of a portfolio benchmarked on size, book-to-market, and momentum. Relative short sale volume is defined as daily short sale volume divided by shares outstanding. The sample consists of credit rating changes of U.S. domestic non-convertible corporate bonds from January 2005 to December 2006.

| Event Date | Downgrade (N=296) | | | | Upgrade (N=357) | | | |
|------------|-------------------|--------|---------|--------|-----------------|--------|---------|--------|
| | ABSS | t-stat | ABRET | t-stat | ABSS | t-stat | ABRET | t-stat |
| -30 | -0.1705 | -0.91 | -0.0011 | -1.11 | -0.3883 | -2.69 | 0.0016 | 1.80 |
| -29 | -0.1711 | -1.06 | 0.0022 | 1.97 | -0.4194 | -3.05 | 0.0012 | 1.22 |
| -28 | 0.2807 | 1.32 | 0.0010 | 0.88 | -0.5188 | -3.97 | 0.0005 | 0.58 |
| -27 | 0.3796 | 1.59 | -0.0002 | -0.17 | -0.6045 | -4.24 | 0.0000 | 0.05 |
| -26 | -0.1381 | -0.86 | -0.0008 | -0.50 | -0.4570 | -2.84 | 0.0012 | 1.26 |
| -25 | -0.2580 | -1.49 | 0.0004 | 0.30 | -0.5254 | -3.72 | -0.0002 | -0.24 |
| -24 | -0.1711 | -0.99 | -0.0022 | -2.36 | -0.4716 | -3.65 | -0.0005 | -0.53 |
| -23 | -0.0327 | -0.16 | -0.0018 | -1.85 | -0.6572 | -4.70 | -0.0003 | -0.28 |
| -22 | 0.0125 | 0.07 | -0.0012 | -1.13 | -0.6969 | -5.18 | -0.0006 | -0.72 |
| -21 | 0.1862 | 0.63 | -0.0015 | -1.63 | -0.5791 | -3.46 | 0.0004 | 0.39 |
| -20 | 0.4275 | 1.13 | 0.0000 | 0.00 | -0.5911 | -4.07 | 0.0013 | 1.21 |
| -19 | 0.2000 | 0.83 | 0.0027 | 2.38 | -0.4248 | -2.45 | 0.0008 | 0.70 |
| -18 | 0.1630 | 0.76 | -0.0010 | -0.86 | -0.5576 | -3.66 | 0.0013 | 1.57 |
| -17 | 0.3553 | 1.53 | 0.0013 | 0.76 | -0.6388 | -4.86 | 0.0007 | 0.73 |
| -16 | 0.2600 | 1.23 | 0.0026 | 2.25 | -0.6203 | -4.41 | 0.0022 | 2.27 |
| -15 | 0.0455 | 0.20 | 0.0008 | 0.74 | -0.5036 | -3.71 | 0.0014 | 1.42 |
| -14 | -0.1089 | -0.65 | -0.0007 | -0.84 | -0.6069 | -4.98 | 0.0018 | 1.99 |
| -13 | -0.0412 | -0.17 | -0.0006 | -0.45 | -0.5293 | -2.40 | -0.0009 | -1.01 |
| -12 | -0.0336 | -0.16 | -0.0014 | -1.21 | -0.5626 | -4.06 | -0.0001 | -0.12 |
| -11 | -0.0231 | -0.11 | -0.0002 | -0.15 | -0.4411 | -2.73 | 0.0014 | 1.58 |
| -10 | -0.0241 | -0.13 | 0.0000 | -0.02 | -0.6153 | -4.18 | -0.0004 | -0.39 |
| -9 | 0.1873 | 0.75 | -0.0001 | -0.08 | -0.5289 | -3.42 | -0.0024 | -1.60 |
| -8 | 0.1904 | 0.69 | 0.0005 | 0.48 | -0.5481 | -3.76 | 0.0025 | 2.39 |
| -7 | 0.1985 | 0.78 | 0.0006 | 0.37 | -0.3281 | -1.90 | -0.0003 | -0.29 |
| -6 | 0.0838 | 0.46 | -0.0019 | -1.81 | -0.3994 | -2.60 | -0.0015 | -1.45 |
| -5 | 0.0152 | 0.08 | -0.0009 | -0.80 | -0.4089 | -2.74 | 0.0014 | 1.51 |
| -4 | 0.1890 | 1.07 | 0.0005 | 0.45 | -0.3876 | -2.40 | 0.0014 | 1.43 |
| -3 | 0.1636 | 0.81 | -0.0005 | -0.42 | -0.5226 | -3.78 | -0.0014 | -1.66 |
| -2 | 0.0490 | 0.19 | -0.0030 | -2.81 | -0.5942 | -3.78 | -0.0002 | -0.21 |
| -1 | 0.0636 | 0.24 | 0.0004 | 0.17 | -0.4741 | -2.65 | 0.0012 | 1.16 |
| 0 | 0.1164 | 0.52 | -0.0033 | -3.17 | -0.4220 | -2.39 | -0.0010 | -1.15 |
| 1 | 0.0719 | 0.28 | -0.0030 | -3.48 | -0.3014 | -1.38 | -0.0004 | -0.42 |
| 2 | 0.0188 | 0.08 | -0.0006 | -0.54 | -0.1906 | -0.88 | 0.0029 | 3.02 |
| 3 | -0.0587 | -0.27 | -0.0036 | -3.24 | -0.3886 | -2.01 | 0.0004 | 0.45 |
| 4 | 0.2475 | 0.87 | -0.0010 | -1.06 | -0.4120 | -2.20 | -0.0004 | -0.47 |
| 5 | -0.0389 | -0.18 | -0.0001 | -0.14 | -0.5911 | -3.22 | 0.0004 | 0.42 |

Table 9: Regression Analysis of Abnormal Short Interest on Downgrade Activity

This table reports regression analysis of abnormal short interest (ABSI) on downgrade activity for the sample of downgraded firms. The dependent variable is ABSI in month t-1 (Panel A), or the mean ABSI over [t-12,t-1] (Panel B). BBB-, Multinotch, Surprise, AcrossClass and Recently downgraded are indicator variables equal to one if: the rating before the downgrade is BBB-, the downgrade is more than 2 notches, the pre-event 12-month abnormal return is positive and CAR(-1,1) is negative, the rating change is from one letter class to the other, the firm experienced a downgrade within the previous 12 months, respectively. Volatility is the standard deviation of residual returns estimated over the one year before the rating announcement. Accruals is the total operating accruals from the most recent fiscal year-end.

Panel A: ABSI at t-1

| Variable | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
|---------------------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|
| | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat |
| BBB- | 0.0045 | 2.89 | | | | | | | | | 0.0039 | 2.35 |
| Multinotch | | | 0.0032 | 3.06 | | | | | | | 0.0027 | 2.43 |
| Surprise | | | | | 0.0028 | 2.09 | | | | | 0.0025 | 1.88 |
| AcrossClass | | | | | | | 0.0017 | 1.92 | | | 0.0000 | 0.01 |
| Recently downgraded | | | | | | | | | 0.0008 | 0.88 | 0.0004 | 0.49 |
| logME | -0.0004 | -1.10 | -0.0004 | -1.17 | -0.0003 | -0.99 | -0.0004 | -1.18 | -0.0004 | -1.19 | -0.0004 | -1.11 |
| B/M | 0.0006 | 0.94 | 0.0007 | 1.04 | 0.0007 | 1.08 | 0.0007 | 1.03 | 0.0006 | 0.98 | 0.0005 | 0.80 |
| 12 mo. prior return | -0.0038 | -3.09 | -0.0038 | -3.12 | -0.0052 | -3.75 | -0.0038 | -3.13 | -0.0038 | -3.11 | -0.0050 | -3.61 |
| Inst | 0.0012 | 0.58 | 0.0015 | 0.74 | 0.0015 | 0.74 | 0.0014 | 0.68 | 0.0014 | 0.66 | 0.0013 | 0.61 |
| Volatility | -0.0767 | -1.74 | -0.0875 | -1.97 | -0.0726 | -1.64 | -0.0762 | -1.72 | -0.0773 | -1.73 | -0.0940 | -2.10 |
| Accruals | 0.0027 | 0.74 | 0.0025 | 0.68 | 0.0019 | 0.54 | 0.0017 | 0.48 | 0.0022 | 0.60 | 0.0031 | 0.87 |
| Intercept | 0.0043 | 1.28 | 0.0041 | 1.23 | 0.0034 | 1.00 | 0.0041 | 1.20 | 0.0045 | 1.32 | 0.0034 | 1.00 |
| Adj R ² | 1.40% | | 1.48% | | 1.11% | | 1.06% | | 0.84% | | 1.95% | |

Panel B: Mean ABSI over [t-12, t-1]

| Variable | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
|---------------------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|
| | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat | Coef | t-stat |
| BBB- | 0.0006 | 1.02 | | | | | | | | | 0.0002 | 0.35 |
| Multinotch | | | 0.0008 | 2.09 | | | | | | | 0.0005 | 1.30 |
| Surprise | | | | | 0.0010 | 2.25 | | | | | 0.0010 | 2.09 |
| AcrossClass | | | | | | | 0.0005 | 1.57 | | | 0.0002 | 0.68 |
| Recently downgraded | | | | | | | | | 0.0010 | 3.27 | 0.0010 | 3.03 |
| logME | -0.0002 | -1.81 | -0.0002 | -1.86 | -0.0002 | -1.70 | -0.0002 | -1.88 | -0.0003 | -2.19 | -0.0002 | -2.12 |
| B/M | -0.0002 | -0.88 | -0.0002 | -0.89 | -0.0002 | -0.84 | -0.0002 | -0.91 | -0.0003 | -1.27 | -0.0003 | -1.34 |
| 12 mo. prior return | -0.0024 | -5.54 | -0.0024 | -5.55 | -0.0029 | -5.96 | -0.0024 | -5.56 | -0.0024 | -5.52 | -0.0028 | -5.84 |
| Inst | 0.0062 | 8.58 | 0.0062 | 8.67 | 0.0062 | 8.69 | 0.0062 | 8.62 | 0.0061 | 8.48 | 0.0061 | 8.50 |
| Volatility | 0.0587 | 3.80 | 0.0556 | 3.58 | 0.0586 | 3.80 | 0.0579 | 3.75 | 0.0516 | 3.31 | 0.0480 | 3.07 |
| Accruals | 0.0013 | 1.02 | 0.0013 | 1.05 | 0.0012 | 0.96 | 0.0012 | 0.91 | 0.0015 | 1.20 | 0.0016 | 1.25 |
| Intercept | -0.0027 | -2.26 | -0.0027 | -2.30 | -0.0030 | -2.53 | -0.0028 | -2.32 | -0.0025 | -2.08 | -0.0029 | -2.41 |
| Adj R ² | 8.9% | | 9.2% | | 9.2% | | 9.0% | | 9.6% | | 9.9% | |

Table 10: Abnormal Stock Returns Following Credit Rating Downgrades

This table reports long-run abnormal returns (BHAR) following credit rating downgrades. Firm-specific BHARs are measured as the buy-and-hold raw returns for the various horizon minus the buy-and-hold return for a benchmark portfolio matched on size, book-to-market, and momentum. For example, BHAR[1,3] denotes the abnormal return measured over the horizon from one month following the downgrade through 3 months following the downgrade. Panel A presents results for all downgrades. Panel B examines abnormal returns by high and low abnormal short interest (ABSI). High (low) ABSI refers to above 90th (below 10th) percentile of mean ABSI from t-12 to t-1. Panel C regresses BHAR on a fitted value of ABSI (ABSI_IV) from a first stage instrumental variable regression. The instrument in the first stage is a dummy variable for option availability.

Panel A: Abnormal returns for all downgrades

| | Mean | t-stat | p-value |
|-------------|--------|--------|---------|
| BHAR[1, 3] | -1.86% | -3.05 | 0.00 |
| BHAR[1, 6] | -1.89% | -1.97 | 0.05 |
| BHAR[1, 12] | -2.60% | -1.63 | 0.10 |

Panel B: Abnormal returns by ABSI

| | Low ABSI (<10th percentile) | | | | High ABSI (≥90th percentile) | | | |
|-------------|-----------------------------|--------|---------|-----|------------------------------|--------|---------|-----|
| | Mean | t-stat | p-value | N | Mean | t-stat | p-value | N |
| BHAR[1, 3] | -2.89% | -1.36 | 0.18 | 138 | -5.00% | -2.13 | 0.04 | 137 |
| BHAR[1, 6] | -5.11% | -1.71 | 0.09 | | -4.45% | -0.89 | 0.38 | |
| BHAR[1, 12] | -9.62% | -2.13 | 0.04 | | -1.47% | -0.19 | 0.85 | |

Panel C: Regression of abnormal returns on fitted ABSI from first stage IV

| Dep. Variable | Variable | Coef | t-stat | p-value |
|---------------|-----------|---------|--------|---------|
| BHAR[1, 3] | Intercept | -0.0222 | -2.95 | 0.003 |
| | ABSI_IV | 0.0276 | 2.09 | 0.037 |
| BHAR[1, 6] | Intercept | -0.0257 | -2.17 | 0.030 |
| | ABSI_IV | 0.0450 | 2.17 | 0.030 |
| BHAR[1, 12] | Intercept | -0.0603 | -3.09 | 0.002 |
| | ABSI_IV | 0.0957 | 2.80 | 0.005 |

Table 11: Abnormal Short Interest and Changes in Bond Yield Spread

This table reports the relation between the change in bond spread (Δ Spread) and abnormal short interest (ABSI) for 234 downgrades with TRACE data during the 12 months leading up to the event month. Δ Spread is the monthly change in the yield spread, calculated as the downgraded firm's yield minus the yield on an index matched by rating and maturity. Panel A displays the average ABSI and average Δ Spread by event month. Panel B reports regressions of Δ Spread on lagged ABSI (Model 1) or ABSI on lagged Δ Spread (Model 2). LogME is the natural log of market capitalization. B/M is the book-to-market ratio. Inst is institutional ownership at the most recent quarter end. Volatility is the standard deviation of residual returns from a market model estimated over the one year ending one week before the rating announcement. Accruals is the total operating accruals from the most recent fiscal year-end. *t*-stats are calculated with standard errors that are clustered by firm and month.

Panel A: Average abnormal short interest and change in bond spread preceding downgrades

| Relative month | ABSI | t-stat | Δ Spread | t-stat |
|----------------|-------|--------|-----------------|--------|
| -12 | 0.22% | 2.25 | 0.12% | 1.23 |
| -11 | 0.26% | 2.51 | -0.02% | -0.18 |
| -10 | 0.22% | 2.44 | 0.09% | 1.68 |
| -9 | 0.22% | 2.57 | -0.04% | -0.80 |
| -8 | 0.24% | 2.46 | 0.08% | 1.84 |
| -7 | 0.26% | 2.76 | 0.02% | 0.24 |
| -6 | 0.37% | 3.58 | 0.00% | 0.04 |
| -5 | 0.30% | 2.84 | 0.06% | 1.45 |
| -4 | 0.26% | 2.86 | 0.03% | 0.72 |
| -3 | 0.46% | 4.21 | 0.14% | 3.59 |
| -2 | 0.45% | 3.88 | 0.08% | 2.18 |
| -1 | 0.47% | 3.66 | 0.03% | 0.61 |
| 0 | 0.32% | 2.37 | 0.07% | 1.68 |

Panel B: Regressions of change in bond spread and abnormal short interest for downgraded firms

| Model | Dep. Variable | Variable | Coef | t-stat | p-value | Adj. R ² |
|---------|-------------------------------------|-----------------------------------------|--------|--------|---------|---------------------|
| Model 1 | Δ Spread _{<i>t</i>} | Intercept | -0.092 | -1.09 | 0.27 | 0.034 |
| | | Δ Spread _(<i>t</i>-1) | 0.050 | 1.25 | 0.21 | |
| | | ABSI _(<i>t</i>-1) | 1.546 | 2.24 | 0.03 | |
| | | AbRet _(<i>t</i>-1) | -0.703 | -4.99 | 0.00 | |
| | | logMe | 0.004 | 0.55 | 0.58 | |
| | | B/M | 0.017 | 0.67 | 0.50 | |
| | | Inst | 0.046 | 1.01 | 0.31 | |
| | | Volatility | 2.588 | 1.70 | 0.09 | |
| | | Accruals | 0.045 | 0.48 | 0.63 | |
| Model 2 | ABSI _{<i>t</i>} | Intercept | -0.005 | -2.19 | 0.03 | 0.440 |
| | | Δ Spread _(<i>t</i>-1) | 0.000 | 0.04 | 0.97 | |
| | | ABSI _(<i>t</i>-1) | 0.644 | 18.93 | 0.00 | |
| | | AbRet _(<i>t</i>-1) | -0.024 | -4.81 | 0.00 | |
| | | logMe | 0.000 | -0.86 | 0.39 | |
| | | B/M | 0.001 | 1.82 | 0.07 | |
| | | Inst | 0.007 | 4.22 | 0.00 | |
| | | Volatility | 0.073 | 1.77 | 0.08 | |
| | | Accruals | 0.005 | 1.62 | 0.11 | |

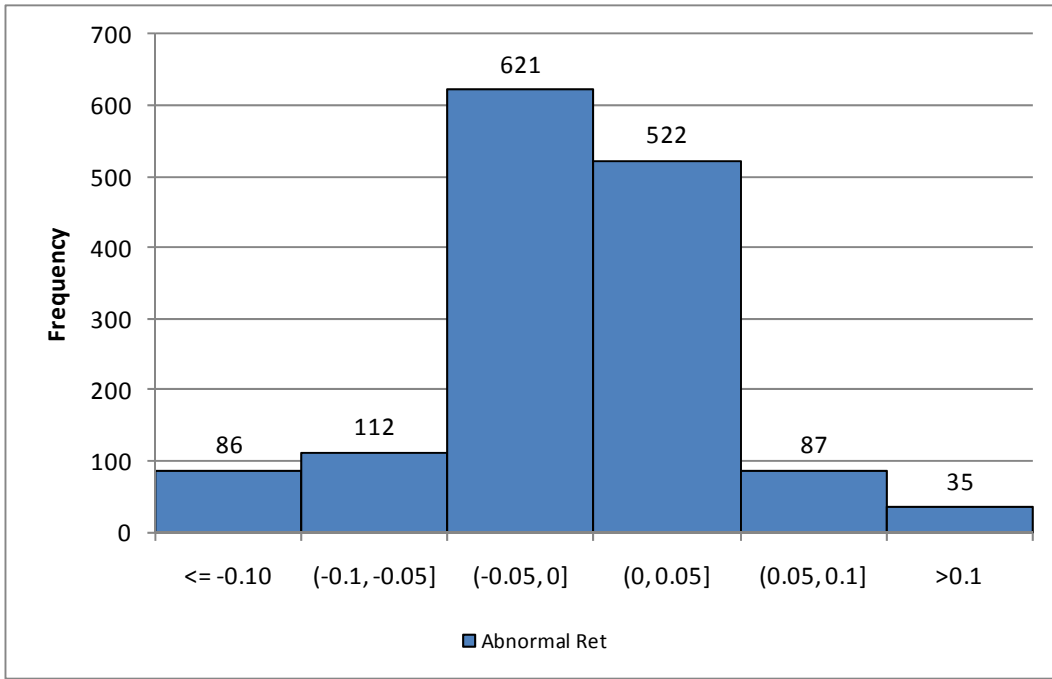


Figure 1: Distribution of abnormal returns around credit rating downgrades. Abnormal return is calculated as raw returns minus value-weighted market returns.

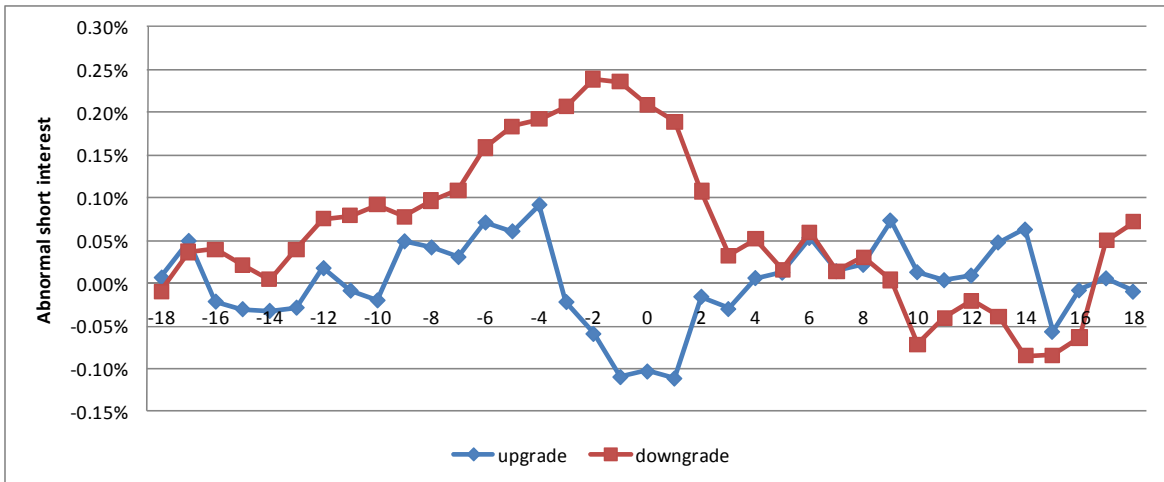


Figure 2, Panel A: Abnormal short interest around credit rating changes, with portfolio benchmarking. Abnormal short interest is the event stock's relative short interest in excess of the mean relative short interest of a portfolio benchmarked on size, book-to-market, and momentum, where relative short interest refers to a stock's monthly short interest minus its moving average over the past 3 months.

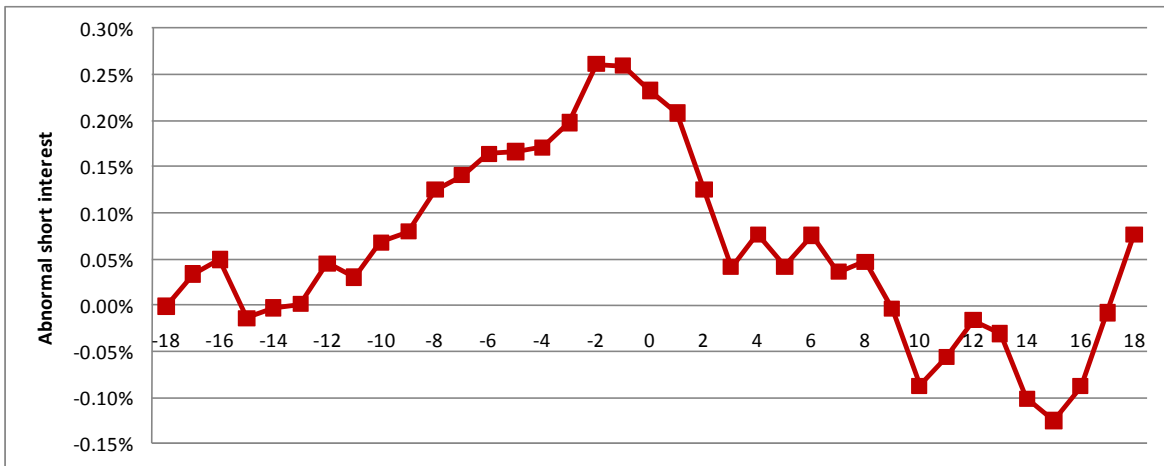


Figure 2, Panel B: Abnormal short interest around credit rating changes, with propensity score matching. Abnormal short interest is the event stock's relative short interest in excess of the mean relative short interest of the 10 firms with the nearest propensity score to the event firm. Propensity scores are calculated with a logit regression using size, book-to-market, momentum, industry, and credit rating as explanatory variables. Relative short interest refers to a stock's monthly short interest minus its moving average over the past 3 months.

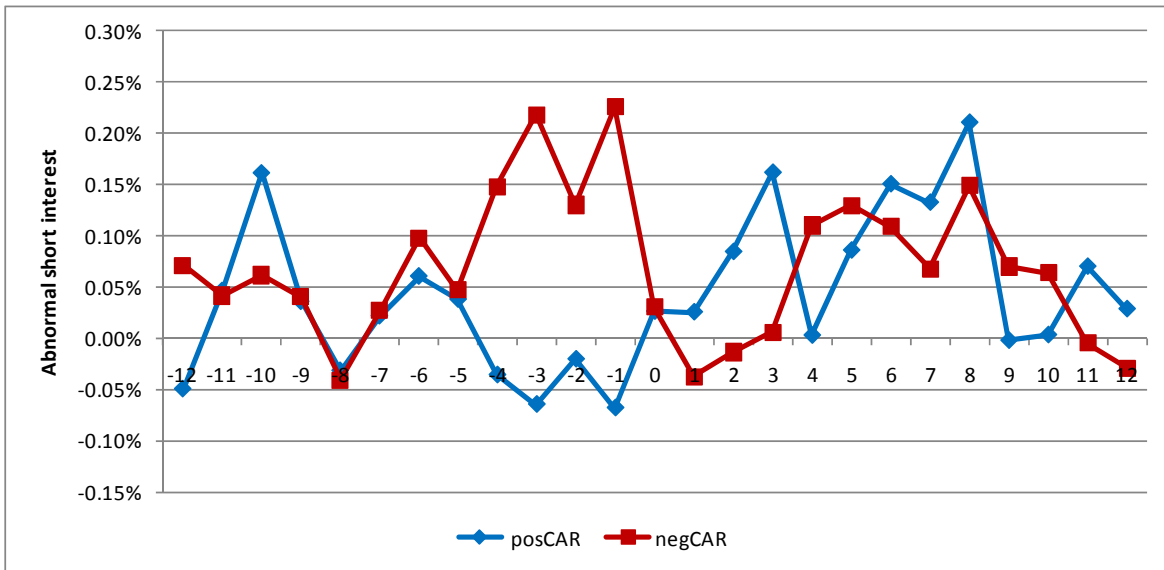


Figure 3, Panel A: Abnormal short selling around surprise downgrade, with portfolio benchmarking. Surprise downgrades are those with positive pre-event BHAR and negative announcement window CAR (N=257). We compare this to downgrades with positive pre-event BHAR and positive announcement window CAR (N=225). Abnormal short interest is the event stock's relative short interest in excess of the mean relative short interest of a portfolio benchmarked on size, book-to-market, and momentum, where relative short interest refers to a stock's monthly short interest minus its moving average over the past 3 months.

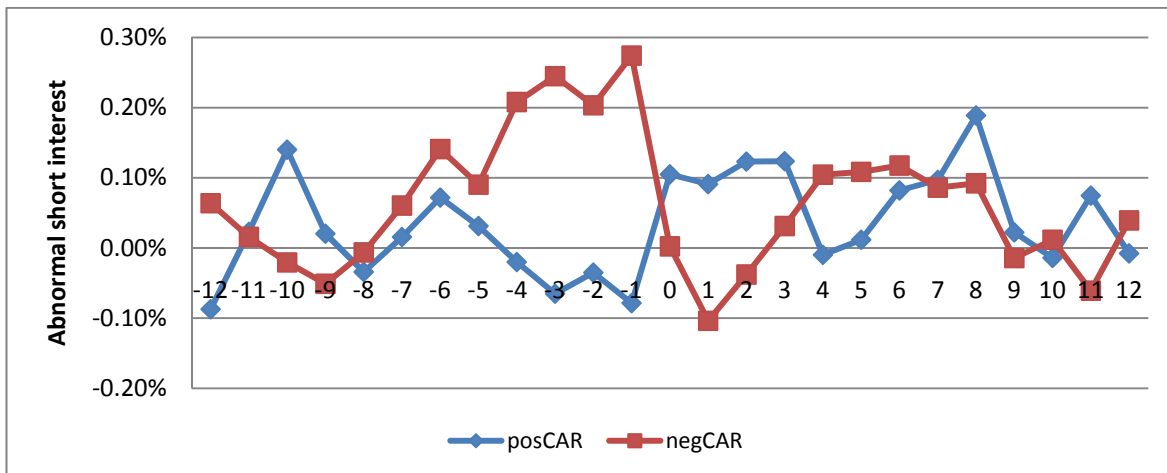


Figure 3, Panel B: Abnormal short selling around surprise downgrade, with propensity score matching. In this panel, abnormal short interest is the event stock's relative short interest in excess of the mean relative short interest of the 10 firms with the nearest propensity score to the event firm. Propensity scores are calculated with a logit regression using size, book-to-market, momentum, industry, and credit rating as explanatory variables. Relative short interest refers to a stock's monthly short interest minus its moving average over the past 3 months.

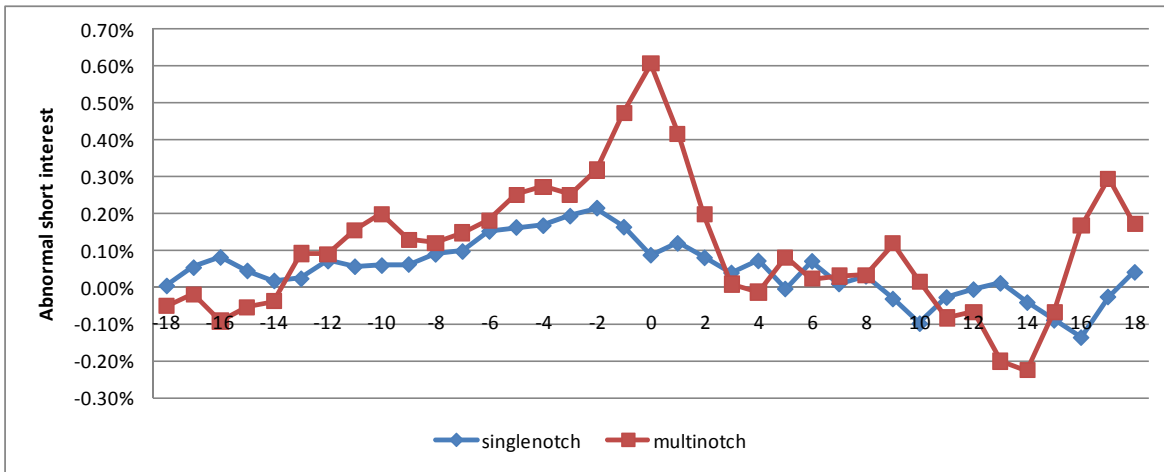


Figure 4, Panel A: Abnormal short interest around downgrades: single notch downgrades versus multi-notch downgrades. Abnormal short interest is the event stock's relative short interest in excess of the mean relative short interest of a portfolio benchmarked on size, book-to-market, and momentum.

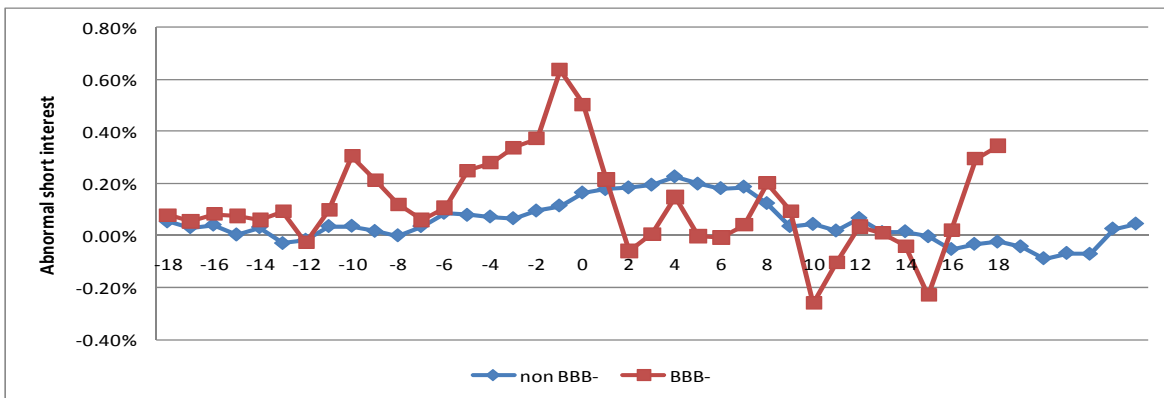


Figure 4, Panel B: Abnormal short interest around downgrades: BBB- downgrades versus other downgrades.

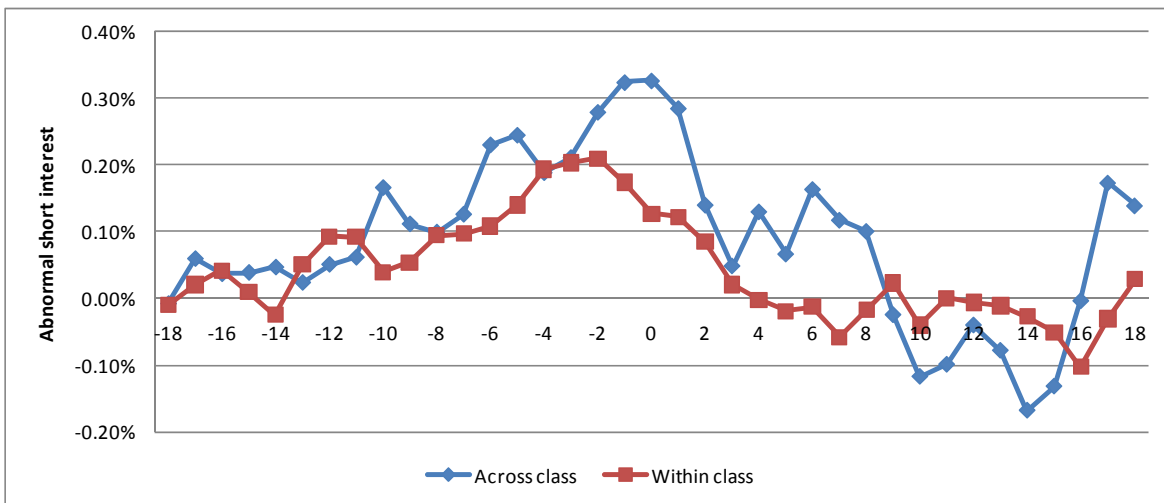


Figure 4, Panel C: Abnormal short interest around credit rating downgrades: Downgrades across a rating class versus downgrades within a rating class.

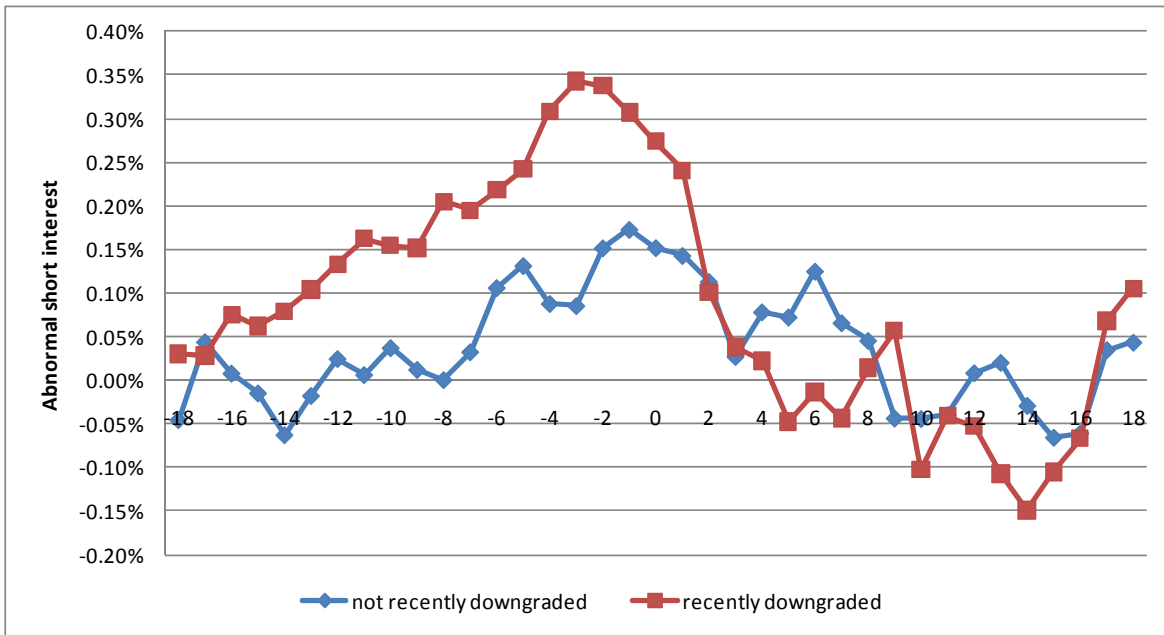


Figure 5: Abnormal short interest around downgrades: recently downgraded versus not recently downgraded firms. The subsample of recently downgraded firms a rating downgrade within the previous 12 months of the current downgrade. Abnormal short interest is the event stock's relative short interest in excess of the mean relative short interest of a portfolio benchmarked on size, book-to-market, and momentum, where relative short interest refers to a stock's monthly short interest minus its moving average over the past 3 months.

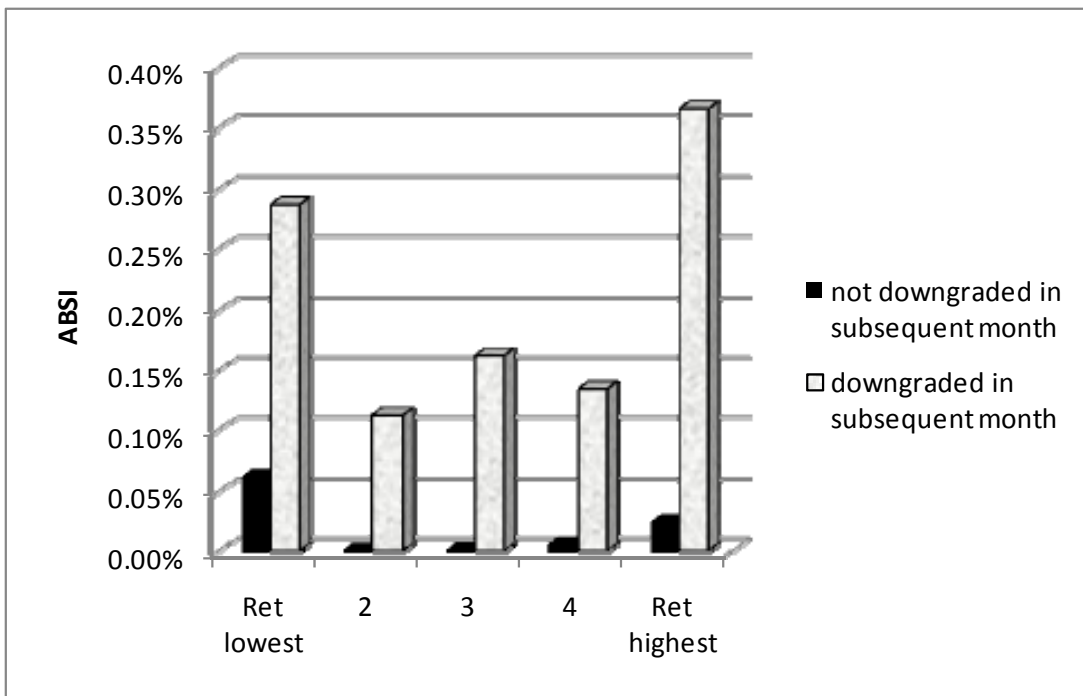


Figure 6: Abnormal short interest and subsequent monthly rating change. This figure shows abnormal short interest (ABSI) sorted by whether or not the firm was downgraded in the *subsequent* month, and sorted into quintiles based on the subsequent monthly return.