The Rules of the Rating Game: Market Perception of Corporate Ratings

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Abstract

We investigate how the informativeness of rating changes varies in different economic and regulatory environments, using the financial crisis and the Dodd-Frank Act as structural changes in the US corporate bond market. Our analysis tests hypotheses based on models of rating agency behavior, highlighting cross-sectional differences in information acquisition costs. We find that the informativeness of rating changes is low when the economy is booming and regulation favors better-rated securities. In economic downturns, the informativeness increases in combination with a high level of illiquidity. After Dodd-Frank, rating changes became more informative, but not for securities with high information costs and low underlying credit risk, showing that rating informativeness highly depends on asset characteristics.

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1 Introduction

Credit rating agencies (CRAs) are meant to provide information for market participants in the determination of the creditworthiness of various securities. Their relevance is accentuated by rating-contingent regulation, which makes it necessary for certain investors (e.g., banks and insurance companies) to take ratings into account in their lending, investment and asset allocation strategies. However, the amount of information they effectively provide to investors, and how it varies over time and cross-sectionally is still object of debate.

In an attempt to tackle this question, recent theoretical studies have modeled the incentives of CRAs and their optimal strategy with respect to information acquisition and rating standards.[1] Various factors are considered relevant for rating informativeness in the context of such models. First, the regulatory environment, through rating-contingent regulation, provides an advantage for better-rated securities and, thus, potentially leading to low informativeness. The second factor is the economic cycle, i.e., rating inflation is generally more pronounced in booms rather than busts.[2] Third, the cost of information acquisition borne by CRAs when rating a security, which can vary significantly across assets, can favor lower information acquisition. In equilibrium, the level of informativeness is determined *jointly* by those factors. However, recent empirical studies have rather focused on the impact of individual factors on rating informativeness. An empirical investigation on the role of all the trade-offs highlighted in such models is still missing. In particular, the consideration of cross-sectional differences in information acquisition costs, and its interaction with rating-based regulation and the business cycle is an open issue.

In this paper, we aim to address this lacuna by exploring how changes in the economic and regulatory conditions alter the informativeness of credit ratings in the cross-section of securities. We use the financial crisis and the passage of the Dodd-Frank Wall Street Reform and Consumer

[1] See, for example, Skreta and Veldkamp (2009) and Opp, Opp, and Harris (2013). Such papers are motivated by the potential conflicts of interest arising within the "issuer-pays" context, fueled by considerations of regulatory arbitrage. In this setting, CRAs are potentially incentivized to provide overly optimistic (inflated) and/or slowly reacting ratings, favoring poor informativeness. The CRAs' behavior is typically modeled within a rational-expectations framework, assuming that investors are not fooled by the rating game, i.e., they take regulatory implications into consideration, independent of the rating informativeness.

[2] In economic downturns, firms are exposed to greater credit risk and have fewer outside options, leading to lower benefits from inflating ratings. See Bolton, Freixas, and Shapiro (2012) and Bar-Isaac and Shapiro (2013), for example.

Protection Act (2010) (known popularly as Dodd-Frank) as structural changes in the context of the US corporate bond market. Informativeness is measured by the impact of rating changes on the prices and liquidity of corporate bonds, considering the varying costs of information acquisition across securities. The recent global financial crisis and the approval of Dodd-Frank are two events that are particularly well suited for testing various hypotheses in this context. The first represents one of the worst episodes of economic downturn, which was accompanied by massive and sudden downgrades of investment grade securities in 2008 and 2009, severely undermined the reputation of CRAs, and brought their business model into question. This global financial crisis was followed by a major regulatory response, represented by the introduction of Dodd-Frank, enacted on July 21, 2010. Dodd-Frank aims at a fundamental reform of many areas of the US financial system.[3] An important aim of security regulators is to improve rating informativeness by making rating agencies legally liable when they provide biased or misleading information to the market. In particular, following the passage of Dodd-Frank, the Securities and Exchange Commission (SEC) is empowered to sanction rating agencies more easily, while courts are enabled to entertain private actions against CRAs.[4] Moreover, as a subsidiary objective, rating-contingent regulation has to be gradually dismantled, in order to eliminate the regulatory advantage enjoyed by highly rated securities, a relevant factor among the multifarious causes of the financial crisis, as previously mentioned.

We focus on the US corporate bond market, as it is one of the markets most heavily affected by the financial crisis and the new regulations, in which credit ratings play a major role in the valuation of securities. Trades of corporate bonds take place over-the-counter (OTC), and not all relevant credit information is easily accessible to investors. In particular, information-acquisition costs might be higher for bonds of some issuers (e.g, financial firms), given the difficulty in evaluating the risk of their assets. However, in contrast to most other OTC markets, detailed transaction

[3] In particular, in "Title IX- Investor Protections and Improvements to the Regulation of Securities" the "Subtitle C- Improvements to the Regulation of Credit Rating Agencies" includes provisions concerning the credit rating industry, and its interaction with the market.

[4] According to Section 933 of the Act, the statements of CRAs should be considered as "statements made by a registered public accounting firm or a securities analyst under the securities laws" and not "forward-looking statements". Additionally, in private actions, it is sufficient to prove that the agency "knowingly or recklessly failed to conduct a reasonable investigation of the rated security" or "to obtain reasonable verification" of the information provided with the rating.

data are available on prices and volumes in the US corporate bond market. This dataset is assembled and disseminated by the Financial Industry Regulatory Agency (FINRA), and is known as the Trade Reporting and Compliance Engine (TRACE). It aggregates virtually all transactions in this market, contributing to greater transparency. Thus, we are provided with an ideal environment in which to study the effects of rating changes.[5]

In our empirical analysis, we focus on bond returns and changes in liquidity around rating events. Our sample covers corporate bond ratings from 2003 to 2014, including 6,594 rating events with 4,332 downgrades and 2,162 upgrades. We analyze three distinct sample periods: rating changes before the crisis, during the crisis and recession, and after the passage of Dodd-Frank. Moreover, we split the sample between bonds of non-financial firms (hereafter non-financial bonds) and bonds of financial firms (hereafter financial bonds), considering the latter to be harder to rate, given their exposure to multiple risk factors, and their generally more complex financial structures. We set up a time window of 181 working days around the rating event (the event day, the 90 days before, and the 90 days after the event), covering all transactions, and provide descriptive statistics for this window. We measure and analyze informativeness through the impact that rating changes have on market prices and trading activity, based on a window from 5 days before to 5 days after the change. Moreover, in a regression setting, we control for other possible factors that could drive the results (e.g., regulatory thresholds or general market movements).

We focus on verifying three different hypotheses. First, we test whether the incentive to provide inflated ratings was indeed large before the financial crisis, when the economy was booming. We expect weak price effects as a consequence, especially for corporate bonds with a high cost of information acquisition. In addition, we analyze market reactions around events crossing the investment-speculative grade regulatory threshold. Second, we test the prediction that the informativeness of rating changes was high during the financial crisis. According to the theoretical literature and in line with intuition, the benefits to CRAs from inflating ratings are lower in such

[5] An alternative approach would be to analyze the behavior of spreads in the credit default swap (CDS) market. However, a comprehensive transaction register over a long time period does not exist for CDS contracts, and, in any case, the breadth of coverage of ratings is significantly greater in the corporate bond market than in the CDS market.

times, leading to greater information acquisition by them and, thus, resulting in more informative ratings. Furthermore, there is additional interaction between credit and liquidity risk in crisis periods, potentially increasing their price and liquidity impacts, as discussed and analyzed in He and Milbradt (2014). Third, we investigate whether increasing the cost of erroneous or biased ratings for rating agencies, and eliminating rating-contingent regulation, indeed lead to an improvement in the informativeness of credit ratings. We are particularly interested in whether such effects can be observed for the whole market or depend on certain characteristics, such as information acquisition costs. To the best of our knowledge, we are the first paper to empirically assess such interactions. In an additional analysis, we shed light on the level of market anticipation of rating changes across periods by estimating market-implied ratings before the events and analyzing the differences with respect to the actual ratings.

Our empirical results show that rating informativeness is indeed low in good economic times, i.e., before the crisis, as the price effects are of the same order of magnitude as average transaction costs. In particular, financial bonds are less informative overall, with a mean return of -0.45% around a downgrade, as opposed to -0.70% for non-financial bonds. We find similar results for upgrades, and confirm that downgrades are more important for market participants than upgrades, as documented by the empirical literature: the price reaction for downgrades is almost *double* that for upgrades in our sample. In addition, our regression analysis shows that there is a stronger effect when a bond is downgraded from investment to speculative grade, suggesting the presence of a regulatory channel. During the crisis, both financial and non-financial bonds show the highest price reactions in line with the theoretical models. These arise against the backdrop of a significant increase in illiquidity, which is particularly high for non-financial bonds. In particular, our regressions show that price reactions are stronger when changes in trading activity and transaction costs are higher. After Dodd-Frank, the downgrades of non-financial bonds are significantly more informative than before the crisis: in the latter period, the price decrease amounts to -1.10%. Thus, trading strategies correctly anticipating these events would yield an annual return after transaction costs of around 10%. On the other hand, downgrades of financial bonds produce less

information for the market than before the crisis, triggering an effect of only -0.24%, and indicating a weaker reaction for these bonds. This evidence indicates that the new regulatory regime has ambiguous effects on the informativeness of rating changes. Thus, we provide empirical evidence that the cost of information acquisition influences rating informativeness, which was suggested by the theoretical literature as likely, but previously untested outcome. Interestingly, the price effects around the threshold between investment grade and speculative grade almost disappear after Dodd-Frank, which might be linked to the trend towards eliminating rating-contingent regulation. Based on all these results, we provide evidence on why our findings cannot be rationalized by alternative explanations, e.g., learning by rating agencies following the crisis, or potential shifts in the overall market structure induced by the expected introduction of the Volcker rule.

We present an extensive battery of robustness tests that rule out other factors which could affect our findings. First, we explore various sample selections, to test how consistent our results are. Specifically, we repeat our analysis excluding confounding events such as announcements of earnings as well as mergers and acquisitions that overlap with the rating event within various alternative time windows. We also control for regulation-induced trading by excluding events crossing the investment-speculative grade threshold. Furthermore, we consider potential systematic shifts in the rating distribution across periods, e.g., more rating events in the speculative classes after the onset of the crisis. In particular, we keep the rating distribution constant by weighting the observations accordingly. Additionally, we check whether our results could be driven by time-varying risk premia in corporate bonds. Finally, we apply a novel methodology developed by Spiegel and Starks (2016) to estimate abnormal returns for illiquid bond markets based an a modified repeat sales model that accounts for heterogeneity in asset characteristics. Overall, we do not find any indication that these factors significantly impact our findings.

In the context of our results on price and liquidity effects, our analysis of market-implied ratings shows that downgrades are overall less anticipated after Dodd-Frank than before the crisis. Consistently with the findings on bond returns, anticipation of downgrades among non-financial bonds disappears after Dodd-Frank, eliminating the staleness of ratings. For financial bonds

instead, the anticipation is reduced just up to a point that minimizes litigation risk but downgrades still lag behind the market. Interestingly, upgrades are instead more anticipated by the market after Dodd-Frank, indicating that CRAs became more reluctant to upgrade bonds. This could be the result of an asymmetry in the penalties with regard to litigation risk, as it is much more likely for CRAs to be sued due to optimistically biased ratings than pessimistic ones, following Dodd-Frank.

Overall, our paper provides a detailed analysis on how corporate rating informativeness varies through different regulations, economic cycles and across securities with different costs of information acquisition. We link our hypotheses to recent theoretical studies concerning the strategic behavior of CRAs and the interaction between the default risk and the market liquidity of corporate bonds. Our findings go beyond what is currently available in the literature on corporate ratings, providing a better understanding of the market's perception of the actions of CRAs in different regimes across securities. We provide detailed evidence on the *whole* corporate bond market, and link our price results to a comprehensive analysis of trading activity and liquidity. Furthermore, we estimate implied ratings, which help to complete the general picture by providing evidence on how the market is able to anticipate rating movements.

The remainder of the paper is as follows: Section 2 reviews the relevant literature, Section 3 discusses the hypotheses, Section 4 describes the data, Section 5 presents the methodology, and Section 6 the results. Section 7 concludes.

2 Related Literature

This paper is related to various strands of the literature. First, we consider the recent and growing literature tackling the strategic behavior of rating agencies and changes in rating informativeness. An important theoretical contribution is made by Opp, Opp, and Harris (2013), who develop a model explaining the variation in credit rating standards over time, and across asset classes. In this model, the impact on informativeness depends on an endogenous threshold level

of the regulatory advantage, beyond which the rating agency is better off terminating information acquisition and inflating its credit rating. The threshold depends on the cost of information acquisition for the security, the issuer's outside options, and the credit quality of the issuers. Given rating-contingent regulation, the model predicts lower rating informativeness during booms, in general. More importantly, the model predicts that the elimination of ratings-based regulation leads to higher informativeness. However, such an effect might not occur for securities with a high cost of information acquisition, and may even be reversed depending on the underlying distribution of credit quality among issuers. Along the same lines, Skreta and Veldkamp (2009) show in a model how more complex assets incentivize rating shopping and, consequently, rating inflation.[6] Modeling rating shopping as well, Sangiorgi and Spatt (2017) show a link between disclosure requirements and informativeness.[7] In addition, rating quality taking into account competition and business cycles is analyzed in Bolton, Freixas, and Shapiro (2012) and Bar-Isaac and Shapiro (2013). Both papers show that rating quality is lower in booms, in particular when competition is high and the credit risk of securities is low. Flynn and Ghent (2017) find that increased competition in the structured product market leads to inflated ratings even after the crisis.[8] For an analysis of structural shifts in rating standards by CRAs, see Alp (2013) and Baghai, Servaes, and Tamayo (2014).

Our paper is also related to the extensive empirical literature studying announcement effects of credit ratings and credit outlook changes. Previous papers analyze the price reaction of credit rating changes and seem to generally support the hypothesis that these changes significantly affected returns. Most of these papers report significantly stronger price reactions for credit downgrades compared to upgrades; however, they focus mainly on *stock returns*.[9] There is not as

[6]Most theoretical papers in this context appeal to the greater complexity of assets in the structured product compared to other asset classes and empirical papers relate this to higher model risk for these products, see e.g. Gordy and Willemann (2012). However, these models are relevant for all cases where certain securities are harder to rate, e.g., by inducing a higher cost of information acquisition and/or resulting in noisier ratings.

[7]Other recent papers that focus on the interaction among informativeness and CRAs incentives are Cohn, Rajan, and Strobl (2016), Goldstein and Huang (2016) and Baghai and Becker (2017a).

[8]Other papers that focus on competition among CRAs are Becker and Milbourn (2011), Bongaerts, Cremers, and Goetzmann (2012), Manso (2013), Bae, Kang, and Wang (2015) and Baghai and Becker (2017b).

[9]See, for example, Holthausen and Leftwich (1986), Hand, Holtausen, and Leftwich (1992), Griffin and Sanvicente (1982), Goh and Ederington (1993), Nayar and Rozeff (1994), Hsueh and Liu (1992), Dichev and Piotroski (2001), Jorion, Liu, and Shi (2005), Kim and Nabar (2007), Agarwal, Chen, and Zhang (2016), King, Ongena, and Tarashev (2017).

much agreement in the literature about whether there is market reaction to bond rating changes, nor about whether the ratings' outlook affects *bond returns*.[10] Overall, the differing magnitudes and varying statistical significance of price effects in the prior literature on bond ratings can be attributed to the great variety of sample periods, methodologies, and datasets used by researchers.

It has been possible to overcome these limitations, to a large extent, since the creation of the TRACE dataset in 2002 by FINRA, which collects price and volume data for all the transactions in the US corporate bond market. Recent studies that make use of this dataset generally find significant abnormal returns around rating changes, with the effect being stronger for downgrades and regulation-induced fire sales.[11] The paper that is most closely related to ours is that of Dimitrov, Palia, and Tang (2015), which is the first to examine the impact of Dodd-Frank on credit ratings by analyzing non-financial bonds in the US corporate bond market. Their empirical evidence suggests that, since the passage of Dodd-Frank in July 2010, CRAs have issued lower ratings, and that their downgrades have been less informative for the market, with similar effects observed for upgrades. Given that Dodd-Frank penalizes inflated ratings, the authors conclude that CRAs have become protective of their reputations and lowered their ratings, regardless of the underlying information. This paper presents the first important insights regarding the impact of Dodd-Frank on credit ratings. However, it is mainly focused on the changes in the regulatory framework and does not consider differences in the underlying economic environment or heterogenous costs of information acquisition across securities, in any detail. Furthermore, the period considered after the introduction of Dodd-Frank is restricted to a time interval of two years, which does not fully incorporate all its ramifications, especially given its gradual phase-in over several years. Our paper offers significant additional insights, given that we carefully consider effects during and after the financial crisis in our results, analyze the *whole* market including financial and non-financial bonds, and strengthen the findings by considering trading activity. A second related paper by deHaan (2017) focuses on the performance of ratings after the global financial crisis and analyzes various

[10] The first papers to analyze credit rating effects on bond prices and returns were Weinstein (1977), Wakeman (1978), and Wansley and Clauretie (1985). They found no effect, whereas Katz (1974), Grier and Katz (1976), Ingram, Brooks, and Copeland (1983), Hand, Holtausen, and Leftwich (1992), Hite and Warga (1997) and Kliger and Sarig (2000) did.

[11] See among others May (2010), Ellul, Jotikasthira, and Lundblad (2011) and Spiegel and Starks (2016).

accuracy measures for non-financial corporate ratings based on observed defaults. In contrast to Dimitrov, Palia, and Tang (2015), the analysis here explicitly considers the impact of the crisis; the results indicate that the rating accuracy improved after the crisis. In addition, the paper shows that sophisticated investors reduce their reliance on ratings in loan contracts after the crisis. Analyzing realized defaults as well, Behr, Kisgen, and Taillard (2017) find that the introduction of rating-based regulation by the SEC in 1975 led to an increase in rating inflation. However, these papers analyze neither price and liquidity effects nor differences in information acquisition across securities.

The effects of rating changes on corporate bond prices are closely related to market liquidity, given the low level of trading activity in the corporate bond market, in general. Thus, our paper relates also to the literature on corporate bond liquidity, which has been growing since the creation of TRACE. These papers quantify various aspects of trading costs and activity for different market segments, time periods, and particular events, e.g., defaults.[12] In addition, He and Milbradt (2014) model the interaction between default and liquidity in the corporate bond market, which arises endogenously in a loop via the roll-over channel: lower liquidity during a bond roll-over is linked to higher default risk. Such feedback effects are particularly important when analyzing the market reaction to credit events and, therefore, allow us to additionally formulate hypotheses related to liquidity.

3 Hypotheses Development

The main research question that we address in this paper is whether the economic and regulatory environment, together with differences in the cost of information acquisition across securities, significantly affects the informativeness of ratings. If secondary market prices and liquidity (i.e., trading volume and transaction costs) are only mildly affected by rating changes, it obviously

[12] Hotchkiss and Jostova (2017) analyze the determinants of the trading volume and liquidity of corporate bonds. Bao, Pan, and Wang (2011) document the illiquidity to be significantly higher than is explicable by the bid-ask spread. Dick-Nielsen, Feldhutter, and Lando (2012) and Friewald, Jankowitsch, and Subrahmanyam (2012) document a dramatic increase in the contribution of illiquidity to corporate bond spreads during the financial crisis. Jankowitsch, Nagler, and Subrahmanyam (2014) study the effect of corporate bond defaults on the trading microstructure.

implies that market participants consider the information transmitted by the rating changes to be weak.[13] This is either because the rating changes do not reflect the signaling value of the new information or because this information is already incorporated in prices. Note, however, that this price impact may reflect *both* information transmission and the effect of regulation, whenever a regulatory threshold is crossed, and some investors may buy or sell for this reason. In the latter case, prices should revert to their fundamental values, once the bonds have been reallocated to unregulated investors, assuming that the marginal investor is unregulated. We explicitly consider this regulatory channel both in our regression analysis and our robustness checks.[14]

We present our hypotheses based on three different periods (*before the crisis*, *during the crisis* and *after Dodd-Frank*), and are particularly interested in comparing the first and last periods, where the regulatory structure differs considerably, but the economic environment is comparable. In addition, the literature presented allows us to test our predictions based on the differences in the cost of information acquisition across securities. In the context of the US corporate bond market, this is particularly interesting, as certain issuers are more difficult to evaluate, i.e., information acquisition is more costly. In particular, Morgan (2002) provides empirical evidence that bonds of financial issuers are much harder to rate for CRAs. The main reason is that the financial industry is opaque in terms of its risk exposure (which can often be quickly changed with derivatives), the legal environment (especially in the face of costly lawsuits) and the value creation process, making credit analysis a challenging task. This is compounded by the uncertainty of rescue efforts by the central bank (e.g., quantitative easing) and the government (e.g., equity infusion) in the event of acute financial stress. Therefore, it is hard to predict the financial distress of financial institutions, and rate their securities with any precision.[15] Additionally, the increase in innovation (e.g., credit derivatives and securitization) in the financial sector has amplified this concern. Indeed, the

[13] Note that we focus on rating downgrades and upgrades, and not on changes in the rating outlook.

[14] Informativeness could be measured in alternative ways, such as the frequency of future defaults, which would automatically control for the regulatory channel. However, given the small number of defaults, especially for investment grade ratings, tests based on default rates would have low statistical power. See Hilscher and Wilson (2017) and Blchlinger and Leippold (2018) for a detailed analysis on the information content of ratings with respect to different credit risk measures. In addition, changes/shifts of the rating distribution due to stricter monitoring are difficult to consider. For example, Opp, Opp, and Harris (2013) show in their model that stricter monitoring on CRAs, as under Dodd-Frank, leads to a mechanical downward shift of the rating distribution.

[15] A similar argument is provided as well by Hau, Langfield, and Marques-Ibanez (2013) with respect to big banks.

financial crisis is a clear example of how even sophisticated investors, together with the main CRAs, have systematically miscalculated the risk of securities issued by financial firms.

Hypothesis 1. When the economy is expanding and rating-contingent regulation is in place, the informativeness of credit rating changes is low, especially among securities with an high cost of information acquisition.

According to the model of Opp, Opp, and Harris (2013) the informativeness of ratings depends on the degree of regulatory advantage for highly rated securities. This advantage determines an endogenous threshold level beyond which information acquisition by the CRAs is no longer optimal. One of the important factors determining this level is the stage of the economic cycle, resulting in the model prediction of lower informativeness in booms. Before the crisis, rating-contingent regulation provided a high degree of regulatory advantage, and the economy was in an expansionary phase. Thus, the endogenous threshold level of the regulatory advantage was lower, beyond which the rating agency would have been better off terminating information acquisition and inflating the rating. Therefore, we expect to find smaller price effects before the crisis, in general.[16] In addition, under the assumption that acquiring information is more costly for certain securities, e.g., bonds issued by financial firms, the threshold level of the regulatory advantage is even lower and rating inflation is more pronounced for these securities. However, we expect a stronger temporary market reaction around rating thresholds through the regulatory channel.[17]

Hypothesis 2. The informativeness of credit rating changes is high in a crisis period, and is associated with greater illiquidity, compared to normal times.

In a crisis period, the credit quality of corporate bonds is generally low; i.e., firms are exposed to greater credit risk, and their outside options, e.g., financing using equity or new loans, are less attractive. As a consequence, according to Opp, Opp, and Harris (2013), the benefits to CRAs

[16] This is also consistent with the model of Skreta and Veldkamp (2009), who motivate rating inflation via rating shopping.

[17] See, e.g., Kisgen and Strahan (2011), Bongaerts, Cremers, and Goetzmann (2012), and Ashcraft, Goldsmith-Pinkham, Hull, and Vickery (2011), who provide evidence of price effects through regulatory channels.

from inflating ratings are smaller, there is more information acquisition and, thus, more informative ratings.[18] Similarly, an informative rating change in a crisis period might be associated with a more pronounced change in the expected default probability and, thus, might lead to stronger price reactions. Furthermore, there is additional interaction between credit and liquidity risk, as proposed by He and Milbradt (2014), potentially increasing the price and liquidity impacts of a rating change. In accordance with this theory, the empirical evidence in the US suggests that the corporate bond market experienced an extremely high level of illiquidity during the global financial crisis, as shown by Friewald, Jankowitsch, and Subrahmanyam (2012). Thus, we would expect to find particularly large price and liquidity effects during the financial crisis.

Hypothesis 3. Increasing litigation risk and removing rating-contingent regulation improves the informativeness of credit ratings, but the effect may be reversed for securities with a high cost of information acquisition and low credit risk.

Dodd-Frank imposed stricter monitoring on CRAs by making rating agencies legally liable when they provide misleading information to the market. In addition, rating-contingent regulation was to be gradually removed subsequently. Along the lines of Opp, Opp, and Harris (2013), the threshold level of the regulatory advantage, beyond which the rating agency stops acquiring information, is shifted by these measures. This shift incentivizes CRAs to provide more informative ratings for both upgrades and downgrades. However, such an improvement might not occur for securities with a high cost of information acquisition, e.g., financial bonds, since for such securities, the shift in the threshold might not be large enough to incentivize CRAs to acquire more information. In addition, the effect could even be reversed, depending on the underlying distribution of credit risk: Opp, Opp, and Harris (2013) provide an example showing that for bonds with lower default probabilities conditional on the rating, the informativeness can even decrease, given a certain level of rating informativeness before the shift.[19] Interestingly, financial bonds experienced historically lower default rates compared to other corporate bonds except for

[18] A similar argument is provided also by Bar-Isaac and Shapiro (2013).

[19] Ambiguous effects on rating informativeness from the introduction of a regulation that incentivizes greater issuer monitoring by the CRAs have also been demonstrated in Cohn, Rajan, and Strobl (2016).

the time period of the financial crisis, see e.g., Standard & Poor's Rating Services (2015) and Moody's Investors Service (2016), and, thus, could exhibit such an effect.[20] Thus, we expect to find larger price effects after Dodd-Frank, in general, but this effect should be smaller for financial bonds, while informativeness could even decrease for these bonds.

4 Data

Our dataset represents credit downgrades and upgrades of US corporate bonds between January 2003 and May 2014, obtained from the Mergent Fixed Income Securities Database (FISD). We consider the ratings of the three main rating agencies for our analysis: Standard & Poor's, Moody's, and Fitch. However, we exclude default or close-to-default events (i.e., downgrades to CCC-, Caa3 or lower and upgrades from CCC-, Caa3 or lower), which might be strongly influenced by asymmetric information and strategic behavior related to the default event.[21] Furthermore, we consider only straight, callable or puttable bonds, excluding all others with complex structures as the price reactions of these bonds might be driven, at least partially, by embedded options.[22] We also restrict our attention to bonds with an amount issued greater than or equal to $10 million.

We set up a time window of 181 working days around the rating event (the event day, the 90 days before, and the 90 days after the event). Within that window, we collect the transaction data for the downgraded/upgraded bonds from TRACE. This rather wide time window allows us to observe and describe general trends in prices and trading activity around the rating event. However, when it comes to the measurement of the rating impact, we focus on a shorter window from 5 days before to 5 days after the rating change.

Since July 2002, following an initiative of FINRA with the aim of bringing more transparency to the market, all transactions in US corporate bonds have had to be registered in the TRACE

[20] These lower default rates might be the result of government interventions supporting systemically-important financial institutions by providing financial or other support. See for example Kelly, Lustig, and Nieuwerburgh (2016).

[21] The different types of default events in the US corporate bond market are discussed extensively in Jankowitsch, Nagler, and Subrahmanyam (2014).

[22] Convertibles, asset backed, exchangeable, foreign currency, perpetual and bonds with other complex optionalities are thus excluded from the final sample.

system by broker-dealers within 15 minutes of their execution; the relevant information required to be provided includes the bond price as a percentage of the face value and the volume traded, among other details.[23] We cleanse the transaction data of errors using the algorithm described in Dick-Nielsen (2009). In particular, we delete duplicates, trade corrections and trade cancellations on the same day. Moreover, we remove reversals, which are errors detected on a day later than that of the initial trade. Additionally, we implement the price filters used in Edwards, Harris, and Piwowar (2007) and Friewald, Jankowitsch, and Subrahmanyam (2012). Specifically, we adopt a reversal filter, which should eliminate extreme price movements, and a median filter, which identifies outliers in prices reported in TRACE, within a given time period.

Given the high level of illiquidity of the corporate bond market, we only include bonds that have one or more trades in at least 15 out of the 90 days before, and also 15 out of the 90 days after the event, similar to Jankowitsch, Nagler, and Subrahmanyam (2014). Moreover, we only consider bonds that, over the event day and the 5 days after, either have an average cumulative daily volume of at least $1 million, or an average volume per trade of at least $100,000. This allows us to exclude downgrades and upgrades of bonds whose price and liquidity impacts are mainly driven by retail investors.[24]

Our final sample contains 6,594 events, of which 4,332 are downgrades and 2,162 are upgrades.[25] Table 1 contains a detailed description of the distribution of downgrades and upgrades over the rating grades and periods. We observe 3,178 downgrades of financial bonds, and 1,254 of non-financial bonds: this considerable difference is mainly driven by the crisis period, when an extremely large number of downgrades occurred in the financial sector. In contrast, upgrades are less divergent between the two sectors: 1,338 are for financial, and 826 for non-financial bonds. We match the sample with bond characteristics taken from the Mergent FISD dataset, and firm characteristics obtained from Compustat. In particular, in our analysis we use the coupon, maturity,

[23] Note that the volume data in TRACE are capped at $5 million for investment grade bonds, and at $1 million for high-yield bonds, for the purpose of immediate public disclosure. Information on the actual volumes is disclosed with a lag of 18 months.

[24] Note that our main results hold even if those bonds are included in the sample.

[25] Our sample size is comparable to May (2010) and Dimitrov, Palia, and Tang (2015). Note that approximately 85,000 bond-specific rating events can be observed during our sample period. However, many bonds have very small issue sizes and/or are extremely illiquid, thus resulting in a significantly lower number of eligible events.

amount issued, inflation-corrected total assets and intangible assets. Table 2 presents summary statistics of the bond and firm characteristics.

5 Methodology

We present, here, our definitions of the three analyzed time periods, the calculation procedures for the bond price and liquidity impacts, and the construction of various types of rating-related variables. We also present the regression setup that we use in our analysis. Finally, we describe our approach for the calculation of implied ratings.

5.1 Time Periods of Interest

We define three time periods, which include the financial crisis and the subsequent regulatory reforms. The first period represents rating events *before the crisis*, between January 2003 and November 2007. The second period represents rating changes *during the crisis*, starting in December 2007, which we identify as the beginning of the financial crisis in accordance with the definition in National Bureau of Economic Research (2010), and ending on July 21, 2010. The third period covers all events after the signing of the Dodd-Frank Act into federal law (*after Dodd-Frank*), and up until May 2014. Note that, with the introduction of Dodd-Frank, certain provisions came into force immediately, whereas others were to be implemented over time. More specifically, the CRAs' increased liability and the relaxation of pleading standards in private actions against rating agencies came into force immediately.[26] On the other hand, the elimination of rating-contingent regulation has instead had a gradual implementation, depending on the actions of individual federal agencies, which bear the responsibility for introducing new measures of creditworthiness that do not rely on ratings. The SEC produced a final rule effective from September 2011, and the Federal Reserve (FED) from June 2012, whereas the Office of the Controller of the Currency (OCC) made the new rules effective starting from January 2013.[27] On the other

[26] Such rules are part of Provision 933 of the Dodd-Frank Act.

[27] For more details, see e.g. SEC Final Rule on Security Ratings (2011) and FED Market Risk Capital Rule (2012).

hand, the National Association of Insurance Commissioners (NAIC) has eliminated reference to credit ratings only for residential and commercial mortgage-backed securities but "still continues to rely on rating agencies for other asset classes", as documented in NAIC (2015).[28] Note that our results are robust to variations in the definitions of the three time periods, given the phased implementation.

To address this issue in more detail, we additionally provide tests for structural breaks in the Appendix, following Andrews (1993). Overall, these results confirm our choice of time periods. As expected, we find a structural break at the time of the financial crisis around the Lehman default, confirming that the financial crisis led to significantly different market reactions. In addition, we find for both financial and non-financial bonds that a structural break occurred in mid-2010. Thus, the introduction of Dodd-Frank can be linked to this second structural break. Further details on the methodology and the results of these tests are presented in the Appendix.

5.2 Price and Liquidity Impacts

For each rating event in our sample, we consider a time window of 181 days (the event day, the 90 days before and the 90 days after the event) and calculate daily measures of price and liquidity observing all transactions related to the affected bond. This allows us to have an overview of price and liquidity trends around the event. We focus on a shorter time window (the event day, the 5 days before and the 5 days after the event) when estimating the impact of the rating event on these measures.

Volume-Weighted Average Daily Price

We use a volume-weighted measure for the price, also applied by Bessembinder, Kahle, Maxwell, and Xu (2009), for example. This measure places more weight on prices arising from transactions

[28] As different market participants were affected at different points in time, an additional area of research would be to investigate potentially diverse trading behavior among these groups, before and after the new regulation became effective for each of them. However, given the small time intervals between the different implementations, this analysis would only be possible with data on the bond holdings of individual institutional investors. While limited data-bases on such holdings are available (e.g., eMAXX from Thomson Reuters), they do not cover all the investors in the market. Therefore, we focus on the overall effect of the new regulation.

with higher volumes, reducing the noise introduced by smaller, potentially unrepresentative trades. The volume-weighted daily average price P_{it} of bond i on day t is given by

$$P_{it} = \frac{\sum_{j=1}^{n_{it}} p_{itj} v_{itj}}{\sum_{j=1}^{n_{it}} v_{itj}}$$

where p is the price observed for transaction j, with a volume of v, and n is the number of transactions on day t.

Trading Activity

The trading activity can be identified both by the frequency and volume of trading. Thus, our first measure is the daily trading frequency, which is the number of transactions n_{it}, in bond i, on day t. The second measure of trading activity we adopt is the cumulative daily volume V_{it}, which is the sum of the volumes of the transactions in bond i, on day t, given by

$$V_{it} = \sum_{j=1}^{n_{it}} v_{itj}$$

where v is the volume of transaction j.

Transaction Costs

The metric we use to capture liquidity is the price dispersion measure, introduced in Jankowitsch, Nashikkar, and Subrahmanyam (2011). This is a direct estimate of transaction costs, based on the dispersion/volatility of the individual traded prices around the fundamental value of the bond, which is given by the average price, in this case. We calculate a daily measure of price dispersion D_{it} for bond i, on day t

$$D_{it} = \sqrt{\frac{1}{\sum_{j=1}^{n_{it}} v_{itj}} \sum_{j=1}^{n_{it}} \left[\left(\frac{p_{itj}}{\frac{1}{n_{it}} \sum_{j=1}^{n_{it}} p_{itj}} - 1 \right)^2 v_{itj} \right]}$$

where p is the price, v the volume of transaction j, and n the number of transactions on day t. At

least two transactions of bond i on day t are needed to calculate the measure. Many other liquidity measures are available for quantifying transaction cost, e.g., the Amihud or Roll measures. However, the price dispersion measure is ideal in the OTC setting of corporate bond markets, since it does not require a long time series for its estimation, and is robust to effects from retail trading.[29]

Price and Liquidity Effects

In order to measure the price effects, we consider the bond return in a time window from 5 days before to 5 days after the rating change. Specifically, the return is defined as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days thereafter.[30,31]

In order to consider market-wide movements in bond prices around the rating event, we include market controls in the regression setup presented in Section 5.4. These controls are based on the same time window around the rating change, by considering the return of a duration-matched risk-free zero-coupon bond and a corporate bond market return matched by rating and maturity. The return of the risk-free bond is obtained from the term structure of swap rates from Bloomberg by matching the resulting risk-free rates with the bond duration at the beginning of the time window and repricing this synthetic zero-coupon bond at the end of the time-window. The market return is based on all available bonds in the market with a similar rating and time to maturity compared to the downgraded/upgraded bond. In particular, based on credit ratings, we divide the sample between investment and speculative grade, while for time to maturity, we consider long-term (> 5 years) and short-term (≤ 5 years) bonds, since the median time to maturity of the corporate bond market from 2003 until 2014 is always between 5 and 6 years. In the market return calculation, we exclude bonds that experience a rating change around the event, as this ensures that the calculated market return is not affected by related regional or industry events that affect many bonds at the

[29] See Friewald, Jankowitsch, and Subrahmanyam (2012) for a discussion.

[30] In addition, we use longer time windows such as 10 and 30 days, on either side of the event date, as a robustness check, and find basically identical results (see Tables IA1 and IA2 in the Internet Appendix). Therefore, our results do not appear to be driven by price reversal effects due to temporary selling pressure.

[31] We calculate our returns with clean prices avoiding linear trends in the announcement return analysis attributable to accrued interest. However, the results basically do not change when including the accrued interest to the calculations, as shown by Table IA3 in the Internet Appendix.

same time, e.g., downgrades in the automobile industry in 2005.[32] In the relevant group, we calculate the return for each bond based on the same methodology used to calculate the return on the downgraded/upgraded bond, and employ an equally-weighted return as the market return of this group. For rating events "crossing" the threshold between investment and speculative grade, we equally weight the returns of the two corresponding groups.

In addition, we analyze the liquidity effects of bonds experiencing rating changes by measuring the daily trading volume, trading frequency and transaction costs, and calculating the difference between the average of the daily measure across the 5 days before the event, and the average across the event day and the 5 days thereafter.

5.3 Rating-Related Variables

In our analysis, we use different variables that are related to the credit rating or its change during the event. In a first step, we assign integer values to the different rating grades, starting from 1 for the highest to 21 for the lowest (see Table 1). This *rating number* allows us to construct various rating-related variables.

We define the *number of notches* as the difference between the rating number before and that after the event, indicating the number by which the downgrade/upgrade moved the bond rating. Intuitively, the more levels by which the rating is changed, the stronger would we expect the price reaction to be. Furthermore, we use a variable related to the *rating threshold* implied by the rating-contingent regulation in place before Dodd-Frank, when, especially for financial institutions, investment grade bonds enjoyed preferred treatment. In order to analyze whether this effect was present in our sample, and whether it changed after Dodd-Frank, we include a dummy variable for rating changes that cross the investment-speculative rating threshold.

Note that every event in our sample is related to a rating change made by one of the three main rating agencies (Standard & Poor's, Moody's and Fitch). Based on the information from these rating agencies, we include the *number of agencies*, indicating how many CRAs rated the

[32] Specifically, we exclude bonds that experience a rating change in the 30 days before, and in the 30 days after the event, in order to make sure that observed price trends linked to rating events do not affect our results.

bond at the time of the rating change. In addition, we calculate the *rating dispersion*, representing the average absolute difference in the ratings of the three different agencies on the day the rating change occurred. This variable allows us to analyze whether greater disagreement among rating agencies leads to stronger price effects.

5.4 Regression Analysis

We use a pooled regression model to investigate the determinants of bond returns around rating changes, where the dependent variable is given by the return, calculated as described in Section 5.2. The regression specification that explains the return related to the rating change of bond i of firm s, on day t, by rating agency u, is given by

$$\begin{aligned} y_{i,t,s,u} = \alpha &+ \beta(Time\ Period\ Dummies)_t + \gamma(Rating\text{-}Related\ Variables)_{i,t,s,u} \\ &+ \delta(Changes\ in\ Liquidity\ and\ Trading\ Activity)_{i,t,s} \\ &+ \zeta(Bond\ Characteristics)_{i,t,s} + \eta(Firm\ Characteristics)_{t,s} \\ &+ \theta(Market\ Controls)_t + \epsilon_{i,t,s,u} \end{aligned}$$

Thus, this specification combines the entire time-series and cross-section of returns. In the construction of our regression sample, whenever there are bonds of the same firm that are downgraded/upgraded on the same day, by the same rating agency, to and from the same rating grade, we take the average of our regression variables and consider it as one observation. In this manner, we avoid the concern that a single event might show up in the regression with multiple observations and potentially bias the results. We run the regressions with standard errors corrected for heteroscedasticity and clustered at the firm level.[33] In addition, we present regressions that are run for each time period separately, allowing us to analyze changes in the model parameters over

[33] As a robustness check, we run regressions considering rating changes on the same day, by the same rating agency, to and from the same rating grade, as separate events. In addition, we select a set in which only rating events that did not overlap with any other event are considered, using clustered standard errors by firm-event. We basically obtained similar results, which are in the Internet Appendix in Tables IA4, IA5, IA6, IA7.

time.

5.5 Implied Ratings Analysis

We shed light on the market anticipation of rating changes across periods by estimating market-implied ratings before the events, and analyzing the difference with respect to the actual rating. If the price information of bonds indicated an anticipation of future rating events, we could conclude that the *additional* information provided by the actual event was low. We measure market anticipation by estimating a *market-implied rating* based on the observed bond yield spreads in the whole US corporate bond market.[34] For every rating event, we specify a time window from 90 days to 30 days before the event. We calculate the mean of the yield spread for each rating grade of the agency involved in the particular event across all days and bonds traded in the market.[35] Thereby, we derive, for each rating grade, an average market yield spread related to each rating event. In the next step, we fit the following nonlinear model across rating grades:

$$y_i = exp(a + bi) + \epsilon_i$$

where y is the market yield spread calculated as above, and i is the rating number. Based on the estimates for a and b, yield spread boundaries between the rating grades can be derived by considering the thresholds $i + 0.5$ between all ratings i and $i + 1$. The implied rating of a bond between 90 and 30 days before its downgrade/upgrade is then given by "slotting" the bond into a rating grade based on its average yield spread within this period and the derived yield spread thresholds. For each rating event, we compute the difference between the numerical rating of the bond preceding the rating change and the implied rating of the same bond, as a measure of the gap between the actual credit rating and the market's judgement.[36] If the difference is negative,

[34]Note that Kliger and Sarig (2000) use the observed yield spreads of bonds before Moody's refined its rating system with modifiers in 1982, to calculate the expected modifier. Thus, they also employ market-implied ratings in the context of rating informativeness. However, their approach is focused on yield spread differences within each individual rating class.

[35]The risk-free rates used in the calculation of the yield spread are obtained from the term structure of swap rates from Bloomberg. The risk-free rates are then matched with the bond durations.

[36]Note that, in order to avoid outliers in these estimated differences, we apply the following filters. First, we do not consider observations where the difference between the rating and the market-implied rating is more than

the implied rating is worse than the actual rating of the bond, which can be seen as an anticipation of the forthcoming downgrade by the market, i.e., that the rating implied by the bond yield has already incorporated the upcoming deterioration of the rating after the future downgrade.

6 Results

This section provides our empirical analysis of market reactions to rating changes. We focus on bond returns but, in addition, cover metrics of changes in trading activity and liquidity for the three defined periods. First, we provide graphical representations of these time series in the interval from 90 days before to 90 days after the rating events and, in the main analysis, we test the statistical significance of the observed returns directly around the event dates, i.e., from 5 days before to 5 days after the events. Second, we employ regression models to analyze the determinants of these price reactions. Third, we present robustness checks discussing various alternative factors. Fourth, we explore whether market-implied ratings predict rating changes, and whether this relation varies over time.

6.1 Price and Trading Volume Around Rating Events

In this section, we analyze the changes in the prices and trading volume of corporate bonds around rating changes. Figures 1 to 4 show the time series of average prices and traded volumes in the time window from 90 days before to 90 days after the event, for downgrades and upgrades, and for bonds issued by non-financial and financial firms, respectively. Starting with downgrades (see Figure 1 for non-financial and Figure 2 for financial bonds), we find significant price reductions in all three periods around rating events. The strongest effect occurs in the crisis period for both non-financial and financial bonds; i.e., prices drop by around 6% of face value in the 91 days running up to and including the event, with a significant proportion of the reduction taking place on the event day. The period before the crisis shows the smallest effect, with a price move in the

four times the number of notches of the upcoming rating change. Additionally, we remove observations where the difference is higher than eight notches. It is very likely that such substantial differences are not the result of stale ratings, but represent missing factors, e.g., seniority or liquidity.

90 days before the event of around 2%, and only a small reaction around the event day itself. The post-Dodd-Frank period lies in between, with the exception that, for financial bonds, the price reactions are more similar to those in the period before the crisis. As for trading volume, we find that it often spikes up significantly in a short period around the event day, increasing by up to four times the average volume. This can be observed for all three periods in the case of non-financial bonds, with a lower increase during the crisis, which could be possibly linked to higher illiquidity in the market. However, for financial bonds, we observe a volume spike only before the crisis.[37] Overall, we find important differences across periods, showing the strongest reactions of prices and volumes during the crisis, and the weakest reactions before the crisis, which are in line with our hypotheses, in general.

Analyzing upgrades (see Figure 3 for non-financial and Figure 4 for financial bonds), we find much smaller reactions of bond prices to the rating change announcements. In addition, we do not observe particular price increases directly around the event days, but rather upward-sloping price trends over the whole period. The only exception can be observed during the crisis period for financial bonds, when, in the first 90 days, prices increase by 6%, again, without any strong reaction on the event day. The trading volume shows a similar picture, in that we observe some increase in the trading volume around the event day for some periods, but the reaction is not as clear as for downgrades. Overall, we find, as May (2010) has documented previously, that credit downgrades seem to elicit a stronger reaction than upgrades from market participants.

6.2 Informativeness of Rating Changes

In order to explore the informativeness of credit ratings, we provide a formal analysis of the impact of rating changes on bond returns and liquidity, as a test of the hypotheses presented in Section 3. We focus on the effects directly around the event date (i.e., from 5 days before to 5 days after the event date), calculated as described in Section 5.2. Table 3 reports the average announcement returns and the results of the t-test and signed-rank test for downgrades and

[37] The trading volumes before and after the event are in line with average trading volumes in the US corporate bond market (see, e.g., Friewald, Jankowitsch, and Subrahmanyam (2012)).

upgrades of financial and non-financial bonds, respectively. In addition, in Table 4, we present the corresponding changes in trading volume and price dispersion.[38]

In our first tests, we focus on announcement returns, in the spirit of Dimitrov, Palia, and Tang (2015). We confirm the above results with our regression analysis including various controls that could affect returns in addition to differences across periods, e.g., market-wide price movements or changes in risk-free interest rates during rating changes. Alternatively, we could have analyzed abnormal returns. However, there is no consensus in the literature concerning the calculation of abnormal returns in the context of illiquid bond markets. Therefore, as a robustness check, we apply a novel methodology developed by Spiegel and Starks (2016) to estimate abnormal returns for illiquid markets based an a modified repeat sales model that accounts for heterogeneity in asset characteristics, as described in Section 6.4.

Analyzing the effects of downgrades, we find that, before the crisis, the prices of non-financial bonds drop by -0.70% after downgrades, whereas downgrades of financial bonds lead to a change of -0.45%. We consider these price effects as being relatively low, as transaction costs in the overall bond market are around 40 bp (see, e.g., Friewald, Jankowitsch, and Subrahmanyam (2012)) and rise to 70 bp in the 5 days before a downgrade, based on the price dispersion measure. Thus, short-term trading strategies correctly anticipating a downgrade event would not be profitable, in most cases. Concerning liquidity, we find a rather strong volume increase (around $2 million) for both non-financial and financial bonds; however trading costs do not show any reactions. Considering the low price and trading cost impact of these events, this result suggests that at least some of the trading is potentially driven by the shifting of clienteles due to the breaches of rating-contingent thresholds, rather than in reaction to new information. Overall, these results confirm Hypothesis 1 predicting a low market reaction (due to rating inflation) in good times, especially for harder to rate securities (i.e., financial bonds).

Moving to the crisis period, in comparison, returns become much stronger for all credit rating downgrades: -1.31% and -1.39% for non-financial and financial bonds, respectively. In both cases,

[38]The trading frequency reveals a similar picture to that of the trading volume, i.e., we see a larger increase in the number of trades when the volume also increases. The results are presented in Table IA8 in the Internet Appendix, to conserve space.

the differences between the two periods (i.e., -0.61% for non-financial and -0.95% for financial bonds) are statistically significant. Thus, the effect doubles for non-financial bonds and triples for financial bonds. Analyzing liquidity, we find that trading volumes increased by $1.39 million and $0.43 million for non-financial and financial bonds, respectively. In addition, all downgrades are accompanied by a statistically and economically significant increase in transaction costs of 26.44 bp and 5.06 bp for non-financial and financial bonds, respectively.[39] Thus, the higher price reactions during the crisis are accompanied by higher transaction costs and rather moderate increases in volumes, potentially indicating higher sell-side pressure. These results are consistent with Hypotheses 2 suggesting a much stronger price reaction due to an increase in informativeness in the crisis period, accompanied by low liquidity.

After Dodd-Frank, downgrades of non-financial bonds have a relatively high price effect of -1.10%, which is comparable to the crisis period, and is much higher than before the crisis. Thus, trading strategies correctly anticipating these events would yield an annual return after transaction costs of around 10%.[40] The difference between the periods *after Dodd-Frank* and *before the crisis*, which amounts to -0.40%, is again statistically significant. This result is in line with Hypothesis 3, according to which rating changes, since the Dodd-Frank Act was passed, should be more informative for the market, as the CRAs face stronger monitoring and also higher litigation risk. Interestingly, for financial bonds, downgrades have a much lower price impact than before the crisis, decreasing by only -0.24% of face value, which amounts to a statistically significant difference between the two periods of 0.21%. In addition, trading volume and transaction costs increases are high for non-financial bonds and only moderate for financial bonds, in line with the price reactions. Thus, as predicted in Hypothesis 3, the increase in informativeness cannot be observed for all bonds, as it is even reversed in the case of financial bonds.

Note that our price reactions concerning downgrades differ from the results provided by Dimitrov, Palia, and Tang (2015), who report that rating informativeness for non-financial bonds has

[39] We consider a variation in price dispersion of at least 5 bp to be economically relevant. Note that, in our data, the average level of price dispersion in the 5 days before a downgrade is 72 bp.

[40] On average, the net return for an event is 40 bp (1.10% minus 0.70% in transaction costs) within 5 days before to 5 days after the event. Repeating this strategy for consecutive downgrades throughout a year (around 250 trading days) results in an annual return of approximately 10%.

decreased following Dodd-Frank. Our results highlight the importance of considering the crisis periods separately as it accounts for very high price reactions, which Dimitrov, Palia, and Tang (2015) incorporate into their "before Dodd-Frank period". In addition, our results for financial bonds provide important new insights. In particular, the differences between financial and non-financial bonds allow us to rule out (simple) alternative explanation of differing price effects across time periods, e.g., that rating agencies might have learned from the crisis and, thus, have improved the reliability of their ratings, or that the general level of default rates might be different after Dodd-Frank. Such explanations would affect the price reactions of all corporate bonds equally and, thus, are not consistent with the divergent results we find for financial and non-financial bonds after Dodd-Frank. A similar argument applies when considering general shifts in the market structure that are unrelated to changes in the regulation of rating agencies, and potentially affecting the willingness of certain investors to trade bonds. The Volcker rule, proposed around the time of Dodd-Frank, falls into this category. It restricts the speculative activities of dealers and could potentially increase the price impact of rating changes after the introduction of Dodd-Frank.[41] Again, such constraints should in principle affect all bonds alike and, thus, cannot explain why the price impact *increased* for non-financial bonds and *decreased* for financial bonds. Even if we assume that trading frictions affect bonds differently, such effects should be captured by differences in the liquidity of bonds around rating changes. However, we find the same price effects after controlling for liquidity in our regression analysis. Additionally, Bao, O'Hara, and Zhou (2017) argue that the effect of such trading restrictions should be especially relevant around the investment-speculative grade threshold. Both our regressions and our robustness tests find that our results hold after explicitly considering this effect. Finally, price impacts driven by trading restrictions after rating changes should most likely revert after a certain period of selling pressure. In our robustness checks we additionally test longer time windows and observe the same level of price reaction.

As for upgrades, we find statistically significant price increases, as well, albeit on a much

[41] Note that while the Volcker Rule was part of Dodd-Frank, it became effective on April 1, 2014, see Bao, O'Hara, and Zhou (2017) for details. Nevertheless, the market structure could have been affected earlier due to anticipation by banks, resulting in severely reduced dealer inventories even before that date.

lower scale. Basically, the price reaction for an upgrade is only roughly 50% of the reaction for a downgrade in all periods. For non-financial bonds, we find price increases of 0.30%, 0.47% and 0.45%, respectively, in the three periods (*before the crisis, during the crisis, after Dodd-Frank*), providing similar insights to those for the downgrades.[42] For financial bonds, the price increases are 0.19%, 0.69% and 0.80%, respectively.[43] The main difference, compared to the downgrades of financial bonds, is that upgrades in the post-Dodd-Frank period lead to rather strong price increases. A possible explanation for this price impact is the asymmetry of responses with regard to litigation risk that has been created by Dodd-Frank. As argued by Dimitrov, Palia, and Tang (2015), on the basis of the arguments in Goel and Thakor (2011), it is easier for CRAs to be sued due for optimistically biased ratings than pessimistically biased ones. Hence, CRAs would be much more reluctant to upgrade a bond, given the increased litigation risk, causing divergences between downgrades and upgrades. Consequently, to upgrade a bond, CRAs must have received a clear signal indicating an improvement in its credit quality. The market anticipates this possibility and, considering that CRAs have access to some degree of private information, reacts strongly whenever an upgrade occurs. As for liquidity, we find only moderate increases in volume and no reactions in transaction costs for non-financial and financial bonds, in line with the low price impacts. The strongest volume increase of around $1 million can be observed during the crisis, indicating that an upgrade might reduce the effects of sell-side pressure. After the Dodd-Frank Act, we find a rather large spike in volume ($2.02 million) for financial bonds, again in line with the observed price impact.

6.3 Regression Analysis

In this section, we present the results of two sets of regression models analyzing bond returns. The first set of regressions uses time-period dummies, which allow us to confirm the tests of the previous section. In the second set, we run individual regressions for each period separately to analyze whether the impact of explanatory variables changes over time (see Section 5). In all these

[42] In the case of upgrades of non-financial bonds, the differences across periods are only marginally significant.
[43] For upgrades of financial bonds, the differences compared with those before the crisis are statistically significant.

regressions, the dependent variable represents the returns following downgrades (for details on the calculation see Section 5.2), as these events turned out to be more important, based on the earlier analysis.[44]

Tables 5 and 6 show the results of the regression models using time-period dummies for non-financial and financial bonds. In Model 1, no additional market control is included. Model 2 includes the return of the duration-matched risk-free bond, and Model 3 includes the corporate bond market return, as described in Section 5.2. Since the results are similar in all three specifications, we will focus on Model 3. Analyzing non-financial bonds (see Table 5) we find, in line with the previous results, that during the crisis and after Dodd-Frank, the informativeness of downgrades is greater than in the pre-crisis regime. Specifically, prices decrease by 0.22% and 0.48% more in the crisis period and after Dodd-Frank, respectively. However, only the *after Dodd-Frank* dummy is statistically significant. The effect observed during the financial crisis is potentially captured by liquidity effects (see below for further discussion). Interestingly, we find a significant effect for the rating threshold between the investment and speculative grades: the price change following such a downgrade has a 1.18% larger decline. Thus, there is an important regulatory price channel for these events, which nevertheless does not drive our main findings.[45] Considering liquidity and trading activity, an increase in the transaction cost and trading frequency is related to a stronger price impact of downgrades (i.e., a one-standard-deviation change leads to price changes for these two variables of -0.50% and -0.34%, respectively). Additionally, we find a slightly weaker reaction for bonds with a longer time to maturity, potentially because these bonds are linked to buy-and-hold investors.

In the case of the results from the regression model for downgrades of financial bonds (see Table 6), we find, again based on the time-period dummies in Model 3, that the crisis period is associated with a decrease in prices that is 1.07% larger, following a downgrade, consistent with the results of the previous analysis. Although positive, the post-Dodd-Frank dummy is, instead, not statistically significant. Thus, the finding that Dodd-Frank improved informativeness only for

[44]The results for credit upgrades are not reported here in the interest of conserving space, but are qualitatively similar and can be found in the Internet Appendix in Tables IA9 and IA10.

[45]For a more detailed discussion about the regulatory channel see Section 6.4.

non-financial bonds is confirmed: the informativeness of financial bonds is, at best, as low as in the period before the crisis. Downgrades from investment to speculative grade do show a stronger reaction as in the case of non-financial bonds, indicating once again that a potential regulatory channel does not drive the results for the period dummies. Trading activity and liquidity variables provide similar effects to those for non-financial bonds.

Some important aspects of the analysis are not covered in all details in the results presented thus far. In particular, it would be interesting to know whether the effect of credit downgrades/upgrades on the regulatory threshold changed after the introduction of Dodd-Frank, when this threshold was no longer legally binding.[46] Table 7 shows the results of such regressions based on the individual periods. Focusing on the rating threshold dummy, we find that for both non-financial and financial bonds, the negative coefficient obtained in the first set of regressions is driven by the years before and during the crisis. Before the crisis, the threshold dummies are significant at the 1% level, and are large in economic terms: a rating change crossing the investment/speculative grade threshold results in a return of -0.86% for non-financial bonds and -1.38% for financial bonds. During the crisis, we find that the statistical significance is marginal with, again, large economic effects. Since Dodd-Frank, however, being downgraded from investment to speculative grade has not led to greater price reactions. This could be linked to the fact that Dodd-Frank aims at removing rating-contingent regulation and, thus, weakened the regulatory channel.[47]

In addition, we find that liquidity effects are observed mainly in the crisis period, consistent with the discussion of the previous results. In particular, the transaction cost and trading volume variables are statistically significant for financial bonds, showing a particularly large price impact for illiquid financial bonds in the crisis. For non-financial bonds, we only find marginal effects for the liquidity measures. However, the total assets and coupon variables are only significant in the crisis period, indicating that non-financial bonds of smaller firms, and those with higher coupons,

[46] Following Dodd-Frank, regulatory thresholds stopped being legally binding, although this was implemented at different times for different kinds of investors, as pointed out in Section 5.1.

[47] However, as already pointed out in Section 5.1, the elimination of rating-contingent regulation has not been homogeneous across market participants. In order to test the direct effect of such a provision, bond holding data would be required. While limited data-bases on such holdings are available (e.g., eMAXX from Thomson Reuters), they do not cover all the investors in the market.

show stronger price reactions, potentially proxying for the liquidity, as well.

6.4 Robustness

In this section we discuss an extensive set of robustness tests analyzing alternative factors that could explain our findings. The tables presenting the results of these checks are reported in the Internet Appendix to conserve space. We find that all our main results hold even within these robustness tests.

Confounding Events. Our first set of robustness checks analyzes whether the informativeness of the rating changes could be driven by other events relevant for bond prices when analyzing announcement returns. In particular, we analyze returns after excluding events that coincide with earnings announcements as well as mergers and acquisitions. The dates of earnings announcements are retrieved from Compustat, while those of mergers and acquisitions (M&A) are both obtained through the CRSP-Compustat merging table and hand-collected.[48] We exclude rating events when earnings announcements are presented within 10-days and when M&A activity (announcement and/or deal completion) are observed within 30 days before and after the events. The results do not change with these modifications (see Table IA11). Furthermore, in a second robustness test we eliminate rating events that overlap with rating changes of any other CRA for the same bond within 10 or 30 days (see Tables IA12 and IA13), and observe that our findings remain robust.

Regulatory Channel. Price impacts around rating changes may reflect *both* information transmission and the effect of regulation, whenever a regulatory threshold is crossed, and some investors trade for this reason. If the regulatory channel is particularly strong, it might be that the observed impacts are not due to informativeness but regulation-induced fire sales. While we control for these events in our regression analysis, we try to further address this concern in a third robustness check by repeating our tests on bond announcement returns by excluding all the events where the investment-speculative threshold is crossed. The results are presented in Table IA14

[48] For mergers and acquisitions, we consider both the announcement date and the date of the deal completion as relevant.

and confirm that our findings are not driven by the regulatory channel.

Distribution of Rating Events. Our fourth set of robustness checks considers differences in the distribution of rating events across rating classes when comparing different periods based on announcement returns. The price impact of a rating change could be dependent on the rating class, e.g., a rating change from AA+ to AA might have a different effect compare to a change from BBB- to CCC+. Thus, the difference in informativeness could be driven, for example, by relatively more changes of speculative grade ratings compared to investment grade ratings across different periods. In the robustness test, we equally weight the observations in the first period (as in the regular analysis), while in the second and third period we weight the observations based on the relative frequency of rating changes in the rating classes in the first period. The results are presented in Table IA15 and confirm our findings.[49]

Time-Varying Risk Premia. Our fifth set of robustness checks focuses on the time variation of the risk premium in the corporate bond market. The market price reaction to an event also reflects the risk-premium in the market at that specific point in time. If the risk premium varies significantly over time (e.g., through the business cycle), the market reaction to a rating change could be significantly different even if the informativeness of the rating stays constant. We address such a concern by including in our regressions the risk premium in the corporate bond market in the month of the rating event. The risk premium is estimated using Fama-Macbeth regressions on monthly corporate bond returns.[50] First we run, for each bond in the TRACE database over our sample period, a time-series regression of single corporate bond returns on the market return.[51] Second, in each month, we run cross-sectional regressions of corporate bond returns on the previously estimated bond-specific betas. The risk premium in each month is the estimated coefficient of the cross sectional regression in that month. Including the risk premium in our

[49] Note that such effects are directly considered at the event level in the regression setup by including rating-related variables. This robustness tests ensures that we are not overlooking any systmatic shift in the distribution of ratings across periods.

[50] A bond needs to have at least 12 monthly returns observations to be included in our sample.

[51] We take as market return the FINRA-Bloomberg Corporate Bond Index. Considering that we are provided with an investment and speculative grade bond index, whenever a bond crosses the threshold in a month we equally weight the returns of the two indexes.

regressions does not change our results, as shown in Tables IA16, IA17, IA18, IA19.

Abnormal Returns. In our sixth set of robustness checks we analyze abnormal returns instead of announcement returns. As pointed out by Spiegel and Starks (2016), the definition of a benchmark index with which abnormal returns can be estimated is a difficult challenge for illiquid bond markets. In particular, differences in the exposure to interest rates, credit and liquidity risk across bonds make the relation of a given bond to the return of a simple market portfolio meaningless, as bond prices are not driven by a single market factor. On the other hand, defining a benchmark portfolio resembling all pricing factors of a particular bond often leads to a low number of representative bonds, which is a problem as bonds are traded infrequently. In addition, there is no consensus in the literature how the benchmark bonds should be chosen. Spiegel and Starks (2016) propose a new methodology to calculate abnormal returns in the corporate bond market. They adopt the repeat sales method by using bond characteristics in the calculation of the benchmark. Each bond in the market is weighted according to the distance of its characteristics from those of the bond of interest. We estimate abnormal returns by following this methodology.[52] In Table IA20, we present cumulative abnormal returns over a 5-days event window centered at the event date and find similar results.

6.5 Implied Ratings Analysis

In this section, we analyze whether rating changes are anticipated by market participants, and whether such expectations vary across the three periods. We estimate a market-implied rating before the rating event by comparing the yield spread of the particular bond to the observed yield spreads in the various rating classes, based on all bonds in the market (see Section 5.5). This market-implied rating is compared to the actual rating of the bond before the event. If a credit rating change occurred unexpectedly, this difference is zero; otherwise, there is a negative

[52] We estimate the repeat-sales model by using the full sample period (January 2003-May 2014). The vector of bond characteristics used to calculate the benchmark index includes yield, time to maturity and a dummy for the industry classification, as in the original specification.

difference when credit downgrades were anticipated, and a positive one for anticipated upgrades.[53]

Table 8 shows the average differences for downgrades and upgrades, separately for non-financial and financial bonds. Starting with downgrades, we find that, before the crisis, rating changes were anticipated in the market; i.e., on average, the differences are -0.61 and -1.82 notches for non-financial and financial bonds, respectively. Thus, for financial bonds, the anticipation is considerably stronger. However, during the crisis, we basically observe no anticipation. After Dodd-Frank, there is a significant decrease in the anticipation of rating changes by the market, suggesting overall that tighter regulatory monitoring is related to more timely downgrades from CRAs. However, interesting differences emerge between non-financial and financial bonds. Specifically, the gap between the rating of the CRAs and that implied by the market preceding the downgrade seems to have completely disappeared for non-financial bonds (0.13), whereas it is, in part, still present for financial bonds (-0.91). This finding is consistent with the results of the price and liquidity impacts in Section 6.1: since Dodd-Frank, downgrades of non-financial bonds are perceived as significantly more informative by the market, whereas those of financial bonds are not. However, note that the anticipation of downgrades of financial bonds strongly decreases after Dodd-Frank. In particular, it is slightly below one notch in absolute terms, thus, avoiding litigation risk and following the market quite closely.

The results for upgrades are interesting, as well. Comparing the time periods before the crisis and after Dodd-Frank, we find that after Dodd-Frank, the expectation of upgrades increases, i.e., on average 0.46 vs 1.28 notches for non-financial bonds, and 0.74 vs 1.53 notches for financial bonds, respectively. Thus, before the crisis, ratings were adjusted rather quickly (less than one notch) in response to good news, whereas since Dodd-Frank, rating agencies have become more reluctant to upgrade, especially in the case of financial bonds. Again, this result could be a direct consequence of the asymmetric litigation risk for CRAs brought about by Dodd-Frank.

Overall, we find that the anticipation of rating changes is different in the three time periods. In particular, the anticipation of credit downgrades drops significantly after Dodd-Frank, virtually

[53] In our sample, 74% of the events show a rating change by one notch. Therefore, considering whether the expectation fits the number of actual notches would not significantly change our main results.

disappearing for non-financial bonds. This indicates that, since CRAs have been subjected to higher monitoring, ratings became significantly less stale. However, CRAs are now more reluctant to upgrade bonds, as a consequence of the potential litigation risk in the event of a lawsuit for damages. In general, these results are in line with the observed price, liquidity and trading activity changes postulated in the hypotheses presented earlier.

7 Conclusion

In this paper, we investigate whether the economic and regulatory environment significantly affects the informativeness of corporate ratings in the cross-section of the rated securities. We empirically test hypotheses based on the existing theoretical models of rating agency behavior, such as Skreta and Veldkamp (2009) and Opp, Opp, and Harris (2013). In particular, these models suggest different reactions to changes in regulation and economic cycles, depending on the cost of information acquisition and the underlying credit risk of the securities.

In this context, the financial crisis in 2008-2009 and the subsequent regulatory changes introduced by Dodd-Frank are particularly suitable to our study. The first represents one of the worst episodes of economic downturn, which brought into question the informativeness of credit ratings. The crisis was followed by a major regulatory response, increasing the CRAs' litigation risk, and subsequently eliminating rating-contingent regulation. One of the markets most heavily affected by these events is the US corporate bond market. In this market, CRAs play an important role in assessing credit risk, as not all the relevant credit information is easily available to all investors. In addition, this market represents an ideal laboratory, as virtually all transaction data are available.

We investigate rating informativeness by analyzing the impact of downgrades and upgrades on prices and liquidity of US corporate bonds from 2003 to 2014. Our dataset covers three important periods: before the crisis, during the financial crisis and recession, and after Dodd-Frank. Moreover, we analyze non-financial and financial bonds separately, considering that the latter securities face a higher cost of information acquisition. We find that the informativeness of

rating changes was generally low before the crisis, and that rating changes for financial bonds were less informative than those of non-financial bonds. Furthermore, the informativeness increased during the crisis, in combination with a high level of illiquidity, in line with the models discussed in the literature. Since Dodd-Frank, credit rating changes have led to a significantly stronger market reaction for non-financial bonds, which we do not find for financial bonds. Our findings indicate that the new regulatory framework has ambiguous effects, which have been discussed as a likely, but previously untested, outcome in the theoretical literature. Our regression analysis additionally shows that the impact of rating-contingent thresholds, observed before the introduction of Dodd-Frank, cannot be found after the regulatory reform. Finally, we analyze ratings implied by market yield spreads, finding that downgrades are less anticipated after Dodd-Frank than before the crisis, whereas the opposite holds for upgrades. This suggests that Dodd-Frank might have reduced or even eliminated stale, overly optimistic ratings that were released before the crisis. However, the asymmetric penalties imposed by Dodd-Frank could make CRAs reluctant to upgrade bonds promptly.

To the best of our knowledge, our paper is the first to provide comprehensive empirical tests on a prominent set of models of rating agency behavior with respect to information acquisition and rating standards. We analyze the interaction of regulation, business cycles and asset-specific costs of information acquisition. Our results may be of interest to policy makers, for evaluating the efficacy of existing regulations, and to market participants, in adapting their investment and risk management strategies to the economic environment and regulatory framework.

Appendix: Structural Break Test

In this section, we provide tests for identifying structural breaks in the price variations of US corporate bonds surrounding rating changes, during our time period from January 2003 to May 2014. Such tests allow us to evaluate the validity of the choice of the three time periods for our analysis (*before the crisis*, *during the crisis* and *after Dodd-Frank*, for more details see Section 5.1).

The most basic test for structural breaks is the Chow test, introduced by Chow (1960). It is designed for time series data, and it allows one to identify a single break at a known time point t^*. Consider the regression models $y_t = x_t^{'}\beta + \epsilon_t$ and $y_t = x_t^{'}\beta + \delta_t x_t^{'}\gamma + \epsilon_t$, where δ_t is a dummy that equals 1 if $t < t^*$. Under the null hypothesis of no structural break at t^*, which is equivalent to $\gamma = 0$, the test statistic is given by

$$F_{t^*} = \frac{(RSS_1 - RSS_2)(T - 2k)}{RSS_2 \cdot k}$$

where RSS_1 and RSS_2 are the residual sums of squares of the first and second regression models presented above, respectively. T is the point of the last observation in the time series and k is the number of regressors. The test statistic has a χ^2 distribution with k and $T - 2k$ degrees of freedom and rejects the null hypothesis when it is too large. A limitation of the Chow test is imposed by the fact that the break date needs to be specified exogenously. The structural break F-test described in Andrews (1993) overcomes this problem and allows one to test for a structural break at an unknown point in time. The basic idea here is to extend the Chow test by calculating the Chow test statistic for *all* the potential breakpoints in a given interval $[\underline{t}, \bar{t}]$. $\underline{t}$ is observation n in the time series, where $n > k$, and conversely $\bar{t}$ is observation $T - n$, where T is the last observation. The test statistic is given by

$$supF = \sup_{\underline{t} \leq t \geq \bar{t}} F_t$$

which has a non-standard pivotal distribution that depends on the number of parameters and

dates tested. We apply this test based on our regression model presented in Section 5.4. Given that the test is designed for time series, we create a monthly time series of our model by taking the average of the price reactions and all the regressors in each month of our sample period.

In the presentation of the results, we focus on price effects of downgrades for financial and non-financial bonds. However, the tests concerning upgrades provide a similar picture. Figure 5 summarizes our results and presents the time series of the F-statistics, covering the full period in the two upper plots and sub-periods, focusing on the regulatory changes in the two lower plots, separately for financial and non-financial bonds. Starting with the full time series of the F-statistics for financial bonds, we find a sharp increase during the crisis period, particularly around the Lehman default, in line with our result of more significant price reactions in this period. Interestingly, the F-statistic drops below the pre-crisis level, after the introduction of Dodd-Frank. Considering non-financial bonds, we again find an increase around the Lehman default; however, there is a second sharp increase after the introduction of Dodd-Frank. Thus, we find important differences between financial and non-financial bonds, as in our analysis of price and liquidity effects.

Applying the test to these F-statistics based on the whole time series, we find a structural break in the financial crisis around the Lehman default, confirming that the financial crisis led to a significant difference in the market reaction. However, as the test can only identify one structural break and we are particularly interested in whether an additional structural break occurred after the introduction of Dodd-Frank, we separately analyze a sub-period spanning only the crisis and the post-Dodd-Frank period. These results are presented in the two lower plots. We find, for both financial and non-financial bonds, that a structural break occurs in the data in mid-2010 (in July for financial and April for non-financial bonds). The F-statistics are significantly lower for financial and higher for non-financial bonds after the break. Thus, these results support our choice of time periods, confirming that a structural break did occur directly around the introduction of Dodd-Frank.

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Figure 1: Time Series for Downgrades of Non-Financial Bonds.
This figure presents, for each of the three sample periods, the time series of the daily average price and daily average cumulative trading volume. Each is calculated across all events within the time interval from 90 days before to 90 days after the event. The lefthand column shows the results for the price, and the righthand one those for the trading volume. Our data refer to downgrades and upgrades that occurred in the US corporate bond market between January 2003 and May 2014. We obtain the ratings from Mergent FISD and the daily bond transactions from TRACE. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014).

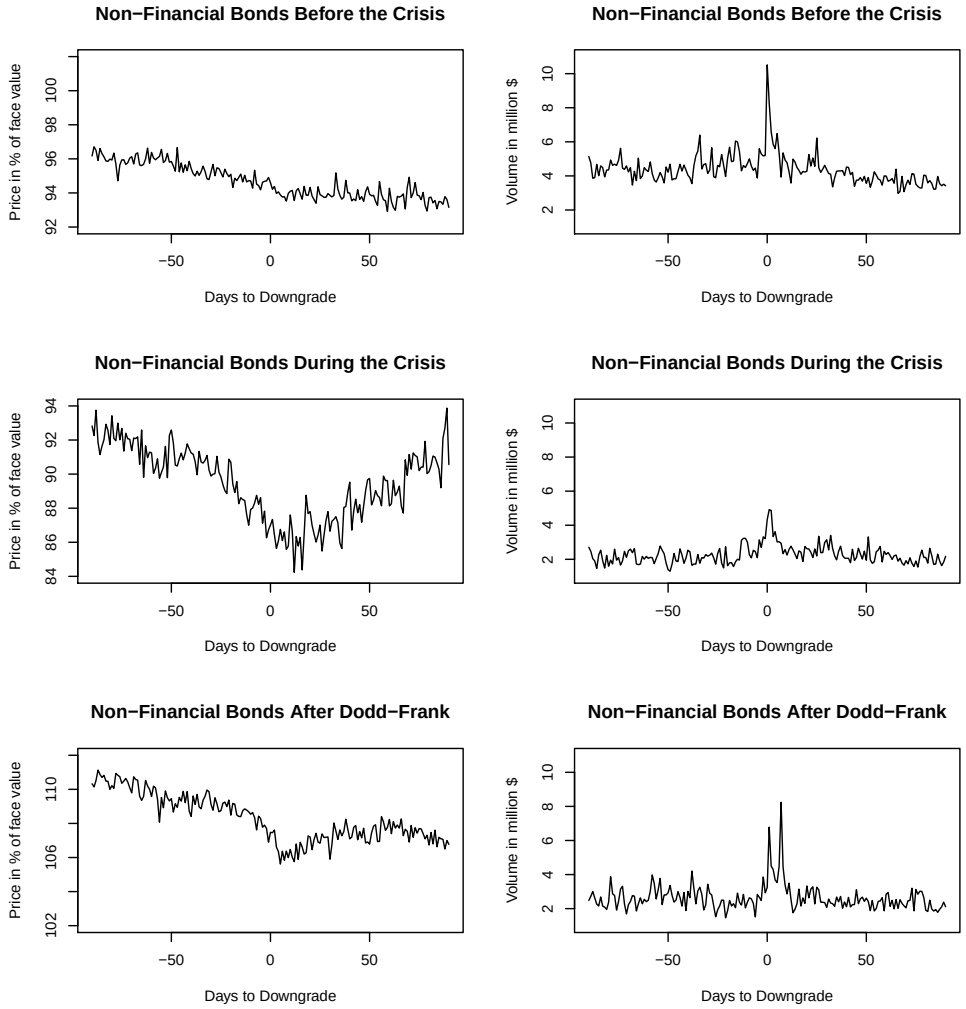

Figure 2: Time Series for Downgrades of Financial Bonds.
This figure presents, for each of the three sample periods, the time series of the daily average price and daily average cumulative trading volume. Each is calculated across all events within the time interval from 90 days before to 90 days after the event. The lefthand column shows the results for the price, and the righthand one those for the trading volume. Our data refer to downgrades and upgrades that occurred in the US corporate bond market between January 2003 and May 2014. We obtain the ratings from Mergent FISD and the daily bond transactions from TRACE. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014).

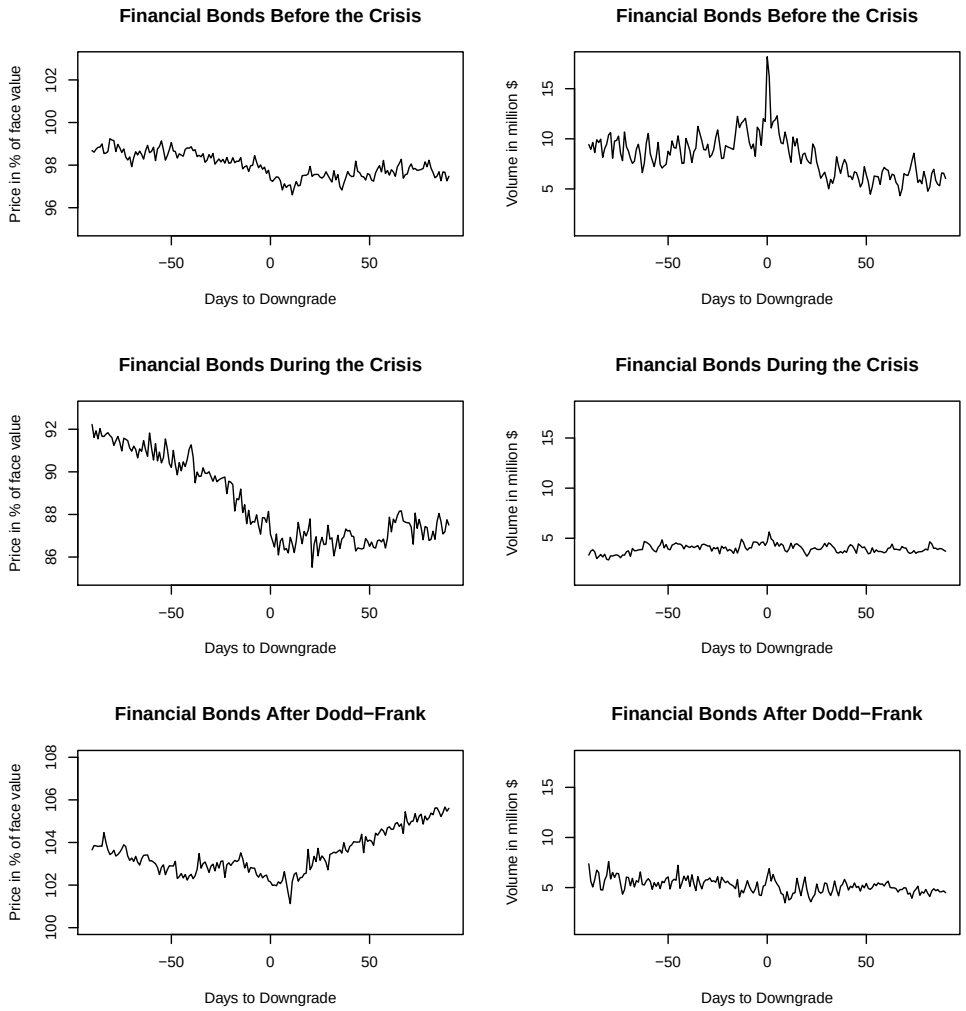

Figure 3: Time Series for Upgrades of Non-Financial Bonds.
This figure presents, for each of the three sample periods, the time series of the daily average price and daily average cumulative trading volume. Each is calculated across all events within the time interval from 90 days before to 90 days after the event. The lefthand column shows the results for the price, and the righthand one those for the trading volume. Our data refer to downgrades and upgrades that occurred in the US corporate bond market between January 2003 and May 2014. We obtain the ratings from Mergent FISD and the daily bond transactions from TRACE. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014).

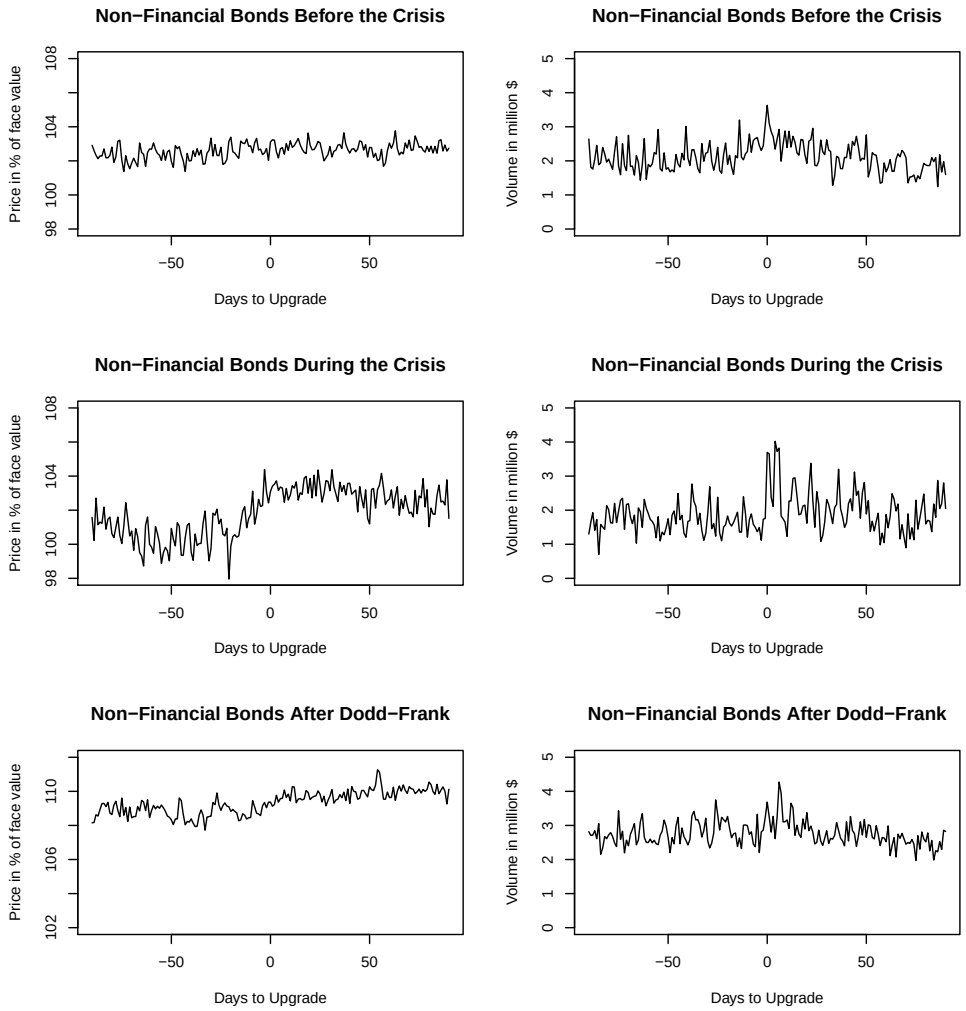

Figure 4: Time Series for Upgrades of Financial Bonds.
This figure presents, for each of the three sample periods, the time series of the daily average price and daily average cumulative trading volume. Each is calculated across all events within the time interval from 90 days before to 90 days after the event. The lefthand column shows the results for the price, and the righthand one those for the trading volume. Our data refer to downgrades and upgrades that occurred in the US corporate bond market between January 2003 and May 2014. We obtain the ratings from Mergent FISD and the daily bond transactions from TRACE. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014).

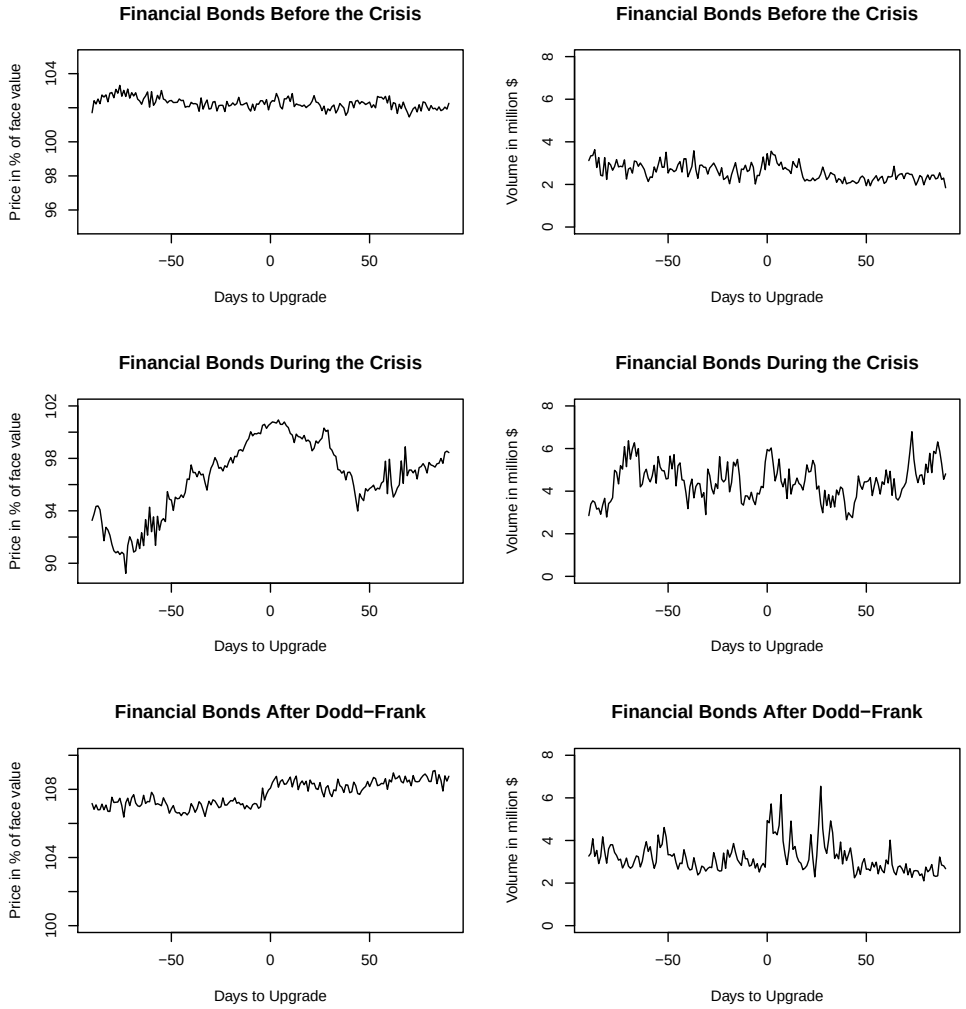

Figure 5: Structural Break Tests: Downgrades of Financial and Non-Financial Bonds. This figure shows the results of the Andrews (1993) test for a structural break in the price variations surrounding rating changes in the US corporate bond market. The results for financial and non-financial bonds are presented in the lefthand and righthand columns, respectively. The two upper plots show the results for the full sample period, whereas the two lower plots concentrate on the sub-periods *during the crisis* and *after Dodd-Frank*. The reference model for the test explains the price reaction related to a rating change, as presented in Section 5.4, excluding the time dummies. The test is performed on a monthly time series of the model, obtained by taking the average of all the variables in each month of the sample period. The horizontal line marks the 1% level of significance derived from the test, where the test statistic is given by SupF, under the null hypothesis of no structural break.

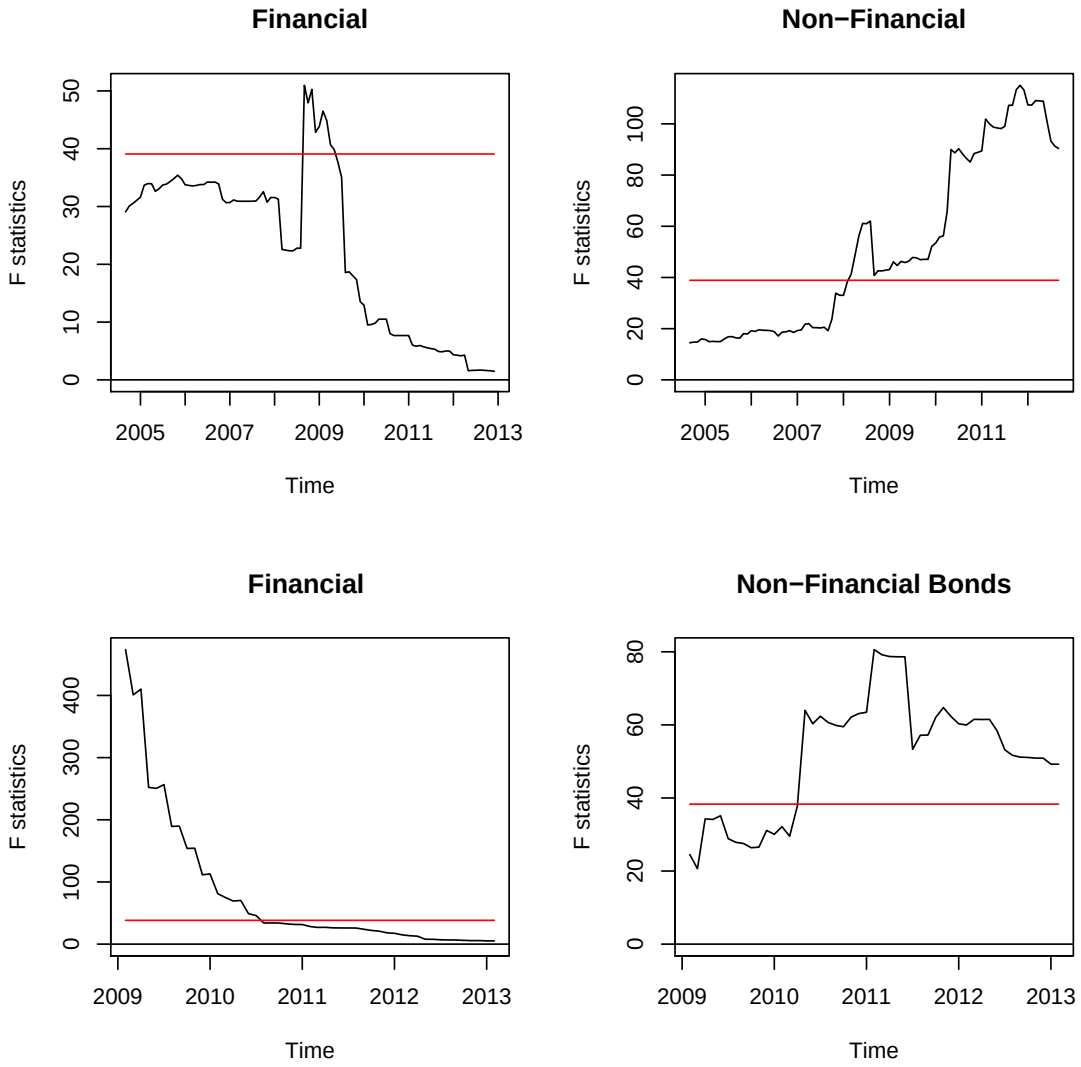

Table 1: Summary Statistics of Downgrades and Upgrades.

This table shows how the rating events are distributed in our sample. The table reports the ratings of the bonds after the downgrade/upgrade. Rating is a variable that assigns integer values to the different rating grades, starting from 1 for the highest and extending down to 21 for the lowest rating grade. The table is divided by rating grade, type of event (downgrade/upgrade), bond issuer (financial/non-financial) and time period (before the crisis, during the crisis and after Dodd-Frank). We obtain the ratings from Mergent FISD and the daily bond transactions from TRACE. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014).

Rating	**Financial Bonds**				**Non-Financial Bonds**				**All Bonds**
	Before	**During**	**After**	**All Periods**	**Before**	**During**	**After**	**All Periods**	**All Periods**
					Panel A: Downgrades				
AAA/Aaa/1	0	0	0	0	0	0	0	0	0
AA+/Aa1/2	5	45	7	57	0	1	1	2	59
AA/Aa2/3	7	71	12	90	1	13	0	14	104
AA-/Aa3/4	19	104	55	178	4	9	6	19	197
A+/A1/5	89	220	154	463	34	11	0	45	508
A/A2/6	33	254	151	438	90	30	10	130	568
A-/A3/7	41	181	178	400	53	35	93	181	581
BBB+/Baa1/8	71	101	135	307	52	45	57	154	461
BBB/Baa2/9	79	125	122	326	63	45	37	145	471
BBB-/Baa3/10	58	67	32	157	64	47	24	135	292
BB+/Ba1/11	119	33	46	198	49	31	21	101	299
BB/Ba2/12	109	28	16	153	44	9	7	60	213
BB-/Ba3/13	63	18	16	97	36	6	15	57	154
B+/B1/14	34	70	4	108	34	17	8	59	167
B/B2/15	16	66	0	82	37	2	6	45	127
B-/B3/16	1	61	12	74	39	6	5	50	124
CCC+/Caa1/17	2	26	6	34	31	8	5	44	78
CCC/Caa2/18	0	0	16	16	4	6	3	13	29
CCC-/Caa3/19	0	0	0	0	0	0	0	0	0
CC/Ca/20	0	0	0	0	0	0	0	0	0
C/C/21	0	0	0	0	0	0	0	0	0
All Ratings	746	1470	962	3178	635	321	298	1254	4432

Table 1 continued on next page.

Table 1 continued from previous page.

Rating	Financial Bonds				Non-Financial Bonds				All Bonds
	Before	During	After	All Periods	Before	During	After	All Periods	All Periods
Panel B: Upgrades									
AAA/Aaa/1	10	0	0	10	0	0	0	0	10
AA+/Aa1/2	57	2	0	59	0	0	0	0	59
AA/Aa2/3	132	20	1	153	1	3	22	26	179
AA-/Aa3/4	202	37	19	258	2	0	49	51	309
A+/A1/5	150	31	31	212	28	11	34	73	285
A/A2/6	78	18	9	105	39	24	57	120	225
A-/A3/7	35	6	23	64	29	16	52	97	161
BBB+/Baa1/8	22	1	66	89	48	29	51	128	217
BBB/Baa2/9	16	1	18	35	42	13	18	73	108
BBB-/Baa3/10	3	1	59	63	35	3	32	70	133
BB+/Ba1/11	42	0	41	83	27	2	10	39	122
BB/Ba2/12	0	0	29	29	24	5	27	56	85
BB-/Ba3/13	1	27	16	44	11	5	26	42	86
B+/B1/14	0	25	39	64	3	2	12	17	81
B/B2/15	0	13	3	16	10	0	7	17	33
B-/B3/16	0	37	10	47	6	1	8	15	62
CCC+/Caa1/17	0	0	5	5	2	0	0	2	7
CCC/Caa2/18	0	0	0	0	0	0	0	0	0
CCC-/Caa3/19	0	0	0	0	0	0	0	0	0
CC/Ca/20	0	0	0	0	0	0	0	0	0
C/C/21	0	0	0	0	0	0	0	0	0
All Ratings	748	219	369	1336	307	114	405	826	2162

Table 2: Summary Statistics of Bond and Firm Characteristics.

This table shows summary statistics of the main characteristics of the bonds and related firms. The table shows the statistics for each of the three sample periods, separately and all together. Moreover, the sample is divided into downgrades, upgrades, financial bonds and non-financial bonds. Maturity and coupon are measured in years and percentage of face value, respectively. Amount issued, total assets and intangible assets are given in billions of dollars. Rating is a variable that assigns integer values to the different rating grades, starting from 1 for the highest and extending down to 21 for the lowest rating grade. We obtain the ratings from Mergent FISD and the daily bond transactions from TRACE. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014).

	Before			**During**			**After**			**Total**		
	Mean	**SD**	**Median**	**Mean**	**SD**	**Median**	**Mean**	**SD**	**Median**	**Mean**	**SD**	**Median**
Panel A: Downgrades of Financial Bonds												
Time to Maturity	4.94	5.68	3.37	5.69	6.58	3.60	6.29	6.94	4.02	5.70	6.51	3.66
Coupon	6.16	1.43	6.22	5.65	1.53	5.63	4.99	1.61	5.25	5.57	1.59	5.63
Amount Issued	1.19	1.11	1.00	1.04	0.94	0.75	1.36	0.90	1.25	1.17	0.98	1.00
Rating	9.51	3.03	10.00	7.85	3.83	7.00	7.52	2.83	7.00	8.14	3.46	7.00
Total Assets	318.20	269.40	287.44	751.93	803.37	348.36	1121.23	848.52	807.70	758.00	784.96	358.99
Intangible Assets	4.90	5.86	5.80	23.85	34.77	6.29	28.08	30.95	11.41	20.61	30.60	6.82
Panel B: Downgrades of Non-Financial Bonds												
Time to Maturity	10.83	9.59	7.25	6.17	7.37	3.58	10.52	12.50	5.30	9.56	10.07	5.43
Coupon	6.66	1.51	6.75	5.93	1.15	5.63	5.62	1.90	5.60	6.23	1.60	6.18
Amount Issued	0.49	0.37	0.40	0.52	0.29	0.50	0.82	0.60	0.60	0.57	0.44	0.50
Rating	10.26	3.64	10.00	9.12	3.31	9.00	9.05	2.81	8.00	9.68	3.42	9.00
Total Assets	124.90	171.33	23.23	44.85	111.28	39.04	106.36	111.93	36.59	100.04	149.29	28.34
Intangible Assets	7.93	11.63	3.11	5.37	15.29	0.09	45.90	56.42	2.60	15.68	33.07	2.51
Panel C: Upgrades of Financial Bonds												
Time to Maturity	5.23	5.43	3.63	4.54	4.86	3.60	6.07	6.06	4.20	5.35	5.54	3.82
Coupon	5.53	1.78	5.73	6.71	1.83	6.55	6.01	2.16	6.00	5.86	1.95	5.88
Amount Issued	0.63	0.55	0.50	1.28	0.85	1.10	0.99	0.68	1.00	0.83	0.69	0.68
Rating	4.83	2.23	4.00	9.28	5.13	7.00	9.68	3.17	10.00	6.90	3.91	5.00
Total Assets	679.83	539.56	503.55	441.88	441.46	150.13	294.60	545.20	105.74	533.08	551.36	320.52
Intangible Assets	25.65	27.67	14.59	10.90	20.44	0.83	4.40	12.39	0.13	17.22	25.04	4.57
Panel D: Upgrades of Non-Financial Bonds												
Time to Maturity	12.23	12.03	7.47	10.61	9.12	7.94	10.30	9.70	6.61	11.06	10.58	7.16
Coupon	6.56	1.45	6.88	6.36	1.26	6.27	5.60	2.15	5.63	6.06	1.87	6.13
Amount Issued	0.48	0.41	0.33	0.54	0.43	0.43	0.69	0.55	0.50	0.59	0.49	0.43
Rating	8.96	2.82	9.00	7.81	2.43	8.00	7.90	3.35	7.00	8.28	3.08	8.00
Total Assets	25.74	19.29	21.50	41.95	53.07	20.70	40.20	41.53	24.12	34.89	37.43	23.07
Intangible Assets	4.56	10.87	0.78	11.40	21.99	2.63	11.42	21.21	1.97	8.78	18.36	1.15

Table 3: Tests on Announcement Returns.
This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The returns are calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 5 Days of Non-Financial Bonds						
Before the Crisis	−0.70	−8.33***	−0.46***	0.30	4.65***	0.14***
During the Crisis	−1.31	−4.6***	−0.7***	0.47	1.93*	0.49***
After Dodd-Frank	−1.10	−9.08***	−0.8***	0.45	8.04***	0.34***
During-Before	−0.61	−2.06**	−0.05	0.17	0.67	0.27**
After-Before	−0.40	−2.72***	−0.29***	0.15	1.69*	0.19***
After-During	0.21	0.68	−0.28*	−0.02	−0.09	−0.09
Panel B: Announcement Return within 5 Days of Financial Bonds						
Before the Crisis	−0.45	−6.58***	−0.35***	0.19	5.87***	0.16***
During the Crisis	−1.39	−6.72***	−0.56***	0.69	6.29***	0.59***
After Dodd-Frank	−0.24	−4.16***	0.00	0.80	13.62***	0.62***
During-Before	−0.95	−4.34***	−0.05	0.50	4.33***	0.37***
After-Before	0.21	2.34**	0.32***	0.60	8.96***	0.39***
After-During	1.15	5.37***	0.32***	0.10	0.83	0.06

Table 4: Results of the Statistical Tests on Volume and Liquidity Variations.
This table shows variations in cumulative daily trading volume and daily price dispersion surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The volume (liquidity) variations are obtained by calculating the difference between the average cumulative daily volume (daily price dispersion) across the 5 days before the event and the average across the event day and the 5 subsequent days. Variations are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades, upgrades, financial and non-financial bonds in each of the periods. The table reports the mean of the variations (in millions of $ for the volume in Panels A and B, and in basis points for the price dispersion in Panels C and D), the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Volume Difference within 5 Days of Non-Financial Bonds						
Before the Crisis	2.23	5.33***	0.98***	0.45	1.81*	0.58***
During the Crisis	1.39	4.35***	1.27***	1.65	4.26***	1.07***
After Dodd-Frank	1.59	4.31***	0.78***	0.33	1.58*	0.23**
Panel B: Volume Difference within 5 Days of Financial Bonds						
Before the Crisis	2.30	3.90***	0.87***	0.66	4.14***	0.52***
During the Crisis	0.43	2.78***	0.50***	1.17	3.39***	1.20***
After Dodd-Frank	1.15	6.58***	0.79***	2.02	7.50***	1.19***
Panel C: Price Dispersion Change within 5 Days of Non-Financial Bonds						
Before the Crisis	−3.86	−2.12**	−3.79***	−1.57	−0.52	0.11
During the Crisis	26.44	4.23***	19.94***	−3.19	−0.50	1.83
After Dodd-Frank	9.00	4.14***	6.28***	0.28	0.17	0.24
Panel D: Price Dispersion Change within 5 Days of Financial Bonds						
Before the Crisis	1.38	0.92	0.73	−3.14	−2.82***	−1.45**
During the Crisis	5.06	2.24**	4.00***	−6.75	−1.70*	−3.66*
After Dodd-Frank	−0.12	−0.11	−0.17	3.15	1.92*	1.76*

Table 5: Determinants of Announcement Returns: Downgrades of Non-Financial Bonds.

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes downgrades of non-financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	-0.519^{**}	-0.507^{**}	-0.478^{**}
	(-2.024)	(-1.993)	(-2.000)
Financial Crisis	-0.179	-0.187	-0.220
	(-0.468)	(-0.492)	(-0.632)
Rating Number	-0.022	-0.021	-0.029
	(-0.568)	(-0.554)	(-0.805)
Rating Dispersion	-0.096	-0.095	-0.109
	(-1.101)	(-1.073)	(-1.282)
Number of Agencies	0.283	0.275	0.367
	(0.981)	(0.990)	(1.348)
Notches	-0.153	-0.156	-0.090
	(-1.128)	(-1.111)	(-0.689)
Invest./Specul. Threshold	-1.070^{**}	-1.071^{**}	-1.184^{***}
	(-2.504)	(-2.505)	(-3.051)
Price Dispersion	-0.013^{***}	-0.013^{***}	-0.009^{***}
	(-4.013)	(-4.009)	(-2.607)
Trading Volume	-0.003	-0.003	0.001
	(-0.133)	(-0.142)	(0.030)
Trading Frequencies	-0.015^{***}	-0.015^{***}	-0.016^{***}
	(-3.026)	(-3.056)	(-3.293)
Time to Maturity	0.028^{*}	0.028^{*}	0.027^{**}
	(1.839)	(1.779)	(2.003)
log(Total Assets)	0.011	0.015	-0.007
	(0.127)	(0.168)	(-0.089)
Intangible Assets/Total Assets	0.109	0.115	0.390
	(0.157)	(0.166)	(0.578)
Coupon	-0.219^{**}	-0.222^{**}	-0.145
	(-2.279)	(-2.392)	(-1.537)
Amount Issued	0.225	0.227	0.299
	(0.943)	(0.962)	(1.405)
Dur-Matched Risk-Free		0.045	
		(0.292)	
Market Return			0.440^{**}
			(2.570)
Intercept	0.343	0.354	-0.355
	(0.289)	(0.305)	(-0.309)
Observations	454	454	454
R^2	0.146	0.146	0.207
Adjusted R^2	0.117	0.115	0.177
Residual Std. Error	2.495 (df = 438)	2.498 (df = 437)	2.408 (df = 437)
F Statistic	4.991^{***} (df = 15; 438)	4.677^{***} (df = 16; 437)	7.109^{***} (df = 16; 437)

Table 6: Determinants of Announcement Returns: Downgrades of Financial Bonds.
This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes downgrades of financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.163	0.159	0.229
	(0.509)	(0.492)	(0.663)
Financial Crisis	-0.939^{**}	-0.963^{**}	-1.066^{***}
	(-2.323)	(-2.454)	(-2.605)
Rating Number	-0.032	-0.040	-0.160^{*}
	(-0.447)	(-0.548)	(-1.911)
Rating Dispersion	0.054	0.081	0.255^{*}
	(0.378)	(0.575)	(1.926)
Number of Agencies	-0.273	-0.154	-0.537
	(-0.500)	(-0.319)	(-1.306)
Notches	-0.537	-0.519	-0.530^{*}
	(-1.575)	(-1.528)	(-1.934)
Invest./Specul. Threshold	-0.934	-0.918	-1.095^{*}
	(-1.224)	(-1.195)	(-1.654)
Price Dispersion	-0.018^{***}	-0.018^{***}	-0.014^{***}
	(-3.509)	(-3.453)	(-3.001)
Trading Volume	-0.109^{**}	-0.108^{**}	-0.088^{**}
	(-2.175)	(-2.170)	(-2.125)
Trading Frequencies	0.002	0.002	-0.002
	(0.254)	(0.213)	(-0.210)
Time to Maturity	-0.013	0.002	-0.012
	(-0.435)	(0.072)	(-0.598)
log(Total Assets)	0.172	0.164	0.146
	(1.315)	(1.244)	(1.420)
Intangible Assets/Total Assets	-1.081	-1.118	1.454
	(-0.669)	(-0.670)	(1.112)
Coupon	0.076	0.065	0.014
	(0.824)	(0.698)	(0.154)
Amount Issued	0.469^{*}	0.438^{*}	0.295
	(1.841)	(1.768)	(1.413)
Dur-Matched Risk-Free		0.403^{**}	
		(2.308)	
Market Return			2.045^{***}
			(5.276)
Intercept	-1.645	-1.828	0.392
	(-0.819)	(-0.977)	(0.227)
Observations	733	733	733
R^2	0.118	0.127	0.338
Adjusted R^2	0.100	0.107	0.323
Residual Std. Error	4.392 (df = 717)	4.375 (df = 716)	3.809 (df = 716)
F Statistic	6.424^{***} (df = 15; 717)	6.486^{***} (df = 16; 716)	22.830^{***} (df = 16; 716)

Table 7: Determinants of Announcement Returns: Single-Period Regressions for Downgrades.

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The table reports the results for non-financial and financial bonds in each single period separately. The explanatory variables are given by rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and corporate bond market return. The regression sample includes downgrades of non-financial and financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Non-Financial			Financial		
Model	**Before the Crisis**	**Financial Crisis**	**After Dodd-Frank**	**Before the Crisis**	**Financial Crisis**	**After Dodd-Frank**
Rating Number	-0.092^{***}	0.214^{*}	0.170	0.0003	-0.251^{*}	-0.105^{***}
	(-2.663)	(1.905)	(1.115)	(0.006)	(-1.745)	(-3.071)
Rating Dispersion	-0.011	-0.555	-0.127	0.249	0.561^{**}	-0.085
	(-0.183)	(-1.480)	(-0.486)	(1.620)	(2.384)	(-0.788)
Number of Agencies	0.273	0.344	3.016	-0.756^{*}	0.131	-0.157
	(1.048)	(0.260)	(0.884)	(-1.826)	(0.188)	(-0.785)
Notches	-0.090	0.568	-0.056	0.521^{**}	-0.639	-0.073
	(-0.696)	(0.862)	(-0.213)	(2.103)	(-1.425)	(-0.699)
Invest./Specul. Threshold	-0.862^{**}	-3.455^{*}	-0.133	-1.375^{**}	-1.932	-0.509
	(-2.221)	(-1.843)	(-0.186)	(-2.001)	(-1.174)	(-1.045)
Price Dispersion	-0.006	-0.011	-0.002	-0.013^{**}	-0.016^{***}	-0.012^{**}
	(-1.414)	(-1.427)	(-0.242)	(-2.081)	(-2.652)	(-2.477)
Trading Volume	0.010	-0.146	-0.227^{***}	0.016	-0.203^{**}	-0.062
	(0.544)	(-0.824)	(-3.480)	(1.232)	(-2.014)	(-1.300)
Trading Frequencies	-0.016	0.002	-0.005	-0.029	0.020^{*}	-0.028^{**}
	(-1.151)	(0.171)	(-0.112)	(-1.590)	(1.825)	(-2.416)
Time to Maturity	0.023^{**}	0.077	0.021	-0.051^{***}	0.015	-0.028
	(1.980)	(1.405)	(0.601)	(-3.150)	(0.466)	(-1.562)
log(Total Assets)	-0.058	0.576^{**}	0.157	-0.208	0.176	0.052
	(-0.749)	(2.108)	(0.651)	(-1.504)	(1.071)	(0.818)
Intangible Assets/Total Assets	0.336	-0.599	2.087^{*}	-0.561	11.765^{*}	-0.305
	(0.576)	(-0.244)	(1.720)	(-0.369)	(1.796)	(-0.347)
Coupon	-0.030	-0.632^{*}	-0.147	-0.059	-0.043	0.026
	(-0.307)	(-1.801)	(-0.809)	(-0.733)	(-0.194)	(0.422)
Amount Issued	0.191	1.167	0.464	0.453^{***}	0.279	0.256^{**}
	(0.762)	(0.693)	(0.712)	(2.939)	(0.627)	(1.999)
Market Return	0.349^{*}	0.531^{*}	1.996^{***}	0.493^{***}	2.294^{***}	2.232^{***}
	(1.669)	(1.662)	(3.057)	(3.048)	(5.409)	(5.664)
Intercept	0.283	-6.288	-12.771	3.596^{*}	-2.571	0.273
	(0.275)	(-1.224)	(-1.227)	(1.844)	(-0.984)	(0.292)
Observations	267	109	78	104	391	238
R^2	0.232	0.274	0.448	0.478	0.363	0.426
Adjusted R^2	0.190	0.166	0.325	0.395	0.340	0.390
Residual Std. Error	1.421 (df = 252)	4.219 (df = 94)	1.334 (df = 63)	1.386 (df = 89)	4.952 (df = 376)	1.249 (df = 223)
F Statistic	5.451^{***} (df = 14; 252)	2.530^{***} (df = 14; 94)	3.652^{***} (df = 14; 63)	5.811^{***} (df = 14; 89)	15.321^{***} (df = 14; 376)	11.839^{***} (df = 14; 223)

Table 8: Implied Rating Analysis.
This table shows the average difference between the rating of the bonds before the downgrade/upgrade and the market-implied rating. The market-implied rating is calculated from bond market yields over the time interval from 90 days before to 30 days before the rating change. Rating is a variable that assigns integer values to the different rating grades, starting from 1 for the highest and extending down to 21 for the lowest rating grade. The sample includes downgrades and upgrades of financial and non-financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). Averages are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *after Dodd-Frank* - *before the crisis* are tested. The table reports the mean of the variations, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Non-Financial Bonds						
Before the Crisis	−0.61	−3.35***	−0.50***	0.46	1.98**	0.50*
During the Crisis	0.86	3.59***	1.00***	3.10	7.64***	3.50***
After Dodd-Frank	0.13	0.61	0.00	1.28	6.71***	1.50***
After-Before	0.74	2.69***	1.00***	0.82	2.70***	1.00***
Panel B: Financial Bonds						
Before the Crisis	−1.82	−17.93***	−2.50***	0.74	6.05***	1.00***
During the Crisis	−0.27	−3.12***	−0.50***	0.02	0.07	0.00
After Dodd-Frank	−0.91	−8.12***	−1.00***	1.53	9.78***	2.00***
After-Before	0.91	6.05***	1.00***	0.79	4.00***	1.00***

Internet Appendix

Internet Appendix to

The Rules of the Rating Game:
Market Perception of Corporate Ratings

Table IA1: Tests on Returns with a 10-days Time Window.
This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The returns are calculated as the percentage change between the average volume weighted daily price across the 10 days before the event, and the average across the event day and the 10 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 10 Days of Non-Financial Bonds						
Before the Crisis	−0.75	−7.84***	−0.45***	0.23	2.98***	0.10*
During the Crisis	−2.27	−6.33***	−1.19***	0.80	2.78***	0.71***
After Dodd-Frank	−1.22	−8.40***	−0.93***	0.51	7.49***	0.40***
During-Before	−1.52	−4.10***	−0.24	0.57	1.92*	0.58***
After-Before	−0.47	−2.69***	−0.40***	0.29	2.79***	0.31***
After-During	1.05	2.72***	−0.16	−0.28	−0.96	−0.25**
Panel B: Announcement Return within 10 Days of Financial Bonds						
Before the Crisis	−0.62	−8.56***	−0.45***	0.16	4.73***	0.16***
During the Crisis	−1.55	−6.58***	−0.71***	0.91	6.83***	0.79***
After Dodd-Frank	−0.38	−6.11***	−0.08***	0.95	12.85***	0.74***
During-Before	−0.93	−3.76***	−0.03	0.75	5.44***	0.55***
After-Before	0.24	2.51**	0.32***	0.79	9.68***	0.51***
After-During	1.17	4.79***	0.30***	0.04	0.29	0.07

Table IA2: Tests on Returns with a 30-days Time Window.
This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The returns are calculated as the percentage change between the average volume weighted daily price across the 30 days before the event, and the average across the event day and the 30 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis* - *before the crisis*, *after Dodd-Frank* - *before the crisis* and *after Dodd-Frank* - *during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 30 Days of Non-Financial Bonds						
Before the Crisis	−0.90	−5.76***	−0.41***	0.22	1.86*	0.12
During the Crisis	−3.32	−5.66***	−1.78***	1.91	3.80***	1.40***
After Dodd-Frank	−1.62	−7.66***	−1.15***	0.74	7.92***	0.67***
During-Before	−2.41	−3.98***	−0.66***	1.69	3.28***	1.26***
After-Before	−0.72	−2.72***	−0.70***	0.53	3.55***	0.51***
After-During	1.70	2.73***	−0.10	−1.16	−2.28**	−0.65***
Panel B: Announcement Return within 30 Days of Financial Bonds						
Before the Crisis	−0.69	−6.36***	−0.41***	0.06	1.22	0.09***
During the Crisis	−2.29	−7.76***	−1.23***	1.70	7.27***	1.53***
After Dodd-Frank	−0.21	−2.85***	−0.17***	1.02	9.93***	0.92***
During-Before	−1.60	−5.09***	−0.36**	1.64	6.86***	1.14***
After-Before	0.48	3.64***	0.23***	0.96	8.43***	0.72***
After-During	2.08	6.83***	0.63***	−0.68	−2.64***	−0.31

Table IA3: Tests on Returns with Accrued Interest.
This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The returns are calculated as the percentage change between the average volume weighted daily dirty price (considering coupon payments) across the 5 days before the event, and the average across the event day and the 5 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 5 Days of Non-Financial Bonds						
Before the Crisis	−0.68	−7.76***	−0.42***	0.27	3.50***	0.20***
During the Crisis	−1.53	−4.96***	−0.79***	0.40	1.79*	0.48***
After Dodd-Frank	−1.10	−8.96***	−0.78***	0.39	5.93***	0.33***
During-Before	−0.86	−2.67***	−0.12	0.13	0.55	0.26**
After-Before	−0.42	−2.80***	−0.31***	0.12	1.19	0.13**
After-During	0.44	1.31	−0.21	−0.01	−0.04	−0.13
Panel B: Announcement Return within 5 Days of Financial Bonds						
Before the Crisis	−0.40	−5.69***	−0.28***	0.15	3.64***	0.20***
During the Crisis	−1.61	−7.32***	−0.62***	0.70	5.90***	0.65***
After Dodd-Frank	−0.21	−3.47***	0.05**	1.02	5.92***	0.72***
During-Before	−1.21	−5.22***	−0.12	0.54	4.33***	0.44***
After-Before	0.19	2.04**	0.30***	0.87	4.88***	0.49***
After-During	1.40	6.12***	0.38***	0.32	1.54	0.09

Table IA4: Regression for Downgrades of Non-Financial Bonds with Firm-Event Cluster

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes downgrades of non-financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm-event level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	-0.751^{***}	-0.736^{***}	-0.563^{**}
	(-2.717)	(-2.729)	(-2.287)
Financial Crisis	-0.313	-0.321	-0.370
	(-0.542)	(-0.557)	(-0.747)
Rating Number	-0.003	-0.002	-0.017
	(-0.043)	(-0.035)	(-0.346)
Rating Dispersion	-0.102	-0.099	-0.077
	(-1.124)	(-1.074)	(-0.861)
Number of Agencies	1.009	0.993	0.776
	(1.157)	(1.150)	(1.144)
Notches	-0.295	-0.300	-0.172
	(-1.562)	(-1.562)	(-1.109)
Invest./Specul. Threshold	-0.766	-0.767	-1.204^{**}
	(-1.235)	(-1.235)	(-2.316)
Price Dispersion	-0.012^{***}	-0.012^{***}	-0.010^{***}
	(-3.636)	(-3.620)	(-3.026)
Trading Volume	-0.032	-0.032	-0.027
	(-1.291)	(-1.310)	(-1.306)
Trading Frequencies	-0.016^{*}	-0.016^{*}	-0.013
	(-1.696)	(-1.689)	(-1.523)
Time to Maturity	0.004	0.004	-0.0001
	(0.308)	(0.317)	(-0.005)
log(Total Assets)	-0.050	-0.045	-0.0005
	(-0.410)	(-0.377)	(-0.005)
Intangible Assets/Total Assets	0.431	0.468	0.514
	(0.488)	(0.513)	(0.678)
Coupon	-0.094	-0.094	-0.043
	(-1.302)	(-1.308)	(-0.678)
Amount Issued	0.133	0.144	0.161
	(0.584)	(0.611)	(0.840)
Dur-Matched Risk-Free		0.059	
		(0.397)	
Market Return			0.695^{***}
			(3.511)
Intercept	-1.759	-1.760	-2.033
	(-0.688)	(-0.688)	(-0.965)
Observations	856	856	856
R^2	0.144	0.144	0.255
Adjusted R^2	0.128	0.128	0.240
Residual Std. Error	2.820 (df = 840)	2.821 (df = 839)	2.632 (df = 839)
F Statistic	9.398^{***} (df = 15; 840)	8.833^{***} (df = 16; 839)	17.920^{***} (df = 16; 839)

Table IA5: Regression for Downgrades of Financial Bonds with Firm-Event Cluster
This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes downgrades of financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm-event level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	−0.157	−0.192	−0.159
	(−0.311)	(−0.382)	(−0.358)
Financial Crisis	−0.702	−0.771	−0.667
	(−1.069)	(−1.174)	(−1.188)
Rating Number	−0.094	−0.092	−0.169
	(−0.630)	(−0.627)	(−1.437)
Rating Dispersion	−0.159	−0.128	0.156
	(−0.589)	(−0.480)	(0.786)
Number of Agencies	−0.093	−0.107	−0.140
	(−0.156)	(−0.183)	(−0.264)
Notches	−0.198	−0.234	−0.315
	(−0.403)	(−0.466)	(−0.701)
Invest./Specul. Threshold	−0.185	−0.158	−1.132
	(−0.254)	(−0.216)	(−1.257)
Price Dispersion	-0.015^{***}	-0.015^{***}	-0.012^{***}
	(−4.054)	(−4.139)	(−3.697)
Trading Volume	−0.029	−0.030	−0.021
	(−1.213)	(−1.284)	(−1.030)
Trading Frequencies	0.002	0.002	0.003
	(0.499)	(0.497)	(0.770)
Time to Maturity	−0.015	−0.011	−0.010
	(−0.691)	(−0.536)	(−0.505)
log(Total Assets)	0.186	0.194	0.153
	(0.491)	(0.517)	(0.464)
Intangible Assets/Total Assets	−2.189	−2.458	−0.816
	(−0.588)	(−0.640)	(−0.221)
Coupon	−0.064	−0.068	−0.093
	(−0.740)	(−0.792)	(−1.132)
Amount Issued	0.344^{**}	0.297^{**}	0.283^{**}
	(2.308)	(2.054)	(2.078)
Dur-Matched Risk-Free		0.512^{**}	
		(2.214)	
Market Return			1.635^{***}
			(3.752)
Intercept	−1.014	−0.943	−0.165
	(−0.215)	(−0.200)	(−0.041)
Observations	2,369	2,369	2,369
R^2	0.060	0.070	0.208
Adjusted R^2	0.054	0.064	0.202
Residual Std. Error	5.036 (df = 2353)	5.009 (df = 2352)	4.624 (df = 2352)
F Statistic	10.017^{***} (df = 15; 2353)	11.087^{***} (df = 16; 2352)	38.522^{***} (df = 16; 2352)

Table IA6: Regression for Upgrades of Non-Financial Bonds with Firm-Event Cluster
This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes upgrades of non-financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm-event level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.213	0.100	0.128
	(1.369)	(0.733)	(0.766)
Financial Crisis	−0.108	−0.042	−0.166
	(−0.244)	(−0.099)	(−0.361)
Rating Number	−0.038	−0.028	−0.030
	(−1.295)	(−1.003)	(−1.197)
Rating Dispersion	0.208**	0.158*	0.164**
	(2.209)	(1.690)	(2.166)
Number of Agencies	−0.407*	−0.262	−0.413*
	(−1.702)	(−1.042)	(−1.696)
Notches	0.193**	0.225***	0.181**
	(2.424)	(2.586)	(2.250)
Invest./Specul. Threshold	0.268	0.427	0.230
	(0.932)	(1.568)	(0.803)
Price Dispersion	−0.001	−0.001	−0.001
	(−0.457)	(−0.334)	(−0.274)
Trading Volume	−0.030	−0.026	−0.027
	(−1.571)	(−1.440)	(−1.522)
Trading Frequencies	0.011	0.008	0.018*
	(1.433)	(1.359)	(1.901)
Time to Maturity	0.011	0.009	0.012
	(0.968	)(0.881	(1.165)
log(Total Assets)	−0.059	−0.048	−0.028
	(−0.534)	(−0.486)	(−0.261)
Intangible Assets/Total Assets	0.139	−0.077	−0.077
	(0.318)	(−0.185)	(−0.226)
Coupon	0.065*	0.050	0.044
	(1.817)	(1.521)	(1.265)
Amount Issued	−0.195	−0.162	−0.162
	(−0.960)	(−0.798)	(−0.948)
Dur-Matched Risk-Free		0.367***	
		(5.161)	
Market Return			0.547
			(1.245)
Intercept	1.521	1.087	1.332
	(0.985)	(0.736)	(0.942)
Observations	438	438	438
R^2	0.114	0.201	0.172
Adjusted R^2	0.082	0.171	0.141
Residual Std. Error	1.381 (df = 422)	1.313 (df = 421)	1.336 (df = 421)
F Statistic	3.619*** (df = 15; 422)	6.636*** (df = 16; 421)	5.478*** (df = 16; 421)

Table IA7: Regression for Upgrades of Financial Bonds with Firm-Event Cluster

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes upgrades of financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm-event level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.440^{**}	0.513^{***}	0.087
	(2.321)	(3.004)	(0.556)
Financial Crisis	0.579^{**}	0.611^{***}	−0.065
	(2.355)	(2.663)	(−0.303)
Rating Number	−0.004	−0.014	−0.013
	(−0.160)	(−0.608)	(−0.537)
Rating Dispersion	0.009	0.055	0.037
	(0.143)	(0.884)	(0.659)
Number of Agencies	−0.041	−0.006	0.265^{*}
	(−0.258)	(−0.039)	(1.792)
Notches	0.148	0.189	0.075
	(1.258)	(1.505)	(0.741)
Invest./Specul. Threshold	0.513	0.562^{**}	0.908^{***}
	(1.619)	(1.984)	(3.680)
Price Dispersion	0.002	0.002	0.003^{*}
	(1.223)	(1.335)	(1.844)
Trading Volume	0.010	0.008	0.005
	(1.249)	(1.116)	(0.577)
Trading Frequencies	−0.005	−0.006	−0.004
	(−1.252)	(−1.430)	(−1.629)
Time to Maturity	0.035^{***}	0.035^{***}	0.022^{***}
	(3.542)	(4.066)	(2.763)
log(Total Assets)	0.010	−0.026	−0.055
	(0.214)	(−0.610)	(−1.375)
Intangible Assets/Total Assets	-1.512^{***}	-1.777^{***}	-0.872^{**}
	(−3.175)	(−2.916)	(−2.093)
Coupon	−0.009	−0.010	−0.016
	(−0.316)	(−0.372)	(−0.611)
Amount Issued	-0.114^{*}	-0.120^{*}	−0.105
	(−1.650)	(−1.955)	(−1.555)
Dur-Matched Risk-Free		0.417^{***}	
		(5.493)	
Market Return			1.137^{***}
			(8.788)
Intercept	0.062	0.389	0.054
	(0.076)	(0.531)	(0.074)
Observations	823	823	823
R^2	0.144	0.228	0.389
Adjusted R^2	0.128	0.213	0.377
Residual Std. Error	0.976 (df = 807)	0.927 (df = 806)	0.824 (df = 806)
F Statistic	9.028^{***} (df = 15; 807)	14.897^{***} (df = 16; 806)	32.123^{***} (df = 16; 806)

Table IA8: Results of the Statistical Tests on Trading Activity Variations.
This table shows variations in daily trading activity surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The trading activity variations are obtained by calculating the difference between the average daily number of trades across the 5 days before the event and the average across the event day and the 5 subsequent days. Variations are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades, upgrades, financial and non-financial bonds in each of the periods. The table reports the mean of the variations, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Trading Frequency Difference within 5 Days of Non-Financial Bonds						
Before the Crisis	3.67	5.46***	1.18***	0.10	0.49	0.17
During the Crisis	2.86	2.04**	0.83***	1.25	2.89***	0.67**
After Dodd-Frank	1.92	3.67***	1.57***	0.44	1.66*	0.08
Panel B: Trading Frequency Difference within 5 Days of Financial Bonds						
Before the Crisis	4.92	4.92***	2.82***	0.38	2.85***	0.17**
During the Crisis	−1.72	−2.01**	0.00	4.40	3.07***	2.92***
After Dodd-Frank	2.25	6.14***	1.19***	1.61	3.31***	1.28***

Table IA9: Determinants of Announcement Returns: Upgrades of Non-Financial Bonds.

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes upgrades of non-financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.256	0.219	0.168
	(1.632)	(1.498)	(1.031)
Financial Crisis	−0.040	0.122	−0.239
	(−0.096)	(0.300)	(−0.495)
Rating Number	−0.014	−0.010	−0.014
	(−0.529)	(−0.364)	(−0.569)
Rating Dispersion	0.190***	0.155**	0.167***
	(2.659)	(2.337)	(2.951)
Number of Agencies	−0.301	−0.208	−0.325
	(−1.241)	(−0.789)	(−1.474)
Notches	0.258***	0.252***	0.233**
	(2.747)	(2.749)	(2.536)
Invest./Specul. Threshold	0.505	0.569	0.403
	(1.418)	(1.638)	(1.110)
Price Dispersion	0.006	0.005	0.006
	(1.285)	(1.265)	(1.398)
Trading Volume	0.005	0.002	0.009
	(0.252)	(0.142)	(0.515)
Trading Frequencies	0.010	0.009	0.018
	(1.033)	(1.079)	(1.384)
Time to Maturity	0.006	0.005	0.007
	(0.325)	(0.269)	(0.452)
log(Total Assets)	0.043	0.064	0.062
	(0.566)	(0.789)	(0.906)
Intangible Assets/Total Assets	−0.027	−0.168	−0.291
	(−0.069)	(−0.450)	(−1.026)
Coupon	0.100*	0.109**	0.085
	(1.897)	(2.157)	(1.638)
Amount Issued	−0.157	−0.189	−0.064
	(−0.524)	(−0.619)	(−0.291)
Dur-Matched Risk-Free		0.303***	
		(3.316)	
Market Return			0.514
			(1.130)
Intercept	−0.312	−0.763	−0.311
	(−0.232)	(−0.518)	(−0.259)
Observations	244	244	244
R^2	0.181	0.233	0.240
Adjusted R^2	0.127	0.179	0.187
Residual Std. Error	1.287 (df = 228)	1.248 (df = 227)	1.242 (df = 227)
F Statistic	3.358*** (df = 15; 228)	4.319*** (df = 16; 227)	4.490*** (df = 16; 227)

Table IA10: Determinants of Announcement Returns: Upgrades of Financial Bonds.
This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return and corporate bond market return). The regression sample includes upgrades of financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.564^{***}	0.541^{***}	0.232
	(2.624)	(2.949)	(1.582)
Financial Crisis	0.806^{***}	0.765^{**}	0.026
	(2.643)	(2.573)	(0.101)
Rating Number	0.0005	−0.002	−0.017
	(0.017)	(−0.062)	(−0.651)
Rating Dispersion	0.040	0.082	0.095
	(0.471)	(0.953)	(1.100)
Number of Agencies	0.058	0.082	0.264^{*}
	(0.213)	(0.543)	(1.760)
Notches	0.099	0.112	0.077
	(1.105)	(1.316)	(0.848)
Invest./Specul. Threshold	0.715^{**}	0.751^{**}	1.002^{***}
	(1.997)	(2.386)	(2.957)
Price Dispersion	0.003	0.002	0.002
	(1.106)	(0.869)	(0.995)
Trading Volume	0.010	−0.002	0.002
	(0.450)	(−0.090)	(0.094)
Trading Frequencies	0.002	−0.001	0.001
	(0.132)	(−0.051)	(0.149)
Time to Maturity	0.027	0.025^{*}	0.021
	(1.527)	(1.848)	(1.377)
log(Total Assets)	0.017	−0.008	−0.062
	(0.284)	(−0.171)	(−1.281)
Intangible Assets/Total Assets	-1.428^{***}	-1.786^{***}	-1.254^{***}
	(−2.751)	(−3.670)	(−2.855)
Coupon	−0.016	−0.017	−0.016
	(−0.311)	(−0.386)	(−0.373)
Amount Issued	-0.210^{*}	-0.206^{*}	-0.243^{**}
	(−1.696)	(−1.701)	(−2.474)
Dur-Matched Risk-Free		0.473^{***}	
		(5.011)	
Market Return			1.313^{***}
			(7.826)
Intercept	−0.267	0.034	0.173
	(−0.248)	(0.046)	(0.253)
Observations	366	366	366
R^2	0.180	0.293	0.401
Adjusted R^2	0.145	0.261	0.373
Residual Std. Error	1.029 (df = 350)	0.957 (df = 349)	0.881 (df = 349)
F Statistic	5.123^{***} (df = 15; 350)	9.047^{***} (df = 16; 349)	14.581^{***} (df = 16; 349)

Table IA11: Tests on Returns Excluding Earning Announcements, Mergers and Acquisitions.

This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). Rating changes overlapping with earning announcements and mergers or acquisitions (M&A) affecting the issuer of the bond are excluded. Specifically, we exclude rating changes that overlap earning announcements (M&A) over an 11 (31) days window centered at the earning announcement day (M&A announcement and/or completion date). The returns are calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 5 Days of Non-Financial Bonds						
Before the Crisis	−0.80	−8.77***	−0.53***	0.26	3.93***	0.12***
During the Crisis	−1.78	−5.45***	−1.16***	−0.06	−0.19	0.27**
After Dodd-Frank	−1.13	−8.50***	−0.79***	0.44	6.89***	0.33***
During-Before	−0.98	−2.89***	−0.28*	−0.32	−0.96	0.12
After-Before	−0.33	−2.03**	−0.25***	0.19	2.05**	0.20***
After-During	0.66	1.86*	0.01	0.50	1.53	0.07
Panel B: Announcement Return within 5 Days of Financial Bonds						
Before the Crisis	−0.36	−4.48***	−0.27***	0.20	6.04***	0.16***
During the Crisis	−1.62	−5.61***	−0.52***	0.14	0.96	0.2**
After Dodd-Frank	−0.16	−3.02***	0.02	0.76	11.35***	0.59***
During-Before	−1.26	−4.21***	−0.10	−0.06	−0.41	0.04
After-Before	0.20	2.03**	0.27***	0.56	7.48***	0.35***
After-During	1.46	4.96***	0.32***	0.62	3.87***	0.35***

Table IA12: Tests on Returns Excluding Overlapping Rating Changes within 10 Days. This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). A rating event is included in the sample if there was no other rating change for that security by any CRA in the past 10 days. The returns are calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 5 Days of Non-Financial Bonds						
Before the Crisis	−0.58	−6.54***	−0.41***	0.31	4.38***	0.14***
During the Crisis	−1.25	−4.34***	−0.67***	0.23	0.96	0.36***
After Dodd-Frank	−0.95	−7.52***	−0.70***	0.44	7.33***	0.33***
During-Before	−0.67	−2.21**	−0.13	−0.08	−0.31	0.17
After-Before	−0.36	−2.35**	−0.26***	0.13	1.41	0.19***
After-During	0.31	0.97	−0.16	0.21	0.85	0.00
Panel B: Announcement Return within 5 Days of Financial Bonds						
Before the Crisis	−0.54	−6.76***	−0.38***	0.17	4.84***	0.14***
During the Crisis	−0.77	−3.59***	−0.31***	0.62	5.11***	0.51***
After Dodd-Frank	−0.23	−3.96***	0.01	0.73	12.14***	0.57***
During-Before	−0.22	−0.98	0.15*	0.45	3.57***	0.31***
After-Before	0.32	3.21***	0.35***	0.56	8.05***	0.38***
After-During	0.54	2.44**	0.19***	0.11	0.79	0.09

Table IA13: Tests on Returns Excluding Overlapping Rating Changes Within 30 Days.

This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). A rating event is included in the sample if there was no other rating change for that security by any CRA in the past 30 days. The returns are calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 5 Days of Non-Financial Bonds						
Before the Crisis	−0.64	−6.87***	−0.46***	0.33	4.57***	0.16***
During the Crisis	−0.97	−3.23***	−0.49***	0.27	1.08	0.41***
After Dodd-Frank	−0.91	−7.86***	−0.70***	0.43	7.2***	0.33***
During-Before	−0.33	−1.06	0.03	−0.06	−0.21	0.20*
After-Before	−0.27	−1.83*	−0.22***	0.10	1.05	0.17***
After-During	0.06	0.19	−0.27*	0.15	0.59	−0.05
Panel B: Announcement Return within 5 Days of Financial Bonds						
Before the Crisis	−0.82	−9.09***	−0.54***	0.20	5.25***	0.17***
During the Crisis	−0.60	−2.45**	−0.22***	0.69	5.49***	0.61***
After Dodd-Frank	−0.16	−2.86***	0.04*	0.71	11.48***	0.54***
During-Before	0.21	0.82	0.38***	0.49	3.71***	0.37***
After-Before	0.65	6.11***	0.54***	0.51	6.98***	0.34***
After-During	0.44	1.74*	0.19***	0.02	0.14	0.01

Table IA14: Tests on Returns Excluding Events Crossing Regulatory Thresholds.
This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). Rating changes crossing the investment-speculative grade threshold are excluded. The returns are calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 5 Days of Non-Financial Bonds						
Before the Crisis	−0.49	−6.47***	−0.37***	0.30	4.36***	0.13***
During the Crisis	−1.08	−3.45***	−0.39**	0.11	0.47	0.33***
After Dodd-Frank	−1.13	−8.88***	−0.8***	0.38	7.55***	0.30***
During-Before	−0.58	−1.82*	0.10	−0.19	−0.80	0.15
After-Before	−0.64	−4.31***	−0.37***	0.08	0.93	0.17***
After-During	−0.06	−0.16	−0.53***	0.27	1.16	0.01
Panel B: Announcement Return within 5 Days of Financial Bonds						
Before the Crisis	−0.38	−4.92***	−0.30***	0.19	5.66***	0.16***
During the Crisis	−1.36	−6.37***	−0.51***	0.68	6.20***	0.58***
After Dodd-Frank	−0.15	−2.85***	0.02	0.71	11.23***	0.52***
During-Before	−0.98	−4.32***	−0.06	0.50	4.31***	0.37***
After-Before	0.23	2.44**	0.32***	0.52	7.33***	0.32***
After-During	1.21	5.5***	0.33***	0.03	0.20	−0.01

Table IA15: Tests on Returns Weighted by the Initial Rating Distribution.
This table shows returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The returns are calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The returns *during the crisis* and *after Dodd-Frank* are weighted according to the distribution of rating events in the period *before the crisis*. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis - before the crisis*, *after Dodd-Frank - before the crisis* and *after Dodd-Frank - during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Announcement Return within 5 Days of Non-Financial Bond						
Before the Crisis	−0.70	−8.33***	−0.46***	0.30	4.65***	0.14***
During the Crisis	−1.05	−4.50***	−0.58***	0.34	2.33**	0.26***
After Dodd-Frank	−0.99	−6.48***	−0.66***	0.40	8.22***	0.29***
During-Before	−0.35	−1.41	0.00	0.03	0.19	0.13
After-Before	−0.29	−1.68*	−0.19***	0.10	1.19	0.15***
After-During	0.06	0.20	−0.21	0.07	0.44	0.03
Panel B: Announcement Return within 5 Days of Financial Bond						
Before the Crisis	−0.45	−6.58***	−0.35***	0.19	5.87***	0.16***
During the Crisis	−1.33	−7.85***	−0.44***	0.69	4.71***	0.28***
After Dodd-Frank	−0.36	−4.77***	0.00	0.40	10.13***	0.28***
During-Before	−0.89	−4.86***	0.02	0.49	3.30***	0.09**
After-Before	0.08	0.84	0.32***	0.20	3.93***	0.12***
After-During	0.97	5.23***	0.24***	−0.29	−1.94*	0.03

Table IA16: Regression for Downgrades of Non-Financial Bonds with Risk Premium
This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return, corporate bond market return and risk premium). The regression sample includes downgrades of non-financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	-0.493^{*}	-0.487^{*}	-0.469^{*}
	(-1.927)	(-1.923)	(-1.949)
Financial Crisis	-0.237	-0.241	-0.242
	(-0.625)	(-0.638)	(-0.682)
Rating Number	-0.019	-0.019	-0.028
	(-0.499)	(-0.493)	(-0.758)
Rating Dispersion	-0.077	-0.077	-0.101
	(-0.857)	(-0.842)	(-1.139)
Number of Agencies	0.209	0.206	0.333
	(0.791)	(0.798)	(1.230)
Notches	-0.144	-0.146	-0.089
	(-1.077)	(-1.053)	(-0.683)
Invest./Specul. Threshold	-1.039^{**}	-1.039^{**}	-1.166^{***}
	(-2.471)	(-2.472)	(-3.004)
Price Dispersion	-0.013^{***}	-0.013^{***}	-0.009^{***}
	(-4.145)	(-4.130)	(-2.589)
Trading Volume	-0.002	-0.002	0.001
	(-0.076)	(-0.080)	(0.046)
Trading Frequencies	-0.016^{***}	-0.016^{***}	-0.016^{***}
	(-3.210)	(-3.231)	(-3.421)
Time to Maturity	0.030^{*}	0.029^{*}	0.028^{**}
	(1.955)	(1.895)	(2.024)
log(Total Assets)	0.018	0.019	-0.003
	(0.204)	(0.224)	(-0.043)
Intangible Assets/Total Assets	0.242	0.244	0.431
	(0.353)	(0.357)	(0.637)
Coupon	-0.214^{**}	-0.215^{**}	-0.146
	(-2.287)	(-2.384)	(-1.561)
Amount Issued	0.211	0.211	0.289
	(0.874)	(0.884)	(1.346)
Dur-Matched Risk-Free		0.022	
		(0.138)	
Market Return			0.419^{**}
			(2.388)
Risk Premium	8.936	8.887	3.676
	(1.594)	(1.574)	(0.694)
Constant	0.316	0.321	-0.334
	(0.276)	(0.284)	(-0.292)
Observations	454	454	454
R^2	0.157	0.157	0.208
Adjusted R^2	0.126	0.124	0.177
Residual Std. Error	2.482 (df = 437)	2.485 (df = 436)	2.408 (df = 436)
F Statistic	5.091^{***} (df = 16; 437)	4.782^{***} (df = 17; 436)	6.747^{***} (df = 17; 436)

Table IA17: Regression for Downgrades of Financial Bonds with Risk Premium

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return, corporate bond market return and risk premium). The regression sample includes downgrades of financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.098	0.097	0.197
	(0.353)	(0.348)	(0.606)
Financial Crisis	-1.645^{***}	-1.642^{***}	-1.295^{***}
	(-4.274)	(-4.267)	(-3.126)
Rating Number	-0.027	-0.030	-0.141^{*}
	(-0.390)	(-0.428)	(-1.694)
Rating Dispersion	0.074	0.083	0.234^{*}
	(0.576)	(0.662)	(1.800)
Number of Agencies	-0.641	-0.591	-0.629
	(-1.311)	(-1.240)	(-1.607)
Notches	-0.673^{**}	-0.664^{**}	-0.579^{**}
	(-2.088)	(-2.059)	(-2.118)
Invest./Specul. Threshold	-0.961	-0.955	-1.082^{*}
	(-1.548)	(-1.526)	(-1.768)
Price Dispersion	-0.015^{***}	-0.016^{***}	-0.014^{***}
	(-3.339)	(-3.324)	(-2.974)
Trading Volume	-0.074^{*}	-0.075^{*}	-0.078^{*}
	(-1.766)	(-1.773)	(-1.936)
Trading Frequencies	0.0004	0.0003	-0.002
	(0.046)	(0.035)	(-0.230)
Time to Maturity	-0.013	-0.007	-0.012
	(-0.555)	(-0.309)	(-0.634)
log(Total Assets)	0.115	0.113	0.129
	(0.997)	(0.976)	(1.296)
Intangible Assets/Total Assets	-0.550	-0.573	1.286
	(-0.404)	(-0.416)	(1.020)
Coupon	0.016	0.013	0.002
	(0.171)	(0.138)	(0.019)
Amount Issued	0.343	0.334	0.275
	(1.597)	(1.552)	(1.346)
Dur-Matched Risk-Free		0.149	
		(1.047)	
Market Return			1.759^{***}
			(4.633)
Risk Premium	33.997^{***}	33.433^{***}	11.897^{**}
	(5.279)	(5.117)	(2.485)
Constant	0.708	0.601	0.931
	(0.396)	(0.343)	(0.571)
Observations	733	733	733
R^2	0.234	0.236	0.348
Adjusted R^2	0.217	0.217	0.332
Residual Std. Error	4.096 (df = 716)	4.096 (df = 715)	3.783 (df = 715)
F Statistic	13.702^{***} (df = 16; 716)	12.956^{***} (df = 17; 715)	22.423^{***} (df = 17; 715)

Table IA18: Regression for Upgrades of Non-Financial Bonds with Risk Premium

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return, corporate bond market return and risk premium). The regression sample includes upgrades of non-financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.235	0.192	0.167
	(1.506)	(1.313)	(1.030)
Financial Crisis	−0.145	0.010	−0.261
	(−0.322)	(0.024)	(−0.534)
Rating Number	−0.011	−0.006	−0.014
	(−0.441)	(−0.250)	(−0.532)
Rating Dispersion	0.193***	0.157**	0.170***
	(2.685)	(2.354)	(2.973)
Number of Agencies	−0.294	−0.195	−0.321
	(−1.202)	(−0.732)	(−1.431)
Notches	0.258***	0.252***	0.234**
	(2.784)	(2.789)	(2.542)
Invest./Specul. Threshold	0.511	0.580*	0.411
	(1.435)	(1.662)	(1.144)
Price Dispersion	0.006	0.005	0.006
	(1.296)	(1.278)	(1.387)
Trading Volume	0.008	0.006	0.010
	(0.435)	(0.359)	(0.558)
Trading Frequencies	0.010	0.010	0.017
	(1.072)	(1.130)	(1.350)
Time to Maturity	0.005	0.005	0.007
	(0.306)	(0.245)	(0.438)
log(Total Assets)	0.041	0.063	0.060
	(0.551)	(0.789)	(0.890)
Intangible Assets/Total Assets	−0.126	−0.286	−0.307
	(−0.341)	(−0.827)	(−1.024)
Coupon	0.099*	0.108**	0.085
	(1.865)	(2.135)	(1.634)
Amount Issued	−0.086	−0.110	−0.046
	(−0.309)	(−0.391)	(−0.201)
Dur-Matched Risk-Free		0.317***	
		(3.356)	
Market Return			0.482
			(0.984)
Risk Premium	13.383*	15.215***	4.396
	(1.940)	(2.685)	(0.419)
Constant	−0.388	−0.869	−0.336
	(−0.291)	(−0.594)	(−0.276)
Observations	244	244	244
R^2	0.197	0.254	0.242
Adjusted R^2	0.140	0.198	0.185
Residual Std. Error	1.277 (df = 227)	1.234 (df = 226)	1.243 (df = 226)
F Statistic	3.474*** (df = 16; 227)	4.519*** (df = 17; 226)	4.242*** (df = 17; 226)

Table IA19: Regression for Upgrades of Financial Bonds with Risk Premium

This table shows the results of different regression models, where the dependent variable is the return surrounding a rating event, calculated as the percentage change between the average volume weighted daily price across the 5 days before the event, and the average across the event day and the 5 days after it. The explanatory variables are given by time-period dummies (during financial crisis, after Dodd-Frank), rating-related variables (rating number, rating dispersion, number of agencies, notches and regulatory threshold dummy), changes in liquidity and trading activity (change in price dispersion, change in volume, change in trading frequency), bond-firm characteristics (time to maturity, coupon, amount issued, log(total assets), intangible assets/total assets) and market controls (duration-matched risk-free bond return, corporate bond market return and risk premium). The regression sample includes upgrades of financial US corporate bonds that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). The table reports the results for three different regression specifications. Test statistics, derived from standard errors corrected for heteroscedasticity and clustered at the firm level, are given in parenthesis. The significance is indicated as follows: $^{*} < 0.1$, $^{**} < 0.05$, $^{***} < 0.01$.

Model	(1)	(2)	(3)
After Dodd-Frank	0.548^{***}	0.532^{***}	0.230
	(2.600)	(2.961)	(1.580)
Financial Crisis	0.686^{**}	0.694^{**}	0.039
	(2.246)	(2.367)	(0.145)
Rating Number	0.004	0.001	−0.018
	(0.140)	(0.022)	(−0.675)
Rating Dispersion	0.026	0.072	0.099
	(0.302)	(0.819)	(1.115)
Number of Agencies	0.049	0.076	0.269^{*}
	(0.191)	(0.524)	(1.782)
Notches	0.098	0.111	0.076
	(1.072)	(1.290)	(0.851)
Invest./Specul. Threshold	0.744^{**}	0.767^{**}	1.001^{***}
	(2.046)	(2.419)	(2.972)
Price Dispersion	0.001	0.001	0.002
	(0.421)	(0.479)	(1.132)
Trading Volume	0.006	−0.004	0.002
	(0.298)	(−0.174)	(0.132)
Trading Frequencies	0.003	−0.0002	0.001
	(0.180)	(−0.015)	(0.133)
Time to Maturity	0.028	0.025^{*}	0.020
	(1.534)	(1.844)	(1.376)
log(Total Assets)	0.024	−0.003	−0.065
	(0.408)	(−0.063)	(−1.312)
Intangible Assets/Total Assets	-1.351^{***}	-1.729^{***}	-1.267^{***}
	(−2.614)	(−3.604)	(−2.811)
Coupon	−0.010	−0.014	−0.017
	(−0.195)	(−0.309)	(−0.401)
Amount Issued	−0.195	-0.197^{*}	-0.246^{**}
	(−1.642)	(−1.686)	(−2.471)
Dur-Matched Risk-Free		0.458^{***}	
		(4.785)	
Market Return			1.334^{***}
			(7.895)
Risk Premium	5.907^{*}	3.569	−1.222
	(1.713)	(1.104)	(−0.424)
Constant	−0.399	−0.056	0.208
	(−0.386)	(−0.077)	(0.297)
Observations	366	366	366
R^2	0.194	0.298	0.401
Adjusted R^2	0.158	0.264	0.372
Residual Std. Error	1.022 (df = 349)	0.955 (df = 348)	0.882 (df = 348)
F Statistic	5.265^{***} (df = 16; 349)	8.703^{***} (df = 17; 348)	13.716^{***} (df = 17; 348)

Table IA20: Tests on Cumulative Abnormal Returns.
This table shows cumulative abnormal returns surrounding US corporate bond rating changes that occurred between January 2003 and May 2014. The sample period is divided into *before the crisis* (January 2003 - November 2007), *during the crisis* (December 2007 - July 21, 2010) and *after Dodd-Frank* (July 22, 2010 - May 2014). Cumulative abnormal returns are calculated following the methodology developed by Spiegel and Starks (2016), over a time window of 5 days centered at the event date. Returns are tested to see whether their mean and median are statistically significantly different from zero. The tests are performed separately for downgrades and upgrades, and financial and non-financial bonds, in each of the periods. Moreover, the differences between *during the crisis* - *before the crisis*, *after Dodd-Frank* - *before the crisis* and *after Dodd-Frank* - *during the crisis* are tested. The table reports the mean of the returns, the value of the two-sided t-test and the pseudo-median derived from the Wilcoxon signed-rank test. The significance is indicated as follows: * < 0.1, ** < 0.05, *** < 0.01.

	Downgrades			**Upgrades**		
Period	**Mean**	**t-Test**	**Wilcoxon**	**Mean**	**t-Test**	**Wilcoxon**
Panel A: Cumulative Abnormal Return over 5 Days of Non-Financial Bonds						
Before the Crisis	−0.75	−8.52***	−0.56***	0.19	2.18**	0.10*
During the Crisis	−2.16	−4.56***	−1.04***	0.59	2.63***	0.51***
After Dodd-Frank	−1.12	−7.04***	−0.73***	0.32	5.38***	0.24***
During-Before	−1.41	−2.93***	−0.04	0.40	1.68*	0.32**
After-Before	−0.37	−2.04**	−0.14*	0.13	1.26	0.09*
After-During	1.04	2.08**	−0.15	−0.27	−1.18	−0.16*
Panel B: Cumulative Abnormal Return over 5 Days of Financial Bonds						
Before the Crisis	−0.73	−8.52***	−0.65***	0.15	2.82***	0.10***
During the Crisis	−2.33	−9.41***	−1.35***	−0.52	−3.11***	−0.54***
After Dodd-Frank	−0.58	−7.82***	−0.26***	0.27	4.00***	0.29***
During-Before	−1.60	−6.11***	−0.41***	−0.67	−3.8***	−0.67***
After-Before	0.15	1.36	0.32***	0.13	1.50	0.06
After-During	1.75	6.79***	0.68***	0.79	4.39***	0.79***