Are Credit Ratings Still Relevant?

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Abstract

We examine the pricing relevance of credit rating downgrades when the underlying firm has Credit Default Swap (CDS) contracts trading on it's debt. Using a comprehensive sample of credit rating changes from 1998 to 2007, we find that, after a CDS contract starts trading on a firm's debt, the firm's stock reacts significantly less to a credit rating downgrade. Firms with traded CDS also have a smaller stock and bond market reaction to a credit rating downgrade than firms without a traded CDS. In addition, CDS spreads explain the cross-sectional variation in primary and secondary bond yields better than credit ratings. One important implication of our study is that it may be beneficial for regulators to focus on improving the transparency in the CDS market rather than solely addressing the conflicts of interest inherent in the business models for rating agencies.

*Preliminary version. Please do not cite without permission. All authors are from the College of Management, Georgia Institute of Technology. We thank Robert Jarrow, Narayan Jayaraman, Stuart Turnbull, seminar participants at Georgia Tech and the 23rd Derivatives Conference at FDIC. We are responsible for all errors. Please address correspondence to Sudheer Chava, 800 West Peachtree Street NW, Atlanta, GA, 30308. Email: sudheer.chava@mgt.gatech.edu.

1 Introduction

Credit rating agencies that specialize in assessing the credit worthiness of bond issuers are an integral component of the financial landscape. Prior literature has provided evidence that stock and bond markets perceive credit rating announcements to have pricing-relevant information with stock and bond prices reacting significantly negatively to credit rating downgrades.[1] Investors, regulators, and managers rely on credit ratings, partly due to a perceived lack of viable alternatives. Credit ratings provide coarse information about a firm's default risk and represent a particular credit rating agency's opinion. In contrast, credit default swap (CDS), a relatively recent financial innovation that provides buyers insurance against the default of the underlying firm's debt, dynamically provide a finer market based benchmark of a firm's default risk. In this paper, we analyze whether stock and bond markets still find credit rating announcements informative when CDS is trading on a firm's debt.

It is difficult for a firm to access public debt markets without obtaining a credit rating. Furthermore, historically, credit ratings are explicitly incorporated in financial regulations with regulators relying on the nationally recognized credit rating agencies (NRSROs) such as Moody's, Standard and Poor's, and Fitch as the official benchmarks of quality (see Flannery, Houston, and Partnoy (2010)).[2] Credit ratings directly impact a firm's cost of capital (Kisgen and Strahan (2010)) and managers pay close attention to them when making financial decisions (Graham and Harvey (2001)). Bond and loan covenants may also contain credit rating related triggers that can result in a coupon rate change or a forced repurchase of the bonds (Chava, Kumar, and Warga (2010)).

[1] Holthausen and Leftwich (1986), Hand, Holthausen, and Leftwich (1992) respectively, show abnormal stock and bond market returns for credit rating downgrades, but not to upgrades. Similarly, Dichev and Piotroski (2001) find negative abnormal returns in the first year following downgrades but no reliable abnormal returns following upgrades. Jorion, Liu, and Shi (2005) argue that the FD regulation might have bestowed upon the credit rating agencies and informational advantage owing to the exemption of the rating agencies from FD regulation. As a result, they find that market reacts to both upgrades and downgrades significantly in the post FD period of 2001.

[2] For example, references to NRSROs ratings to rules under the Securities Act, Exchange Act, Investment Company Act, and Investment Advisers Act, exemption from regulation FD that allows credit rating agencies to receive inside information which was otherwise unavailable to the other market participants, exemption from Rule 436(g) under the Securities Act of 1933 etc.,

The prominence of credit rating agencies in the financial markets is also accompanied by frequent criticisms over their rating performance and the conflicts of interests inherent in their issuer-pay business model (see Flannery, Houston, and Partnoy (2010), and White (2010)). In the last few years alone, they were blamed for their slow response in predicting corporate defaults (e.g., Enron, Worldcom) and, for their role in the recent subprime mortgage crisis. Becker and Milbourn (2011) and Bolton, Freixas, and Shapiro (2012) provide theoretical and empirical evidence of competition and conflicts of interest within the credit rating industry that may result in inefficient ratings with decreasing ability to predict default. Benmelech and Dlugosz (2009) provide evidence consistent with ratings shopping during the recent financial crisis. In response, legislators and regulators have proposed a number of reforms to reduce the over reliance on credit ratings.[3]

One reason why the regulatory reliance on credit rating agencies may have persisted so long, even though the regulators may be cognizant of the shortcomings of the credit rating agencies, is the perceived lack of viable alternatives to credit ratings. It is possible to infer the default probability of a firm from it's bond spreads. But bonds can differ on many dimensions such as yield, maturity, callability and covenants (see Chava, Kumar, and Warga (2010)) leading to market segmentation and illiquidity. Moreover, Elton, Gruber, Agrawal, and Mann (2001) demonstrate that on average, only 25% of corporate bond spreads represent compensation for default risk.

In contrast, CDS are standardized contracts and relatively more liquid than corporate bonds. Though a relatively recent financial innovation, CDS markets have experienced a tremendous growth with the outstanding notional amount increasing from $8 trillion in 2004 to $62 trillion in 2007. Ericsson, Jacobs, and Oviedo (2009) show that the CDS spread is "purer" measure of a firm's default risk. Jarrow (2011) argues that CDS allows investors to better hedge their credit risk leading to a more optimal allocation of risks in the economy.

[3]For example, the Dodd-Frank Act of 2010 mandates that federal regulators remove references to credit ratings from their rules. Securities and Exchange Commission (SEC) has recently proposed rules to eliminate certain aspects of regulatory reliance on credit ratings and in a similar vein Federal Deposit and Insurance Corporation (FDIC) has proposed rules that will reduce large U.S. banks' reliance on credit ratings when evaluating the risk of their assets.

Recently, it has been argued that CDS contracts that can dynamically reflect market's perception of the default risk of a firm can be a viable alternative to credit ratings. CDS spreads anticipate credit rating downgrades (Norden (2011)). Flannery, Houston, and Partnoy (2010) evaluate the viability of CDS spreads as substitutes for credit ratings and support using CDS for regulatory purposes. In a similar vein, Hart and Zingales (2011) make a compelling case for basing capital requirements of large financial institutions on their CDS spreads. CDS spreads have been shown to lead stock (Acharya and Johnson (2007)) and bond market (Blanco, Brennan, and Marsh (2005)) in information discovery.

In this paper, we analyze how the stock and bond markets react to credit rating agency downgrades of a firm's bonds when CDS is trading on it's debt. With the introduction of CDS contracts, investors have a market-based alternative to quantifying the firm's default risk and may be able to anticipate the credit rating downgrades. In that case, markets may not react to the stale information contained in the credit rating downgrades. But CDS markets are also subject to criticism regarding their level of transparency and speculation. If stock and bond markets perceive that credit ratings agencies contain valuable information not contained in the CDS spreads then they may still react significantly to credit rating downgrades.

We use credit rating change announcements from the three major NRSROs - Standard and Poor's, Moody's and Fitch from 1998 to 2007.[4] We obtain CDS data from the CMA Datavision database and consider the date of the first available quote for each firm as the start of active trading in CDS tied to that firm's debt. We also extract CDS data from Bloomberg and in case Bloomberg reports CDS quotes earlier than CMA, we consider the earlier date as the date of CDS introduction. Using both univariate and regression analyses, we find that firms with traded CDS contracts react significantly less to rating change downgrades relative to firms without traded CDS contracts. On the other hand, consistent with Holthausen and Leftwich (1986) and Hand, Holthausen, and Leftwich (1992), we find insignificant stock price reactions

[4]We focus our study in the pre-crisis period when the CDS market was steadily growing. Several government interventions and regulatory reforms in the financial markets took place after 2007. In addition, in the aftermath of the subprime debacle credit rating agencies may have suffered a reputation loss. In order to avoid confounding our results with the subprime crisis and the associated regulatory interventions, we focus our attention to the period 1998-2007.

to rating change upgrades for firms with and without CDS contracts. Our finding confirms that upgrades generally are not informative.

It is possible that firms with traded CDS are different from firms without traded CDS on some observable or unobservable dimensions. We address this concern by restricting attention to firms that have CDS traded at some point of time during the sample period. This allows us to compare stock market reaction of individual firms to credit downgrades before and after the CDS trading. Consistent with the cross-sectional results, we find a significant reduction in the firm's stock price reactions after CDS contracts start trading on the firm's debt. The analysis restricting attention only to traded CDS firms should ameliorate the concern that CDS and non-CDS firms may differ on some unobservable dimensions and that is driving the previous cross-sectional results.

Another concern with our analysis so far is the potential for endogeneity. Firms with and without CDS trading may have different characteristics. Similarly, the onset of CDS trading on a firm may be driven by time-varying risk factors. We demonstrate that such endogeneity concerns are not driving results by implementing a propensity score matched sample analysis (see Rosenbaum and Rubin (1983)). We show that a control group of non-traded-CDS firms with similar characteristics (based on Ashcraft and Santos (2009)) to traded-CDS firms, react significantly more negatively to credit rating downgrades, than the traded-CDS firms. In contrast, both control and treated CDS firms react negatively and significantly to the credit rating downgrades before the introduction of CDS but the difference is not statistically significant.

We next analyze the bond market reaction to credit rating downgrade announcements. Because of the lack of liquidity and the paucity of the corporate bonds data, the number of unique firms in our sample reduces drastically. Nevertheless, the cross-sectional univariate test confirms our finding in the equity market. We find that bond prices of traded-CDS firms react significantly weaker to credit rating downgrades than for non-traded-CDS firms. Bond yield regressions show that CDS spreads are an important determinant of bond yields and

explain the cross-sectional variation in bond yields better than credit ratings. One implication is that CDS spreads can directly affect the firm's cost of debt. The evidence indicates that in the presence of traded CDS, credit ratings are less important in explaining the cross-sectional variation in both the primary and secondary bond yields.

To our knowledge, our paper is the first to examine how the introduction of CDS market impacts the pricing relevance of credit rating agencies. Previous studies such as Holthausen and Leftwich (1986), Hand, Holthausen, and Leftwich (1992), and Dichev and Piotroski (2001) unanimously confirm that rating downgrades contain relevant information to the bond and equity holders. More recently, Jorion, Liu, and Shi (2005) show that the informativeness of credit rating announcements increased in the post-FD period due to the private information made available to credit rating agencies. We show that even after reg-FD, the onset of CDS trading has significantly decreased the importance of these rating change announcements.[5]

Our results have an important policy implication. Legislators and regulators have invested most of their energy in crafting proposals that attempt to reform the credit rating agency industry and reduce the reliance of regulators and investors on credit rating agency opinions. The lack of viable alternative to credit ratings has been cited as the main reason for the over reliance on credit rating agencies. Our findings support the arguments made by Flannery, Houston, and Partnoy (2010) and Hart and Zingales (2011) that CDS can be a viable alternative to credit ratings. Our results show that stock and bond markets do not perceive credit ratings to be as informative when a market based benchmark for a firm's default risk is available through the CDS spread. In this context, it may be more beneficial for regulators (and investors) to design policies that promote transparency and liquidity in the CDS market rather than focusing solely on reforming the credit rating industry.

The rest of this paper proceeds as follows. Section 2 describes the data. Section 3 presents the methodology and the main empirical results. Section 4 provides results from extending our analyses to the corporate bond market. Finally, Section 5 concludes.

[5]The Dodd-Frank act mandated that the credit rating agencies' exemption to the FD regulation is removed.

2 Data and descriptive statistics

We use CMA Datavision database (CMA) to identify all firms for which we observe CDS quotes on their debt. CMA DataVision is consensus data sourced from 30 buy-side firms, including major global investment banks, hedge funds and asset managers. Mayordomo, Pena, and Schwartz (2010) compare CDS data qualities across the six most widely used databases: GFI, Fenics, Reuters, EOD, CMA, Markit and JP Morgan. They conclude that the CMA database quotes lead the price discovery process. The CMA database is widely used among financial market participants and since October 2006, it has been disseminated through Bloomberg. We further ensure the accuracy in the coverage of CDS quotes by augmenting the original CMA database with the CDS data obtained from Bloomberg. The earliest quote were then taken as the first sign of active CDS trading on a firm's debt.

Data on bond ratings was gathered from the Mergent Fixed Income Securities Database (FISD) database. FISD is a comprehensive database consisting of issue details on over 140,000 corporations, U.S. Agencies, and U.S. Treasury debt securities. FISD contains detailed information for each issue such as the issuer name, rating date, rating level, agency that rated the issue, and credit watch status etc. We restrict our sample to U.S. domestic corporate debentures and exclude yankee bonds, bonds issued via private placement and private placement issues which are exempt from registration under the SEC rule 144a. We include only ratings issued by the top three NRSROs - S&P, Moody's and Fitch. We exclude issuers whose stocks are not traded on either the NYSE, AMEX, or NASDAQ. The final sample consists of about 85% of the ratings reported in the FISD database. Approximately 15% of the ratings are from Fitch, and the remaining ratings are split evenly between S&P and Moody's.[6]

[6]We provide the mapping of the rating codes to the cardinal scale in Table 1. Moody's uses code from Aaa down to C to rate bonds whereas S&P rates bonds from AAA down to D. Within the 6 classes - AA to CCC for S&P and Aa to Caa for Moody's, both rating agencies have three additional gradations with modifiers +,- for S&P and 1,2,3 for Moody's (For example AA+, AA, AA- for S&P and Aa1, Aa2, Aa3 for Moody's). We transformed the credit ratings for S&P (Moody's) into a cardinal scale starting with 1 as AAA(Aaa), 2 as AA+(Aa1), 3 as AA(Aa2), and so on until 23 as the default category. As Fitch provides three ratings for default, we follow Jorion, Liu, and Shi (2005) and chose 23 instead of 22 for the default category which is the average of three default ratings, i.e. DD.

We consider a rating change for an issuer as one observation. When there are rating changes on multiple bond issues for an issuer on the same day, we use the issue with the greatest absolute rating scale change because such change is likely to create the strongest impact on bond and stock prices. The FISD ratings database has a variable called "reason" which provides the reason for the rating change on an issue. We consider only those rating changes for which the reasons are either "DNG" (downgrade) or "UPG" (upgrade) which constitute about 90% of the total rating changes. About 4.5% of the total rating changes correspond to "IR" (Internal Review) and 2% to "AFRM" (Affirmed). As robustness checks, we repeat all the analyses using all the "reason" types and obtain the same results. The final sample is from January 1998 to December 2007 and consists of 4195 downgrades and 1856 upgrades; we refer to it as the "full sample" for the remaining of this paper. The full sample consists of 1293 unique firms of which 390 have CDS trading.

Table 2 provides a distribution of the number of upgrades and downgrades and the size of rating change over each year. There are about 2.2 downgrades for every upgrade which is, more or less consistent with the previous studies.[7] We observe clustering of upgrades and downgrades in certain years over the 15-year period. We find that 33% of all upgrades occurred between 2006 and 2007, whereas 31% of all downgrades came between 2001 and 2002. This finding can be attributed to the economic downturn in 2001 and the historically low market volatility period, i.e. VIX level, in 2006 and 2007. The size of the rating change is the absolute value of the change in rating scale as defined in the previous section. Table 2 shows that the average size of rating change doesn't vary significantly over the years. There are 813 downgrade and 473 upgrade events during which the underlying firms have CDS contracts traded. On the other hand, the sample contains 3382 downgrades and 1383 upgrades during which the underlying firms do not have CDS contracts traded. For downgrades (upgrades), the mean size of absolute rating change for an issue without CDS is 1.68 (1.32) and for an issue with CDS is 1.44 (1.25). Table 2 shows that the start dates of CDS trading in our sample

[7]Our number is closer to Dichev and Piotroski (2001) who reported twice as many downgrades as upgrades over the sample period of 1970 to 1987. Whereas Jorion, Liu, and Shi (2005) had 4 downgrades for every upgrade in the period from 1998 to 2002.

begin in 2002 where we observe only 12 downgrades on firms that have CDS contracts traded. Nevertheless, the number of firms that have CDS contract traded increase significantly in subsequent years. In fact, Table 2 shows that the number of downgrade events on firms with and without CDS contracts traded are roughly equal after 2005.

Jorion, Liu, and Shi (2005) show that rating agencies have a weaker impact on stock returns during the pre-FD period compared to the post-FD period. Therefore, we also consider rating changes that took place between 2001 and 2007. We refer to this subsample as the "Year 01-07" in Table 2. The use of this subsample helps us focus more on recent rating changes as well as avoiding the potential contamination from the pre-FD (Fair Disclosure) regulation period, i.e. prior to September 2000.

Many of the firms in our sample never experience CDS trading over the 1998-2007 period. It is possible that firms for which CDS trade are inherently different from firms for which CDS do not trade. In order to control for the differences between these two firm types, we consider a subsample of firms for which CDS starts trading at some point during our sample period. More specifically, we compare their stock reactions to rating change announcements made between their pre and post CDS trading periods. We refer to this sample as the "Traded-CDS". The mean size of rating change for the "Traded-CDS" sample is 1.44 before CDS trading starts and 1.35 after CDS trading starts.

In addition, we further refine the "Traded-CDS" sample by looking at a shorter time period. We consider 3 years prior and 3 years post of the date when CDS started trading on a firm. We therefore have a balanced panel data when focusing on this subsample. We call this subsample, the "Traded-CDS Balanced". Similarly, Table 2 shows that the mean absolute scale change for the"Traded-CDS Balanced" sample before and after the introduction of CDS are very similar for both downgrades and upgrades.

Table 3 reports the summary statistics for the distribution of absolute magnitude of rating changes for pre and post-CDS trading periods. In panel B, we report absolute rating changes for "within class", "across class", and "across investment grade" rating changes. A rating

change is defined as "within class" if the rating change is within the same alphabet letter (e.g., A+, A, A-). All other rating changes are classified as "across class". Among the across class rating changes, those that change between investment grade to speculative grade, and vice versa, are considered "across investment grade" change. Table 1 summarizes rating classes that belong to the investment and speculative grades. Previous studies (see Jorion, Liu, and Shi (2005), and Holthausen and Leftwich (1986)) show that across investment grade change is likely to be important due to regulatory reasons that prevent certain investment institutions from holding speculative grade bonds in their portfolio. Hence, a rating change from investment grade to speculative grade will elicit a stronger price reaction compared to a rating change within investment grade. Overall, Tables 2 and 3 show that the pre-CDS rating events and the post-CDS rating events are roughly similar in terms of magnitude of the absolute value of rating scale change and types of rating change events.

3 Stock price reaction to rating changes

3.1 Methodology

We apply the standard event study methodology to study changes in the daily abnormal stock returns on the date of rating change announcements in pre and post-CDS periods. The analysis is carried out separately for upgrades and downgrades. We define the daily abnormal stock return as the difference between the raw return, R_{it}, and the return fitted from the following market model

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it},$$

where R_{it} is the raw return for firm i on day t, and R_{mt} is the value weighted NYSE / AMEX / NASDAQ index return. The daily abnormal return, AR_{it}, is then computed using

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

where $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the OLS estimators of α_i and β_i. We estimate $\hat{\alpha}_i$ and $\hat{\beta}_i$ using a rolling window over a period of 255 days from -91 to -345 relative to the event date.[8]

We examine whether the mean cumulative abnormal returns (CAR) around the event period is significantly different from zero. Following Holthausen and Leftwich (1986), we compute CAR using the three-day window (-1,0,+1) centered on the announcement date. That is, $CAR_i(-1,1) = \sum_{t=-1}^{+1} AR_{it}$. We then test the null hypothesis that the sample mean of CAR is equal to zero. There are three potential econometric concerns with our methodology. First, the prediction of security returns using the fitted market model may be imprecise. Second, there could be more factors affecting the firm during the event period. Third, we are implicitly assuming that the abnormal returns in the cross-section of firms are independent. Kothari and Warner (2007), however, show that short horizon event studies such as ours is not highly sensitive to the assumption of cross-sectional or time-series dependence of abnormal returns as well as the benchmark model used for computing abnormal returns. Nevertheless, in robustness tests, we verify that the results remain qualitatively similar whether we define the abnormal returns as $AR_{it} = R_{it} - R_{mt}$ or if we use standardized CAR instead of CAR. The latter method potentially controls for the heterogeneity among firms and other factors that might affect the firm during a rating change.

In the remaining parts of this paper, we present univariate results of stock market reactions to rating change announcements. We then present multivariate regression analysis controlling for standard factors that may affect price reaction to rating change announcements.

3.2 Univariate analysis

Full Sample

Table 4 reports the mean of CAR for the pre and post-CDS trading periods. The results in Panel A is based on the "full-sample". As described in Section 2, this sample contains traded-CDS firms as well as non-traded-CDS firms. Traded-CDS firms are those that eventually

[8]Our results are robust to shorter estimation windows.

have CDS traded at some point during our sample period. On the other hand, non-traded-CDS firms are those that never experience CDS trading at any point in our sample, which is from 1998 to 2007. Consistent with previous studies (Holthausen and Leftwich (1986), Hand, Holthausen, and Leftwich (1992), and Goh and Ederington (1993)), we find that stock prices react significantly to downgrades (-3.95%) but not to upgrades (0.06%). Prior studies argue that firms are reluctant to release bad news whereas they voluntarily release good news to the market. The market therefore perceives the information content in downgrades as more valuable than upgrades because rating agencies often expend more resources in detecting a deterioration in credit quality. Furthermore, rating agencies are averse to reputational risk. The loss to their reputation may be greater if they fail to detect failing credit conditions rather than letting improvements in credit quality go undetected.

Table 4 shows that the mean CARs over the three-day window around rating downgrades is negative and significant at the 1% level for the pre and post-CDS periods. However, the magnitude is significantly weaker for the post-CDS period. The mean CAR in the post-CDS period is -1.22% compared to -4.61% in the pre-CDS period. The difference in CAR between these two groups is -3.39% and is statistically significant at the 1% level. Panel B of Table 4 shows the results using the sample period 2001-2007. This subsample excludes the period prior to the implementation of the Fair Disclosure (FD).[9] Jorion, Liu, and Shi (2005) show that the market reaction to rating downgrades is significantly weaker in this excluded period compared to the period from 2001 onwards. Jorion, Liu, and Shi (2005) argue that the stronger stock reaction to rating downgrades from 2001 onwards is due to the exemption of the rating agencies from the FD regulation. Such exemption puts rating agencies in an advantageous position because it allows them to continue accessing private information from firms that they were rating. By eliminating the 1998-2000 period, we eliminate all the rating events in the pre-FD regulation period. Panel B of Table 4 shows that the results that we obtain earlier hold. The difference in the mean CARs between pre-CDS and post-CDS periods is -3.41%. This value is statistically significant at the 1% level. Even though the mean CARs

[9]The implementation of the Fair Disclosure (FD) regulation took place on October 23, 2000.

for upgrades is not significant for both periods, it is worth noting that market reaction to upgrades is smaller in the presence of CDS trading.

Previous studies demonstrated that across investment grade rating changes often generate stronger price reactions than within investment grade rating changes. Panel B of Table 3 shows that the fraction of across investment grade rating changes in the post-CDS (18.20%) period is higher relative to the pre-CDS period (9.17%). Therefore, based on the sample distribution of across investment grade rating changes, we would expect to find stronger price reaction in the post-CDS period rather than in the pre-CDS period. However, our results in Table 4 suggest the opposite. Stock prices react less to credit rating changes after the introduction of CDS. Because the results in Table 4 look at all rating changes collectively, they are likely to understate the impact that the introduction of CDS has on the relevance of rating changes.

All in all, results in Table 4 are in line with our hypothesis that rating changes are less informative when CDS is introduced. However, the sample that we use to generate these results are subject to two potential criticisms. First, the sample consists of traded-CDS firms and those that never have CDS contracts traded on their debts, i.e. non-traded-CDS firms. It is possible that traded-CDS and non-traded-CDS firms are inherently different and hence may not be comparable. To tackle this problem, we repeat the analyses using only traded-CDS firms. We discuss the results in the next section. The second criticism is that the timing of CDS introduction may be endogenous. CDS contracts may have been introduced during a period when the firm's credit quality improves. Similarly, there may have been other time-varying risk factors that influence the introduction of CDS contracts on a firm's debt. Such endogeneity issue would then lead us to find that the introduction of CDS contracts decrease the relevance of credit rating changes. We later address this problem by using a matched sample analysis to study stock price reaction to rating changes announcements.

Traded-CDS firms sample

Table 5 presents the univariate results for the "Traded-CDS" sample. As mentioned earlier, this sample allows us to determine more cleanly, the effect of CDS introduction on the stock market reaction to rating changes. Panel A of Table 5 reports the results for the period 1998 to 2007. Confirming our previous results, Table 5 indicates that stock price reacts significantly weaker to credit rating downgrades in the post-CDS period. We find the difference of -2.21% in the mean CAR between the pre-CDS and post-CDS periods. This magnitude is statistically significant at the 1% level.

In Panel B, we consider a more balanced time period of the "Traded-CDS" sample. This corresponds to 3 years prior and 3 years post of the date when CDS started. Again, the results are remarkably consistent. The mean CAR between the pre and post-CDS trading groups is -1.80% and is again statistically significant at the 1% level. To summarize, we find that even after controlling for the potential selection bias that traded-CDS firms are inherently different from non-traded-CDS firms, our conclusion remains intact. In section 4.4, we verify our results using a matched sample analysis in order to address the potential endogeneity issue in the timing of CDS introduction

3.3 Regression analysis

In this section, we employ multivariate regressions to further control for factors that could affect the stock price reaction to rating changes. In line with previous studies (see Holthausen and Leftwich (1986) and Jorion, Liu, and Shi (2005)), we run the regressions separately for upgrades and downgrades. We report the results in Table 6. We estimate the following model

$$\begin{aligned} CAR_i &= \beta_0 + \beta_1 dIgrade_i + \beta_2 dCDS_i + \beta_3 ScaleDiff_i + \beta_4 LnDays_i \\ &\quad + \beta_5 FirmControls_i + \varepsilon_i, \end{aligned} \tag{1}$$

where for bond i, CAR is the cumulative abnormal return which is defined as the bond issuer's 3-day cumulative return centered on the date of rating change announcements, i.e. event window (-1,1). $dIgrade$ is a dummy variable equal to one if a bond is revised from investment grade to speculative grade or vice-versa and zero otherwise. $dCDS$ is a dummy variable equal to one if the rating change takes place when CDS trades on the underlying firm and zero otherwise. $ScaleDiff$ is the absolute value of rating change in cardinal value. $LnDays$ is the natural logarithm of the number of days between the previous rating change in the same direction for the same bond but by another rating agency. The number of days is set to 60 if both rating agencies rate on the same day or if the rating by the second rating agency is in the opposite direction or if the rating change by the other rating agency is more than 60 days. $FirmControls$ include, Leverage defined as the total debt over assets; Profit Margin defined as net income over sales; Log Market Value defined as the natural logarithm of the market value of the entity.

Of the above, the coefficient of $dCDS$ is of main interest to us as it captures the change in informational impact of rating changes in the presence of CDS trading. If the rating changes by rating agencies become less informative in the presence of CDS trading, then we would expect the coefficient of $dCDS$ to be positive for downgrades and negative for upgrades. As documented in prior studies, we expect that the larger the coefficient on $ScaleDiff$, the larger is the stock price response. We therefore expect this coefficient to be negative for downgrades and positive for upgrades. Because there are regulations limiting the amount of speculative grade bonds that certain institutions can hold, we expect a strong price reaction when a bond rating is revised from investment grade to speculative grade or vice-versa. This effect is captured by the coefficient on the variable $dIgrade$; we expect it to be negative for downgrades and positive for upgrades. The $LnDays$ variable tests for the price impact when a rating change made by one rating agency is in the same direction as the change issued by previous rating agency. If the period between in-the-same-direction rating changes is long, then we expect that the later rating change conveys new information to the market. On the other hand, the longer period could also indicate that the rating changes are issued

following other news events, consequently decreasing the informativeness of the rating change. Consequently, the sign on the coefficient of $LnDays$ is ambiguous. For the control variables, we expect a negative (positive) coefficient for downgrades (upgrades) on the leverage variable and positive (negative) coefficient for downgrades (upgrades) on the profit margin variable. The sign for the log market value variable is ambiguous. Large firms typically have higher media and analyst coverage and hence a rating change for them can most likely be preempted by other news events thereby reducing the informational value of the rating change. On the other hand, large firms are more widely held, it is therefore possible to see a stronger market reaction when rating changes convey new information about them.

Table 6 reports the results for the above multivariate regression analysis separately for downgrades and upgrades. We report the results for four samples: the full sample ("Full"); the 2001-2007 sample ("01-07"); the traded-CDS firms sample ("FullTrdCDS"); the balanced time period of traded-CDS firms ("BalTrdCDS"). The definitions of these four samples are as defined in Section 2. All standard errors are clustered at the firm level. The coefficients on $dCDS$ are all positive, and with the exception of the "BalTrdCDS" sample, they are significant at the 1% level. As for upgrades, the coefficients on $dCDS$ are mostly negative but not significant. These results confirm that the average stock price reaction to rating changes is weaker after the introduction of CDS when compared to the period before the introduction of CDS. The coefficient on $LnDays$ is positive and significant for two out of the four samples for both downgrades and upgrades. This possibly suggests that there is lesser information content when a rating downgrade is issued following a previous rating downgrade by another agency. On the other hand, for upgrades, rating changes in the same direction seem to provide new information to the market or by possibly reinforcing the good credit quality of the firm.

Robustness Tests for Stocks

As part of robustness checks, we perform the entire stock univariate analysis as well as stock regression analysis using abnormal returns defined as the excess return over the market return

and find that the results remain qualitatively similar. Another concern is that there could be many more factors affecting the firm during the event period that could be unrelated to the event and as a result the cross-sectional abnormal returns need not average out to zero. For such cases, the problem can be alleviated by using standardized CAR (SCAR) instead of CAR alone. SCAR is defined as $SCAR_i(-1,+1) = \frac{CAR_i(-1,+1)}{\sigma(AR_i)\sqrt{3}}$ where $\sigma(AR_i)$ is the standard deviation of the one-period mean abnormal return, and the factor of $\sqrt{3}$ appears as our event window which is 3 days from (-1,+1) . We now carry out the univariate and the regression analysis using SCAR calculated for a stock for both abnormal return (AR) specifications namely, AR calculated by fitting the market model as well as AR calculated as the excess return over the market return and find that the results are qualitatively the same.

In order to rule out the possibility that our results are driven by outliers, we winsorize each of the CAR and SCAR specifications at the 1% and also independently calculate the difference in mean stock price reaction between the pre- and post-CDS groups using the bootstrapping method. In both cases, we find that the results do not change qualitatively. In addition we also conduct various sub-sample analysis based on credit rating agencies, industry type, within class rating change, across investment grade rating change and find that our results are robust and confirm the findings from the previous univariate and regression analysis sections.

Apart from the matching analysis described in the next section, another method to test for the possible concern that the above results may be related to changes in certain market conditions over time, such as the changes in volatility of the stock market is by using the "placebo test" in which the event study methodology is applied to randomly generated event dates in the pre- and post-CDS periods. We find that the CARs on these random event dates are not significantly different from zero. The difference in the stock price reactions between the pre- and post-CDS periods is also not significantly different from zero. Overall these host of robustness tests provide confirmation that the abnormal stock return around the credit rating downgrade is significantly weaker for firms with traded CDS as compared to firms without traded CDS.

3.4 Matched sample

In this section, we address the concern that firms with traded CDS are different from firms that do not have CDS traded on some observable characteristics (for example, size, leverage etc.,). We undertake a matched sample analysis in order to address this concern. Each traded-CDS firm is matched with a firm that never has CDS trading on its debt on several observable dimensions (based on Ashcraft and Santos (2009)). The traded-CDS firms constitute the treated group whereas the matched non-traded-CDS firms constitute the control group. The matching is done at the start of CDS trading. The matched control group is assigned counterfactual CDS trading start dates. Following this approach, we can answer the counterfactual question of how would the stock prices of firms in the control group react to the rating change announcements when CDS is introduced. Such analysis controls for time-varying risk factors and the endogeneity in the timing of CDS introduction. The typical problems encountered with matched sample (control group) analysis is that the control group and the treated group may not have substantial overlaps. Also, if dimensions are matched one by one and the dimensions upon which the firms have to be matched are large in number, then we may end up with a very small number of observations for the control group.

In order to mitigate the above problems, we use a propensity score matching method (Rosenbaum and Rubin (1983)) which can incorporate a large number of matching dimensions. Using the entire sample of firms in our data, we estimate a probit model where the dependent variable is a dummy variable equal to 1 if the firm's CDS starts to trade in the current quarter and is 0 otherwise. We estimate the probability of having a CDS market with a probit model, using the (one-quarter lagged) covariates from Ashcraft and Santos (2009): equity analyst coverage; log stock market volatility; dummy variable equal to one if the firm has a credit rating; log sales; debt-to-assets; book-to-market; and log equity market trading volume. For each CDS firm, we identify a non-CDS firm with the closest propensity score. While matching, we make sure that the propensity score of the matched non-traded-CDS firm is within $\pm 10\%$ of the propensity score of the matched traded-CDS firm. The matching technique used for

this is the nearest neighborhood caliper matching approach of Cochran and Rubin (1973). There are many more firms without CDS trading than firms with CDS trading in our sample and hence we face a trade-off between bias and efficiency in our analysis. In order to increase our sample of matched firms, based on Dehejia and Wahba (2002), Smith and Todd (2005), we allow each non-traded-CDS firm to serve as a match for upto three firms with traded CDS. This exercise leaves us with a sample of 176 traded-CDS firms matched to 92 unique non-traded-CDS firms.

We report the univariate results for the matched sample analysis in Table 7. Panel A considers the entire sample period, 1998 to 2007, while Panel B reports results for the balanced sample period covering 3 years before to 3 years after of the first date of CDS trading. We winsorize our data at the 1% CAR's cutoff to eliminate any remaining extreme outliers from the matching procedure. The results clearly suggest that the market reaction to downgrades for the non-traded-CDS firms is stronger and significant in the post-CDS period compared to the traded-CDS firms. Looking at Panel A, the difference in mean CAR between the treated and control groups is 2.94% for downgrades and statistically significant at the 1% level. In the pre-CDS period, this difference is small and insignificant indicating that the stock prices of the control group and the treated group react similarly to downgrades. However, upon the onset of CDS trading, there is a significant difference in the extent to which these firms' stock prices react to rating downgrades. Overall, from the univariate perspectives, we show that after controlling for changing risk factors, and cross-sectional differences between traded and non-traded-CDS firms, the stock price reacts significantly less after the onset of CDS trading on the underlying firms.

In Table 8, we run a regression similar to Table 6 for the matched sample. However, this time, our variable of interest is the difference in difference (DID) estimator which measures the effect of the introduction of CDS controlling for other time-varying factors. We introduce two new variables namely, *dControl* - a dummy variable equal to 1 for a firm in the control group which is matched with a traded-CDS firm and value zero otherwise, and $dCDS \times dControl$

- an interaction term between the dummy variables $dCDS$ and $dControl$. We estimate the following regression model

$$\begin{aligned} CAR_i &= \beta_0 + \beta_1 dIgrade_i + \beta_2 dCDS_i + \beta_3 dControl + \beta_4 dCDS \times dControl + \\ &\quad + \beta_5 ScaleDiff_i + \beta_6 LnDays_i + \beta_7 FirmControls_i + \varepsilon_i. \end{aligned}$$

The coefficient of the interaction term $dCDS \times dControl$ is the DID estimator which is of the following form

$$\begin{aligned} \beta_5 = E_z(CAR|dCDS = 1, dControl = 1) - E_z(CAR|dCDS = 0, dControl = 1) \\ - E_z(CAR|dCDS = 1, dControl = 0) - E_z(CAR|dCDS = 0, dControl = 0). \end{aligned} \tag{2}$$

Note that $E_z[\ ]$ is the expectation operator conditional on the information set Z which represents the control variables in the regression. Equation (2) shows that after controlling for various factors, if the informational content of rating changes decreases in the post-CDS period then the sign on the DID coefficient should be negative for downgrades and positive for upgrades. As expected, we find that the sign on the coefficient of the DID estimator is in line with our expectation and is significant for the full and the balanced sample for downgrades. Overall, matched sample univariate and DID regression results clearly suggest that the information content in rating announcements has decreased for downgrades after the onset of CDS trading even after controlling for potential time trends.

4 Bond price reaction to rating changes

In this section, we analyze the bond market reaction to the credit rating downgrade announcements.

4.1 Corporate bond data

We obtain corporate bond data from TRACE. The data set contains individual bond transaction starting from July 1, 2002. The TRACE database covers a large cross section of daily bond prices compared to the other commonly used Mergent FISD database which consists only of trades carried out by large U.S. insurance companies. The database reports the transaction date, time, price, yield, and size of the executed trades. Other information includes bond identification (CUSIP) and individual trade identification. We apply a number of standard filters to the data set. Following Bessembinder, Kahle, Maxwell, and Xu (2009), we eliminate trades that have been canceled, corrected, and trades that have commissions. Elimination of canceled trades involves removing the original trade as well as the reported reversal trade. Bessembinder, Kahle, Maxwell, and Xu (2009) show that eliminating non-institutional trades from the TRACE data increases the power of the test for detecting abnormal performance relative to using all trades, or the last quote of the day. Therefore, we remove observations where the par value of the transaction is less than or equal to $\$100,000$ (Edwards, Lawrence, and Piwowar (2007)) as they tend to be non-institutional trades. The prices reported in the TRACE database are the "clean" prices. They do not include the accrued coupon payment. We add the accrued coupon payment to the clean prices by merging in information from the Mergent FISD database. The final bond prices that we use are therefore the settlement prices. Finally, following Bessembinder, Kahle, Maxwell, and Xu (2009), we calculate the daily bond price using the trade-weighted average of all the prices reported during the day.

Similar to our analyses for stock returns, we consider a rating change event on a debt's issuer as one observation. In a number of cases, there are multiple bond issues per issuer. These multiple issues usually experience rating changes on the same day. In order to avoid double counting rating change events, we study the return of a weighted bond portfolio (equal or value weighted) for each firm. We construct both the equal- and value-weighted portfolios using all the issues written on a firm. We find that the results are not qualitatively affected by the weighting methods. To save space, we present only the results that are based on the

value-weighted portfolios.

Table 9 displays the number of upgrades and downgrades and the size of rating change per year. There are 1.6 downgrades for every upgrade in the bond sample. This value is lower compared to the stock sample (Table 2) which contains 2.2 downgrades for every upgrade. Relative to the stock sample, we find fewer number of rating events between 2002 and 2004. This is because the TRACE database had limited bond coverage during these early years. It was not until March 2003 that TRACE begins to cover all the bonds with an issue size of at least $100 million and rated "A" or higher. Nevertheless, in the subsequent years, the coverage has steadily increased to completion. Most of the CDS contracts in our sample start trading after 2004. For downgrades (upgrades), the mean size of absolute rating change for a firm without CDS is 1.54 (1.34) and for a firm with CDS is 1.50 (1.24). The "Traded-CDS" sample for bonds is constructed in the same manner as for the stocks (see Section 3.2). We observe a large reduction in the number of observations from the "Full sample" to the "Traded-CDS" sample (about one-fifth). Given that we have a small number of observations in the bond's full sample to begin with, the significant decrease in observations make the "Traded-CDS" sample difficult to work with. The number of unique firms in this "Traded-CDS" sample is only 47 (as opposed to 516 unique firms for the full sample). Therefore, we rely mainly on the "Full sample" when interpreting the results.

Table 10 reports the distribution of the absolute magnitude of rating changes. It is calculated by rounding off, to the nearest integer, the value-weighted rating scale changes of the multiple bond issues written on a firm on the rating event day. Consistent with the stock sample, rating changes by one notch account for most of the sample ($> 70\%$) for downgrades and upgrades. Overall, the bond sample, although much smaller, is similar to the stock sample in terms of the distribution of rating changes and the number of downgrades to upgrades.

4.2 Abnormal bond return

We apply the event study methodology to study the changes in abnormal bond returns around the rating change dates. Unlike the stock sample analysis, bond trading is relatively thin. We therefore face several econometric difficulties concerning the calculation of abnormal bond returns. Based on our filtered sample for the years 2006 and 2007, we find that on average, each bond trades in only 30 days per year. Conditional on the day that we observe trades, the average number of trades is 3.48 times per day.[10] To compute abnormal bond returns, we follow the method advocated in Bessembinder, Kahle, Maxwell, and Xu (2009) by differencing the raw returns with the benchmark of indices. We match returns to six benchmark indices based on the Moody's six major rating categories (Aaa, Aa, A, Baa, Ba, and B), and the equivalent S&P and Fitch rating categories corresponding to the rating scale 1 to 16 (See the mapping in Table 1). Matching further on additional dimensions yields a small matched sample as a number of bonds do not trade daily.[11]

We construct daily bond return indices based on the above six rating categories. Few bonds trade on a daily basis and if an index is constructed solely based on these bonds alone then the index is biased in terms of capturing only liquid bonds. Hence in constructing the daily bond return index, we include all bonds that trade on consecutive days. This means that the composition of the index changes every day and to mitigate this issue, as suggested by Bessembinder, Kahle, Maxwell, and Xu (2009), we construct a value-weighted daily bond return index. Additionally, for a cleaner test, we remove all bonds of a firm when that firm is rated on the day the index is constructed.

We designate the rating change event day as day 0. The cumulative bond return is first computed per issue using the last transaction price observed between event-day -7 to -1 and the first transaction price between event-day +1 to +7. On average, we observe transaction

[10] For this analysis, we consider the sample from 2006 onwards when TRACE gained complete coverage of the corporate bond data.

[11] We also implemented the match analysis outlined in Klein and Zur (2011). The method involves matching on additional dimensions such as industry, time to maturity, and trading frequency. Unfortunately, the resulting sample size was to small to draw any conclusions.

prices on -2.4 and +2.3 event-days relative to the event date. Sampling windows of (-3,+3) and (-5,+5) lead to a very small sample of unique firms for the "Traded-CDS" sample. On the other hand, while extending the sampling window, e.g. (-10,+10), will increase the number of observation, such procedure increases the bias due to confounding information arrivals.[12]

The cumulative abnormal return for the bond is then calculated by subtracting the cumulative bond return with the cumulative bond index return over the same window period. Finally, the bond market reaction to a rating change event for a firm is calculated as the value-weighted average returns of all of the issues traded around the event date.

4.3 Univariate results

Table 11 reports the mean CAR for the pre- and post-CDS trading periods.[13] The results in Panel A are based on the full sample. As described earlier this sample contains traded-CDS firms as well a non-traded-CDS firms. Traded-CDS firms are those that eventually have CDS traded at some point in our sample. Consistent with prior literature (Hand, Holthausen, and Leftwich (1992)), we find that overall, bond prices react significantly to downgrades (-0.89%) and upgrades (0.10%). This differs from our results for the stock market which does not react significantly to upgrades. The reaction of the bond market to upgrades is possibly due to the regulatory effect of the rating agencies. Panel A also reports the mean of bond CARs over the event window (-7, +7) centered on the rating change date. In both cases, the reactions to downgrades are negative and significant a the 1% level. However, the magnitude of bond price reaction is significantly weaker in the post-CDS period compared to the pre-CDS period. The mean CARs for the pre and post-CDS cases are -1.40% and -0.52%, respectively. Their difference is significant at the 1% level. For upgrades, the difference between the bond price reaction in pre and post-CDS cases is not significant. This set of results is consistent with the

[12]Several firm-specific news releases are often released around the rating change announcements (see Shivakumar, Urcan, Vasvari, and Zhang (2010), and Elkamhi, Jacobs, Langlois, and Ornthanalai (2011)). Therefore, extending the sampling window further increases the chance that rating change event coincides with other important news releases.

[13]All cumulative abnormal returns are winsorized at the 1% level.

evidence provided in the past literature - that firms tend to hide negative information whereas they voluntarily release good information.

Panel B of Table 11 displays results for the "Traded-CDS" sample. This sample represents firms for which CDS trades at some point in the sample period from 2002 to 2007. Again, we find that the overall bond price reaction to downgrades is negative (-0.87%) and significant at the 1% percent level. Consistent with our hypothesis, the magnitude of bond market reaction is weaker in the post-CDS period (-0.71%) compared to the pre-CDS period (-1.05%), although not significant. The fall in statistical power is clearly due to the small sample size. The "Traded-CDS" sample corresponds to the rating events of only 47 unique firms whereas the full sample (Panel A) corresponds to the rating events of 516 unique firms. As a result, tests reported in Panel B are not very powerful.

Robustness Tests for Bonds

To drive out concerns that our results are due to outliers, we calculate the difference in the mean bond price reactions using the bootstrapping method.[14] Confirming the above findings, the bootstrapping method indicates that the magnitude of bond price reaction is significantly weaker in the post-CDS period compared to the pre-CDS period at the 1% level. The above results are robust to a host of robustness checks. The same conclusion is obtained when we replicate the bond results using various sub-samples by looking only at senior bonds, and those without asset backing or without enhancements. We also test for the robustness of our choice results to different event windows. We find that the results are qualitatively similar when the event windows of (-3,3), (-5,+5), and (-10,+10) are employed.

A possible concern is that the above results may be related to changes in certain market conditions over time, such as the changes in volatility of the bond market or the change in coverage of the TRACE database.[15] We tackle this concern using a "placebo test" by applying

[14]We construct 1000 draws (to get 1000 means) of each the original pre-CDS and post-CDS datasets where each draw is obtained by randomly sampling with replacement.

[15]TRACE coverage prior to 2004 was limited only to higher rate bonds.

the event study methodology to random event dates in the pre- and post-CDS periods. We find that the CARs on these random event dates are not significantly different from zero. The difference in the bond price reactions between the pre- and post- CDS periods is also not significantly different from zero, confirming the efficacy of our bond abnormal return computation methodology.

4.4 Bond yield regressions

In this subsection, we analyze the relative explanatory power of credit ratings and CDS spreads for primary market and secondary market bond yields.

Table 12 and Table 13 present the regression results for the primary and the secondary markets, respectively. To carry out these regression, we merge the bond data with the CDS quote data. We obtain data for the firm fundamentals from COMPUSTAT.[16] To partially reduce the endogeneity problem that bond yields and CDS spreads are jointly determined, we use the latest available CDS quote before the rating change event in the regressions. In the primary market regressions CDS quotes before the issuance of the bond in the primary market are considered .

Tables 12 and 13 show that the adjusted R^2 for the regressions is higher when the lagged CDS quote is included. In models 1 and 2, CDS alone explains 55.7% and 75.1% of the bond yields in the primary and secondary markets. This is 9.3% (primary market) and 30% (secondary market) more explanatory power compared to the rating scale alone as an explanatory variable. The magnitude of the coefficient of rating scale drops by about half when the lagged CDS quote and the firm fundamentals are included. On the other hand, the magnitude of the coefficient on lagged CDS quote only reduces marginally. The results in Tables 12 and 13 demonstrate that the market values the information implicit in CDS spreads higher than the information implicit in credit ratings when determining the bond yields.

[16]The definitions of the firm level controls obtained from COMPUSTAT are given in the Appendix.

5 Conclusion

We present evidence that the informativeness of credit rating downgrades decreases when the underlying firm has CDS trading on it's debt. The abnormal stock return around the credit rating downgrade is significantly weaker for firms with traded CDS as compared to firms without traded CDS. Restricting attention to firms that have CDS traded, we show that once CDS starts trading on the firm's debt, the stock market reaction to credit rating downgrades is much weaker as compared to the period when CDS was not trading on the firm's debt. Our results are robust to different model specifications and a propensity score based matching analysis. We also show that bond markets react less to credit rating downgrades in the presence of CDS. Furthermore, CDS spreads explain the cross-sectional variation in primary and secondary market bond yields better as compared to credit ratings. The evidence indicates that both equity and bond markets place less reliance on credit rating announcements when CDS is trading on the underlying firm's debt. One important implication of the evidence presented in the paper is that, stock and bond markets perceive CDS as a viable alternative to credit ratings. It may be more beneficial for regulators to design policies that can enhance the transparency and liquidity in the CDS market instead of solely focusing on regulating the credit rating agencies.

Appendix: Variable Definitions

- Bond return = raw bond return around the rating change event ($t = 0$) calculated as:

$$BondReturn_{t=0} = \frac{BondPrice_{t+7} - BondPrice_{t-7} + AccruedInterest}{BondPrice_{t-7}}$$

- Daily bond index = weighted (equal or value) index of bond returns partitioned by rating based on Moody's six major rating categories
- Total debt = long-term debt + short-term debt
- Market value of assets = (stock price × shares outstanding) + short-term debt + long-term debt + preferred stock liquidation value − deferred taxes and investment tax credits
- Term spread = yield spread between the 10- and 1-year treasury bonds
- Operating income to Sales = operating income after depreciation ÷ sales
- Total debt to market value = total debt ÷ (market value of equity + book value of total liabilities)
- Long-term debt to total assets = long-term debt ÷ book value of total assets
- Interest coverage = (operating income after depreciation + interest and related expense) ÷ interest and related expense
- Daily bond index = weighted (equal or value) index of bond returns partitioned by rating based on Moody's six major rating categories

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Table 1: **Classification by Rating Agencies**

The table presents mapping of rating codes issued by the credit rating agencies to the cardinal scale we use in our analysis. The rating codes used by S&P and Fitch are similar and are different from those used by Moody's. Moody's uses code from Aaa down to C to rate bonds whereas S&P rates bonds from AAA down to D. Within the 6 classes - AA to CCC for S&P and Aa to Caa for Moody's, both rating agencies have three additional gradations with modifiers +,- for S&P and 1,2,3 for Moody's (For example AA+, AA, AA- for S&P and Aa1, Aa2, Aa3 for Moody's). We transformed the credit ratings for S&P (Moody's) into a cardinal scale starting with 1 as AAA(Aaa), 2 as AA+(Aa1), 3 as AA(Aa2), and so on until 23 as the default category. As Fitch provides three ratings for default, following Jorion, Liu, and Shi (2005), we chose 23 instead of 22 for the default category which is the average of the default DD rating.

Explanation	Standard & poor's (modifiers)	Moody's (modifiers)	Fitch (modifiers)	Cardinal Scale
Investment grade				
Highest grade	AAA	Aaa	AAA	1
High grade	AA (+,none,-)	Aa (1,2,3)	AA (+,none,-)	2,3,4
Upper medium grade	A (+,none,-)	A (1,2,3)	A (+,none,-)	5,6,7
Medium grade	BBB (+,none,-)	Baa (1,2,3)	BBB (+,none,-)	8,9,10
Speculative grade				
Lower medium grade	BB (+,none,-)	Ba (1,2,3)	BB (+,none,-)	11,12,13
Speculative	B (+,none,-)	B (1,2,3)	B (+,none,-)	14,15,16
Poor standing	CCC (+,none,-)	Caa (1,2,3)	CCC (+,none,-)	17,18,19
Highly speculative	CC	Ca	CC	20
Lowest quality	C	C	C	21
In default	D		DDD/DD/D	23

Table 2: **Distribution of number and size of bond rating changes**

The Sample consists of 4195 downgrades and 1856 upgrades of taxable corporate bonds issued by U.S. firms during the period from January 1998 to December 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. In Panel A, Count represents the number of rating changes which are downgrades and upgrades split between years and the pre-CDS and post-CDS trading periods. Bond ratings are converted to a cardinal scale measured on a 23 point scale. Size represents the mean of the cardinal value of the new rating minus the cardinal value of the old rating. In Panel B, "Full Sample" represents the entire sample period consisting of both kinds of firms - firms for which CDS trades (traded-CDS firms) and firms for which CDS does not trade (non-traded-CDS firms). "Year 01-07" represents a sample consisting of traded-CDS firms and non-traded-CDS firms from the January 2001 to December 2007. It is a balanced time panel around the year 2004 when CDS trading began for most of the firms in our sample. "Traded-CDS" sample represents only traded-CDS firms for the entire time period from January 1998 to December 2007 where "Traded-CDS Balanced" sample represents only traded-CDS firms for the balanced time panel of 3 years before and 3 years after CDS starts trading.

	Downgrades				Upgrades			
Year	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	Count	Size	Count	Size	Count	Size	Count	Size
Panel A: Distribution of number and size of bond rating changes by year								
1998	289	1.68			198	1.34		
1999	374	1.71			148	1.19		
2000	485	1.72			132	1.33		
2001	646	1.86	12	1.25	115	1.39		
2002	574	1.67	71	1.20	87	1.55	4	1.00
2003	294	1.65	103	1.23	119	1.30	19	1.05
2004	189	1.57	115	1.30	123	1.30	82	1.24
2005	167	1.50	153	1.61	108	1.51	107	1.30
2006	178	1.31	179	1.58	204	1.18	136	1.26
2007	186	1.59	180	1.46	149	1.28	125	1.22
Total	3382	1.68	813	1.44	1383	1.32	473	1.25

	Downgrades				Upgrades			
	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	Count	Size	Count	Size	Count	Size	Count	Size
Panel B: Distribution of number and size of bond rating changes by sub-sample								
Full Sample	3382	1.68	813	1.44	1383	1.32	473	1.25
Year 01-07	2234	1.67	813	1.44	905	1.33	473	1.25
Traded-CDS	714	1.48	615	1.40	264	1.22	394	1.25
Traded-CDS Balanced	531	1.44	475	1.35	149	1.18	289	1.26

Table 3: **Sample distribution by absolute magnitude of rating changes, within class, across class and across investment grade**

The Sample consists of 4195 downgrades and 1856 upgrades of taxable corporate bonds issued by U.S. firms during the period from January 1998 to December 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. In Panel A, Freq represents the number of rating changes which are downgrades and upgrades split between the cardinal value of rating change and the pre-CDS and post-CDS trading periods. Bond ratings are converted to a cardinal scale measured on a 23 point scale. Scale Change represents the cardinal value of the new rating minus the cardinal value of the old rating. Pct represents percentage. In Panel B, a rating change is defined as "Within Class" if the rating change is within the same letter class (e.g., A+, A, A-). All other rating change events are classified as "Across Class" as the rating change for them is from one letter class to a different letter class. The "Across Inv Grade" change is defined as the rating changes for firms from investment grade (at or above BBB for S&P and Fitch and Baa for Moody's) to speculative grade or vice-versa.

	Downgrades				Upgrades			
Scale Change	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	Freq	Pct(%)	Freq	Pct(%)	Freq	Pct(%)	Freq	Pct(%)
Panel A: Sample distribution by absolute magnitude of rating changes								
1	2016	59.61	594	73.06	1118	80.84	390	82.45
2	833	24.63	148	18.20	178	12.87	62	13.11
3	325	9.61	34	4.18	50	3.62	16	3.38
4	116	3.43	20	2.46	20	1.45	2	0.42
5	43	1.27	11	1.35	6	0.43	1	0.21
6	25	0.74	3	0.37	3	0.22	1	0.21
7	10	0.30	2	0.25	3	0.22		
8	7	0.21			2	0.14	1	0.21
9	2	0.06			1	0.07		
10	3	0.09						
11	2	0.06	1	0.12	2	0.14		
Total	3382	100.00	813	100.00	1383	100.00	473	100.00

	Downgrades				Upgrades			
	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	Freq	Pct(%)	Freq	Pct(%)	Freq	Pct(%)	Freq	Pct(%)
Panel B: Sample distribution by within class, across class and across investment grade								
Within Class	1562	46.19	435	53.51	874	63.20	293	61.95
Across Class	1820	53.81	378	46.49	509	36.80	180	38.05
Across Inv Grade	310	9.17	148	18.20	145	10.48	59	12.47

Table 4: **Stock price (CAR) response to bond downgrades and upgrades**

The Sample consists of 4195 downgrades and 1856 upgrades of taxable corporate bonds issued by U.S. firms during the period from January 1998 to December 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. CAR is the cumulative abnormal return defined as the abnormal return (by fitting the market model to the underlying) cumulated over the over the 3-day event window (-1,+1), where day 0 represents the rating change event day. Panel A displays results for the full sample which represents the entire sample period consisting of both kinds of firms - firms for which CDS trades (traded-CDS firms) and firms for which CDS does not trade (non-traded-CDS firms). "Year 01-07" represents a sample consisting of traded-CDS firms and non-traded-CDS firms from the January 2001 to December 2007. It is a balanced time panel around the year 2004 when CDS trading began for most of the firms in our sample. All T-statistics are displayed in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

	Downgrades		Upgrades	
Full Sample	Mean % CAR	Count	Mean % CAR	Count
Panel A: Distribution of CAR for full sample from 1998 to 2007				
Pre-CDS	-4.61***	3382	0.09	1383
	[-9.58]		[0.68]	
Post-CDS	-1.22***	813	-0.01	473
	[-3.99]		[-0.04]	
Difference	-3.39***		0.09	
(Pre−Post)	[-3.42]		[0.39]	
Total	-3.95***	4195	0.06	1856
	[-10.06]		[0.61]	
	Downgrades		Upgrades	
Year 01-07	Mean % CAR	Count	Mean % CAR	Count
Panel B: Distribution of CAR for all firms from 2001 to 2007				
Pre-CDS	-4.63***	2234	0.09	905
	[-6.79]		[0.61]	
Post-CDS	-1.22***	813	-0.01	473
	[-3.99]		[-0.04]	
Difference	-3.41***		0.10	
(Pre−Post)	[-2.98]		[0.41]	
Total	-3.72***	3047	0.06	1378
	[-7.34]		[0.51]	

Table 5: **Stock price (CAR) response to bond downgrades and upgrades: traded-CDS firms**

The sample consists of 1249 downgrades and 610 upgrades of taxable corporate bonds issued by U.S. firms during the period from January 1998 to December 2007. This sample consists only of firms for which CDS starts trading at some point of time in the period from 1998 to 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. CAR is the cumulative abnormal return defined as the abnormal return (by fitting the market model to the underlying) cumulated over the over the 3-day event window (-1,+1), where day 0 represents the rating change event day. Panel A displays results for the full "Traded-CDS" sample which represents the entire sample period consisting only of firms for which CDS trades. "Traded-CDS Balanced" represents a sample of only traded-CDS firms for the balanced time panel of 3 years before and 3 years after CDS starts trading. It is a balanced time panel around the year 2004 when CDS trading began for most of the firms in our sample. All T-statistics are displayed in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

	Downgrades		Upgrades	
Traded-CDS	Mean % CAR	Count	Mean % CAR	Count
Panel A: Distribution of CAR for all traded-CDS sample from 1998 to 2007				
Pre-CDS	-2.92***	714	0.53*	264
	[-5.61]		[1.80]	
Post-CDS	-0.71***	615	-0.06	394
	[-2.82]		[-0.34]	
Difference	-2.21***		0.60*	
(Pre−Post)	[-3.64]		[1.80]	
Total	-1.90***	1329	0.18	658
	[-6.24]		[1.09]	
	Downgrades		Upgrades	
Traded-CDS Balanced	Mean % CAR	Count	Mean % CAR	Count
Panel B: Distribution of CAR for all traded-CDS firms for balanced sample				
Pre-CDS	-2.52***	531	0.52	149
	[-4.22]		[1.38]	
Post-CDS	-0.72**	475	-0.05	289
	[-2.33]		[-0.19]	
Difference	-1.80***		0.57	
(Pre−Post)	[-2.60]		[1.32]	
Total	-1.60***	1029	0.13	503
	[-4.96]		[0.75]	

Table 6: **Regression results for stock price response (CAR) to bond downgrades and upgrades**

The sample consists of 4195 downgrades and 1856 upgrades of taxable corporate bonds issued by U.S. firms during the period from January 1998 to December 2007. The dependent variable CAR is the cumulative abnormal return defined as the abnormal return (by fitting the market model to the underlying) cumulated over the over the 3-day event window (-1,+1), where day 0 represents the rating change event day. "Full" represents the entire sample period consisting of both kinds of firms - firms for which CDS trades (traded-CDS firms) and firms for which CDS does not trade (non-traded-CDS firms). "01-07" represents a sample consisting of traded-CDS firms and non-traded-CDS firms from the January 2001 to December 2007. It is a balanced time panel around the year 2004 when CDS trading began for most of the sample in our firms. "FulltrdCDS" sample represents only traded-CDS firms for the entire time period from January 1998 to December 2007 and "BalTrdCDS" sample represents only traded-CDS firms for the balanced time panel of 3 years before and 3 years after CDS starts trading. dIgrade is a dummy variable equal to one if a bond is revised from investment grade to speculative grade or vice-versa and zero otherwise. dCDS is a dummy variable equal to one if the rating change takes place when CDS trades for the underlying and is zero otherwise. ScaleDiff is the absolute value of rating change cardinal value. LnDays is the natural logarithm of the number of days between the previous rating change in the same direction for the same bond but by another rating agency. Firm controls include, Leverage defined as the total debt over assets; ProfMargin defined as net income over sales; LnMktVal as the natural logarithm of the market value of the entity. All standard errors are clustered at firm level. All T-statistics are displayed in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

Table 6: **(Table 6 Cont.) Regression results for stock price response (CAR) to bond downgrades and upgrades**

	Downgrades				Upgrades			
	Full	01-07	FulltrdCDS	BalTrdCDS	Full	01-07	FulltrdCDS	BalTrdCDS
dIgrade	-1.52	-2.72*	-3.55*	-5.83**	0.58	0.95	0.78	0.70
	[-1.26]	[-1.82]	[-1.88]	[-2.33]	[0.96]	[1.41]	[0.96]	[0.62]
dCDS	1.81**	2.18**	2.01***	1.27	-0.40	0.13	-0.25	-0.17
	[2.30]	[2.15]	[2.63]	[1.37]	[-0.53]	[0.19]	[-0.34]	[-0.21]
ScaleDiff	-1.55***	-0.84	0.46	1.08	-0.07	-0.13	-0.27	-0.74
	[-2.75]	[-1.27]	[0.75]	[1.27]	[-0.31]	[-0.47]	[-0.61]	[-1.26]
LnDays	-0.07	-0.28	-0.01	-0.12	0.21	0.20	0.44**	0.49*
	[-0.22]	[-0.77]	[-0.05]	[-0.34]	[1.20]	[0.89]	[2.13]	[1.67]
Leverage	-8.12*	-7.37	-0.73	-7.48	-0.64	-0.28	-4.00	-1.73
	[-1.91]	[-1.39]	[-0.09]	[-1.10]	[-0.23]	[-0.07]	[-1.05]	[-0.26]
LnMktVal	0.38	1.25	-0.78	-2.07	-0.20	-0.12	-1.15	0.19
	[0.30]	[0.74]	[-0.52]	[-1.49]	[-0.37]	[-0.16]	[-1.62]	[0.18]
ProfMargin	4.17	3.68	-1.66	-3.89	-2.70	-2.36	-2.71	0.34
	[1.03]	[1.09]	[-0.78]	[-1.33]	[-1.12]	[-0.82]	[-0.62]	[0.06]
Constant	-2.17	-10.23	4.63	18.94	1.55	0.46	10.67	-3.93
	[-0.20]	[-0.71]	[0.31]	[1.53]	[0.32]	[0.07]	[1.52]	[-0.37]
N	4032	2943	1316	996	1803	1352	646	429
adj. R^2	0.127	0.093	0.054	0.050	0.010	0.031	-0.040	-0.098

Table 7: **Matched firms (CAR) response to bond downgrades and upgrades before cds and after cds starts trading**

The Sample consists of 1650 downgrades and 886 upgrades of taxable corporate bonds issued by U.S. firms during the period from January 1998 to December 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. The sample is further split between treated group and control group. The treated group consists of all firms for which CDS trades at some point in our sample period (traded-CDS firms) and the control group consists of firms for which CDS never trades throughout our sample period (non-traded-CDS firms). The firms in the control group are matched to similar treated group firms based on propensity score matching and are assigned counterfactual CDS trading start dates. CAR is the cumulative abnormal return defined as the abnormal return (by fitting the market model to the underlying) cumulated over the over the 3-day event window (-1,+1), where day 0 represents the rating change event day. Panel A displays results for the "Full Period" sample which represents the entire sample period consisting of the matched pairs of firms. "Balanced Period" is a balanced time panel of the matched pairs of firms 3 years before and 3 years after CDS starts trading. All T-statistics are displayed in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

Table 7: **(Table 7 Cont.) Matched firms (CAR) response to bond downgrades and upgrades before cds and after cds starts trading**

	Downgrades			Upgrades		
Full Period	Pre-CDS Mean % CAR	Post-CDS Mean % CAR	Difference Pre−Post	Pre-CDS Mean % CAR	Post-CDS Mean % CAR	Difference Pre−Post
Panel A: Distribution of CAR for full matched sample from 1998 to 2007						
Treated	-2.83***	-1.23***	-1.59**	0.07	0.03	0.04
	[-4.88]	[-3.45]	[-2.20]	[0.19]	[0.13]	[0.10]
Control	-2.05***	-4.17***	2.12	-0.14	-0.02	-0.12
	[-2.85]	[-3.67]	[1.64]	[-0.26]	[-0.07]	[-0.17]
Difference	-0.78	2.94***		0.21	0.05	
(Treated−Control)	[-0.76]	[3.22]		[0.33]	[0.12]	
Total	-2.60***	-2.07***		-0.01	0.01	
	[-5.64]	[-4.97]		[-0.05]	[0.08]	
	Downgrades			Upgrades		
Balanced Period	Pre-CDS Mean % CAR	Post-CDS Mean % CAR	Difference Pre−Post	Pre-CDS Mean % CAR	Post-CDS Mean % CAR	Difference Pre−Post
Panel B: Distribution of CAR for all matched firms for balanced						
Treated	-2.94***	-1.40***	-1.54*	-0.43	0.03	-0.46
	[-4.49]	[-3.37]	[-1.91]	[-0.87]	[0.11]	[-0.86]
Control	-2.60***	-4.78***	2.18	0.26	-0.06	0.32
	[-2.78]	[-4.10]	[1.44]	[0.36]	[-0.17]	[0.41]
Difference	-0.35	3.38***		-0.69	0.09	
(Treated−Control)	[-0.28]	[3.38]		[-0.81]	[0.19]	
Total	-2.85***	-2.46***		-0.12	0.00	
	[-5.25]	[-5.24]		[-0.29]	[0.02]	

Table 8: **Regression results for the matched sample stock price response (CAR) to bond downgrades and upgrades**

The sample consists of 1650 downgrades and 886 upgrades of taxable corporate bonds issued by U.S. firms during the period from January 1998 to December 2007. The sample is further split between treated group and control group. The treated group consists of all firms for which CDS trades at some point in our sample period (traded-CDS firms) and the control group consists of firms for which CDS never trades throughout our sample period (non-traded-CDS firms). The firms in the control group are matched to similar treated group firms based on propensity score matching and are assigned counterfactual CDS trading start dates. The dependent variable CAR is the cumulative abnormal return defined as the abnormal return (by fitting the market model to the underlying) cumulated over the over the 3-day event window (-1,+1), where day 0 represents the rating change event day. "Full" sample represents the entire sample period consisting of the matched pairs of firms. "Balanced" is a balanced time panel of the matched pairs of firms 3 years before and 3 years after CDS starts trading. dIgrade is a dummy variable equal to one if a bond is revised from investment grade to speculative grade or vice-versa and zero otherwise. dCDS is a dummy variable equal to one if the rating change takes place when CDS trades for the underlying and is zero otherwise. ScaleDiff is the absolute value of rating change cardinal value. LnDays is the natural logarithm of the number of days between the previous rating change in the same direction for the same bond but by another rating agency. dControl is a dummy variable that takes the value 1 for a firm in the control group which is matched with a traded-CDS firm and value zero otherwise, dCDSxdControl is an interaction term between the dummy variables dCDS and dControl. Firm controls include, Leverage defined as the total debt over assets; Profit Margin defined as net income over sales; Log Market Value as the natural logarithm of the market value of the entity. All standard errors are clustered at firm level. All T-statistics are displayed in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

Table 8: **(Table 8 Cont.) Regression results for the matched sample stock price response (CAR) to bond downgrades and upgrades**

	Downgrades		Upgrades	
	Full	Balanced	Full	Balanced
dIgrade	-2.78***	-4.12***	1.14**	0.72
	[-3.01]	[-4.09]	[1.97]	[1.02]
dCDS	2.05***	1.86**	-0.08	0.28
	[2.69]	[2.21]	[-0.19]	[0.49]
dControl	-0.18	-0.85	-0.14	0.75
	[-0.18]	[-0.71]	[-0.26]	[1.04]
dCDSXdControl	-3.36**	-3.44**	0.13	-0.71
	[-2.34]	[-2.13]	[0.17]	[-0.76]
ScaleDiff	-0.69*	-0.37	0.22	0.15
	[-1.88]	[-0.87]	[0.96]	[0.61]
LnDays	0.20	0.19	0.22	0.26
	[0.66]	[0.58]	[1.09]	[1.02]
Leverage	-0.75	-5.48**	-0.69	-0.78
	[-0.33]	[-2.15]	[-0.74]	[-0.69]
LnMktVal	-1.15***	-1.63***	-0.15	-0.06
	[-3.71]	[-4.77]	[-0.86]	[-0.27]
ProfMargin	2.51	1.82	1.87	-0.02
	[1.04]	[0.67]	[1.36]	[-0.01]
Constant	8.19**	13.73***	0.72	-0.47
	[2.58]	[3.86]	[0.39]	[-0.21]
N	925	724	501	335
adj. R^2	0.029	0.055	-0.001	-0.015

Table 9: **Distribution of number and size of bond rating changes for the bond sample**

The Sample consists of 1029 downgrades and 650 upgrades of taxable corporate bonds issued by U.S. firms during the period from July 2002 to December 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. In Panel A, Count represents the number of rating changes which are downgrades and upgrades split between years and the pre-CDS and post-CDS trading periods. Bond ratings are converted to a cardinal scale measured on a 23 point scale. Size represents the mean of the cardinal value of the new rating minus the cardinal value of the old rating. In Panel B, "Full Sample" represents the entire sample period consisting of both kinds of firms - firms for which CDS trades (traded-CDS firms) and firms for which CDS does not trade (non-traded-CDS firms). "Traded-CDS" sample represents only traded-CDS firms for the entire time period from July 2002 to December 2007.

	Downgrades				Upgrades			
Year	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	Count	Size	Count	Size	Count	Size	Count	Size
Panel A: Distribution of number and size of bond rating changes by year								
2002	34	1.79	16	1.00	2	1.50	2	1.00
2003	35	1.54	59	1.12	14	1.57	11	1.09
2004	43	1.40	73	1.32	23	1.48	35	1.20
2005	101	1.62	131	1.65	46	1.74	84	1.33
2006	105	1.41	160	1.60	123	1.23	135	1.24
2007	112	1.58	160	1.54	72	1.19	103	1.19
Total	430	1.54	599	1.50	280	1.34	370	1.24

	Downgrades				Upgrades			
	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	Count	Size	Count	Size	Count	Size	Count	Size
Panel B: Distribution of number and size of bond rating changes by sub-sample								
Full Sample	430	1.54	599	1.50	280	1.34	370	1.24
Traded-CDS	80	1.59	87	1.33	52	1.21	73	1.22

Table 10: **Sample distribution by absolute magnitude of rating changes for the bond sample**

The Sample consists of 1029 downgrades and 650 upgrades of taxable corporate bonds issued by U.S. firms during the period from July 2002 to December 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. In Panel A, Freq represents the number of rating changes which are downgrades and upgrades split between the cardinal value of rating change and the pre-CDS and post-CDS trading periods. Bond ratings are converted to a cardinal scale measured on a 23 point scale. Scale Change represents the cardinal value of the new rating minus the cardinal value of the old rating. Pct represents percentage.

	Downgrades				Upgrades			
Scale Change	Pre-CDS		Post-CDS		Pre-CDS		Post-CDS	
	Freq	Pct(%)	Freq	Pct(%)	Freq	Pct(%)	Freq	Pct(%)
Panel A: Sample distribution by absolute magnitude of rating changes								
1	293	68.14	428	71.45	223	79.64	310	83.78
2	80	18.60	105	17.53	37	13.21	45	12.16
3	38	8.84	33	5.51	13	4.64	10	2.70
4	7	1.63	19	3.17	3	1.07	2	0.54
5	5	1.16	10	1.67	1	0.36	1	0.27
6	6	1.40	1	0.17	2	0.71		
7			1	0.17				
8	1	0.23					2	0.54
11			2	0.33	1	0.36		
Total	430	100.00	599	100.00	280	100.00	370	100.00

Table 11: **Bond price (CAR) response to bond downgrades and upgrades**

The Sample consists of 1029 downgrades and 650 upgrades of taxable corporate bonds issued by U.S. firms during the period from July 2002 to December 2007. The sample is split between rating changes that occur in the presence of CDS trading (post-CDS period) and absence of CDS trading (pre-CDS period) for the underlying firm that is being rated. CAR is the cumulative abnormal return defined as the firm's value-weighted bond portfolio's excess return against the bond return of a matching portfolio based on Moody's six major rating categories (Aaa, Aa, A, Baa, Ba, and B) around the shortest trading window within (-7,+7), where day 0 represents the rating change event day. Panel A displays results for the full sample which represents the entire sample period consisting of both kinds of firms - firms for which CDS trades (traded-CDS firms) and firms for which CDS does not trade (non-traded-CDS firms). "Traded-CDS" sample represents only traded-CDS firms for the entire time period from July 2002 to December 2007. All T-statistics are displayed in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

	Downgrades		Upgrades	
Full Sample	Mean % CAR	Count	Mean % CAR	Count
Panel A: Distribution of Bond CAR for full sample from 2002 to 2007				
Pre-CDS	-1.40***	430	0.12**	280
	[-7.05]		[2.14]	
Post-CDS	-0.52***	599	0.08*	370
	[-7.85]		[1.67]	
Difference	-0.88***		0.04	
(Pre−Post)	[-4.76]		[0.55]	
Total	-0.89***	1029	0.10***	650
	[-9.59]		[2.67]	
	Downgrades		Upgrades	
Traded-CDS	Mean % CAR	Count	Mean % CAR	Count
Panel B: Distribution of Bond CAR for all firms from 2002 to 2007				
Pre-CDS	-1.05**	80	0.01	52
	[-2.51]		[0.12]	
Post-CDS	-0.71***	87	0.20*	73
	[-2.83]		[1.94]	
Difference	-0.34		-0.19	
(Pre−Post)	[-0.72]		[-1.14]	
Total	-0.87***	167	0.12	125
	[-3.65]		[1.53]	

Table 12: **Primary Market Regression Tables for Traded-CDS firms**

The sample consists of a panel data of corporate bond issuance for those issues whose firms had CDS trading. We regress corporate bond yields spreads over Treasury with the same maturity as the bond at issuance against the variables listed below. Time dummies and industry dummies are included in models (4), (5), (6), (7). All standard errors are clustered at firm level to correct for correlation across observations of a given firm. T-statistics are presented in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

	Regression						
	1	2	3	4	5	6	7
Rating Scale	15.67***		8.01***		17.09***		8.92***
	[9.05]		[5.17]		[7.23]		[4.51]
Lagged CDS quote		0.68***	0.48***			0.59***	0.47***
		[5.18]	[3.88]			[4.19]	[3.60]
Sales (log)				-31.18***	-2.78	-16.40***	-4.39
				[-6.35]	[-0.54]	[-4.43]	[-1.37]
Operating Income to Sales				-175.38***	-42.85	-81.66***	-28.88
				[-5.38]	[-1.36]	[-3.30]	[-1.20]
Long-term debt to assets				-5.44	-3.13	-20.15	-15.24
				[-0.12]	[-0.12]	[-0.83]	[-0.79]
Total debt to capitalization				140.85***	49.83**	56.20***	24.11
				[4.85]	[2.21]	[2.66]	[1.32]
10yr-1yr Treasury(%)				30.65***	44.12***	23.53***	32.35***
				[2.71]	[4.67]	[3.65]	[5.43]
Issue size (log)				22.05***	18.29***	14.86***	14.20***
				[2.87]	[3.19]	[3.07]	[3.38]
Years to Maturity				1.36***	1.65***	1.78***	1.85***
				[5.74]	[9.08]	[8.34]	[9.94]
Industry fixed effects	No	No	No	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes	Yes	Yes	Yes
N	322	319	319	320	320	317	317
adj. R^2	0.464	0.557	0.630	0.455	0.643	0.755	0.795

Table 13: **Secondary Market Regression Tables for Traded-CDS firms**

The sample consists of a panel data of corporate bond yields for those issues whose firms had CDS trading. We regress corporate bond yields spreads over the closest benchmark Treasury against the variables listed below. Time dummies and industry dummies are included in models (4), (5), (6), (7). All standard errors are clustered at firm level to correct for correlation across observations of a given firm. T-statistics are presented in square brackets. *, ** and *** indicate significance better than 10%, 5% and 1% respectively.

	Regression						
	1	2	3	4	5	6	7
Rating Scale	27.20***		8.58***		23.29***		8.47***
	[9.47]		[5.24]		[9.58]		[4.48]
Lagged CDS quote		0.67***	0.57***			0.55***	0.50***
		[12.24]	[9.57]			[8.99]	[8.19]
Interest Coverage<5				-121.71***	-129.75***	-26.66*	-37.38*
				[-2.96]	[-2.89]	[-1.76]	[-1.94]
5≤Interest Coverage<10				-126.40***	-121.18***	-36.29**	-41.80**
				[-2.89]	[-2.66]	[-2.30]	[-2.14]
10≤Interest Coverage<20				-82.90	-78.98	-31.25*	-34.07
				[-1.63]	[-1.58]	[-1.74]	[-1.62]
20≤Interest Coverage				-56.54	-47.85	-30.18	-29.18
				[-1.02]	[-0.90]	[-1.51]	[-1.30]
Market Cap (log)				-24.52***	5.87	-13.10***	-2.99
				[-3.25]	[0.70]	[-4.09]	[-0.93]
Operating Income to Sales				-251.71***	-164.87***	-41.78	-27.44
				[-3.92]	[-3.54]	[-1.38]	[-1.15]

Long-term debt to assets				138.99***	81.47***	57.07***	42.88***
				[3.64]	[2.72]	[3.10]	[2.91]
Total debt to capitalization				255.05***	220.01***	15.08	22.05
				[3.47]	[4.15]	[0.50]	[0.88]
10yr-1yr Treasury(%)				24.52***	32.76***	17.10***	20.70***
				[4.69]	[7.48]	[5.20]	[6.45]
Issue size (log)				8.91	1.97	8.06**	5.61*
				[1.31]	[0.40]	[2.02]	[1.67]
Years to Maturity				2.04***	2.56***	2.41***	2.57***
				[4.55]	[7.57]	[11.60]	[12.52]
Coupon Rate(%)				18.25***	5.28**	6.70***	2.93*
				[5.33]	[2.12]	[3.59]	[1.70]
Industry fixed effects	No	No	No	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes	Yes	Yes	Yes
N	332323	332323	332323	301009	301009	301009	301009
adj. R^2	0.451	0.751	0.779	0.556	0.641	0.817	0.826