Financial Management

Split Bond Ratings and Information Opacity Premiums

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This paper examines the relationship between split bond ratings and bond yields at the notch level for newly issued corporate bonds. We find that split rated bonds average a 7-basis-point yield premium over nonsplit rated bonds of similar credit risk. The yield premium increases from 5 basis points for one-notch splits to 15 (20) basis points for two-notch (three-notch) splits. These findings indicate that investors demand higher yields for split rated bonds to compensate for the information opacity of such bonds. In addition, the yield premium for split rated bonds is higher during economic recessions, indicating investors are more risk averse during economic downturns. Consequently, split ratings impose higher borrowing costs for firms, especially during economic downturns.

Firms issuing public bonds usually receive ratings from two major bond rating agencies, Moody's and S&P. While the two rating agencies often assign the same credit rating independently, the two credit ratings may differ, resulting in split bond ratings. In fact, about 13% of bond ratings are split at the letter level while about 50% are split at the notch level (Ederington, 1986; Cantor, Packer, and Cole, 1997).

Split bond ratings indicate that financial experts, rating analysts in this case, cannot agree with each other on their assessment of the issuing firm. There is evidence that disagreement among experts can be an indication of information opacity.[1] Morgan (2002) indicates that industries and firms with information opacity problems are more likely to have split ratings.[2] In this paper, we examine the impact of information opacity (as proxied by split bond ratings) on bond yields.

Information opacity has been measured by several proxies including firm size, intangible assets, and dispersion of analysts' forecasts. While these variables can be used to proxy for information opacity, they are more difficult to measure. Alternatively, split ratings are directly observable. Using split ratings to measure information opacity has the advantage that split ratings are directly and unequivocally observable. Consequently, this paper will concentrate on split ratings as a measure of information opacity.

While previous studies find evidence that split ratings are an indication of information opacity, no study has examined the impact of split ratings and the implied information opacity on bond yield. If split ratings are indeed a signal of information opacity, then split rated bonds are expected

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[1] For example, Bomberger and Frazer (1981) find that disagreement about future inflation (as measured by standard deviations of inflation forecasts) is positively correlated with inflation uncertainty (as measured by the mean forecast errors).

[2] We use the term "information opacity" to incorporate information uncertainty or ambiguity.

to have higher yields than nonsplit rated bonds of similar default risk to compensate investors for the greater information opacity.[3] Thus, in examining the yields on split rated bonds, this paper tests the joint hypotheses that: 1) a split rating is a signal of information opacity, and 2) information opacity is priced by bond investors.

An alternative explanation of split ratings is Ederington's (1986) random error hypothesis, which argues that the default risk of a split rated bond is close to the borderline of two rating categories and the two rating agencies assign different ratings randomly. The random error hypothesis implies no yield premium for split rated bonds.

While some split rated bonds may be caused by information opacity problems and others by random errors, investors cannot easily distinguish between the two groups. Consequently, the existence of the split rating suggests information opacity to risk-averse investors, who require a yield premium for split rated bonds. If the two ratings differ by more than one notch, the probability that the split is caused by a random error is much smaller as it implies that the default risk of the split rated bond spans three or more rating categories. As a result, multiple-notch splits are a stronger signal of information opacity, and risk-averse investors should accordingly demand a higher yield premium on these wider splits than on one-notch splits.

In this paper, we examine the yields for split rated bonds empirically using two methodologies. First, we examine the yields for bonds with two-notch split ratings. Two-notch splits involve three ratings: 1) the superior rating, 2) the inferior rating, and 3) the rating in the middle. For example, for an A+/A− rated bond, there is a rating of A in the middle allowing us to compare the yield for the split rated bond (with ratings A+/A−) with the yield for a nonsplit bond rated at the middle rating (A) by both rating agencies. We find that yields for bonds with two-notch splits are, on average, 15 basis points above the yields for nonsplit bonds with a rating in the middle suggesting a yield premium of 15 basis points on two-notch split rated bonds.

Second, we consider the more general case of split ratings including one-notch, two-notch, three-notch, and four-notch splits.[4] Since most split rated bonds do not have a natural middle rating, we perform two comparisons. We first compare the yields for split rated bonds with the yields for nonsplit rated bonds with a superior rating from both rating agencies (referred to as the yields for the superior rating hereafter). Second, the yields for split rated bonds are compared with yields for nonsplit rated bonds with an inferior rating from both rating agencies (referred to as the yields for the inferior rating hereafter). We find that the yields for split rated bonds are higher than the yields for the superior rating but lower than the yields for the inferior rating.[5]

While the yields for split rated bonds lie between the yields for the superior rating and yields for the inferior rating, they are about 7 basis points higher than the average of the two. This phenomenon suggests that investors require a yield premium to compensate for the greater information opacity of split rated bonds. Furthermore, as the split in rating increases, the information opacity premiums get larger. The yield premium increases from 5 basis points for one-notch splits to 15 (20) basis points for two-notch (three-notch) splits. These findings provide evidence that

[3] Several recent studies of corporate bonds identify information opacity as a determinant of Treasury spreads, the difference between the yields for corporate bonds and Treasury securities of similar maturity. Sengupta (1998) and Yu (2005) find that high quality accounting disclosure lowers Treasury spreads, especially for short-term bonds. Mansi, Maxwell, and Miller (2006) find that wider dispersion of financial analysts' forecasts (a proxy for information opacity) is positively related to bond yields. All of these studies indicate that bond investors require higher yields to compensate for information opacity.

[4] While four-notch splits also have a middle rating, there are very few bonds with four-notch split ratings. Thus, we do not analyze four-notch splits separately. Grouping two-notch and four-notch splits together does not affect the results.

[5] This is consistent with findings by Cantor, Packer, and Cole (1997) and Jewell and Livingston (1998) that both superior and inferior ratings have an impact on the yields of split rated bonds.

information opacity (proxied by split ratings) is a risk factor that bond investors price into bond yields. Consequently, split ratings and the information contained in split ratings impose costs upon opaque firms in the form of higher interest rates on their bonds.

Finally, split ratings are found to be less common during economic recessions, and the information opacity premiums for split rated bonds are much higher during such times. These recessionary patterns indicate greater risk aversion for investors, more difficult access to the capital market for firms with significant information opacity, and higher yield premiums during recessions. These findings support the "financial accelerator" models of Bernanke, Gertler, and Gilchrist (1996).

The findings in our paper make two major contributions to the literature. While a number of studies demonstrate that split ratings are a signal of information opacity, this paper is the first to show that investors require an information opacity premium for split rated bonds imposing a cost to issuing firms with information opacity problems. In addition, the finding of an information opacity premium further supports the theory that a split rating is an indication of information opacity. Second, the findings in this paper support the financial accelerator models as firms with significant information opacity have a harder time accessing the bond market and must pay higher information opacity premiums during economic downturns.

The rest of the paper is organized as follows. Section I summarizes the previous literature and describes our hypothesis that split ratings signal higher information opacity, implying higher yields to maturity. Section II describes the data and provides summary statistics. Section III examines the yields for two-notch split rated bonds. Section IV examines the yields for all split rated bonds while Section V provides our conclusions.

I. Previous Literature and Testable Hypotheses

A. Previous Literature

This subsection discusses two streams of literature regarding split ratings: 1) the correlation between split ratings and bond yields and 2) the causes of split bond ratings. Several studies examine the impact of split ratings on bond yields with contradictory findings. While Billingsley et al. (1985), Liu and Moore (1987), and Perry, Liu, and Evans (1988) find that the lower of the two ratings determines bond yields, Hsueh and Kidwell (1988) and Reiter and Ziebart (1991) find that the higher of the two ratings sets bond yields.

A number of factors may explain the contradictory findings. First, most of the studies have very small sample sizes.[6] Second, these studies use bond issues from different segments of the bond market in the 1980s.[7] Additionally, different studies use different methodologies.[8]

Two more recent studies have significantly different findings from the earlier studies. Cantor, Packer, and Cole (1997) and Jewell and Livingston (1998) find that both superior and inferior bond ratings have an impact on bond yields. The two studies use longer time periods and much larger samples. Furthermore, the two studies contain significant amounts of

[6] For example, the sample in Billingsley et al. (1985) has only 225 nonsplit rated bond issues and 33 split rated issues. Such a small sample, especially the small number of split rated bond issues, makes reliable statistical inference hard to achieve.

[7] Hsueh and Kidwell (1988) examine municipal bond issues, while Reiter and Ziebart's (1991) sample consists of utility bond issues.

[8] While Billingsley et al. (1985), Hsueh and Kidwell (1988), and Reiter and Ziebart (1991) use multivariate regression analysis, Perry et al. (1988) and Liu and Moore (1987) essentially apply univariate analysis.

below-investment-grade bonds in their samples making their results more representative. However, these two studies do not explicitly measure opacity premiums from split ratings.

Another line of research focuses on the cause of split ratings. An early study by Ederington (1986) finds that the two rating agencies use a similar set of accounting and nonaccounting variables to determine the ratings. Furthermore, the two rating agencies assign similar weights to each variable and there is no systematic difference in the scale of the two rating systems. Thus, Ederington (1986) argues that split ratings are caused by random errors of the two rating agencies, implying that split rated bonds are likely to have default risks bordering the rating cutoff points. We designate this viewpoint as the random error hypothesis for split ratings.

Recent studies by Morgan (2002) and Livingston, Naranjo, and Zhou (2007) find that industries and firms with severe information opacity problems are more likely to receive split ratings, suggesting a causal link between information opacity and split ratings. Hyytinen and Pajarinen (2008) find that split ratings are more common among younger firms, which may experience more acute information opacity due to shorter histories and/or less analysts' or media coverage. Furthermore, Livingston, Naranjo, and Zhou (2008) confirm that split rated bonds are more likely to have rating changes after the initial bond issuance implying significant information uncertainty for firms with split rated bonds. We designate this viewpoint as the information opacity hypothesis for split ratings.

B. Testable Hypotheses

While the random error and information opacity hypotheses offer different explanations for split ratings, both of them implicitly assume that evaluating the true default risk of a firm is an imperfect process. Consequently, rating agencies may not be able to pin down an exact level of default risk but instead determine a default risk range. Rational rating firms may plausibly come up with different rating categories for the same firm as information is difficult to evaluate and the estimated default risk range crosses two rating categories. As a result, two rating firms may derive different ratings even though both are acting rationally.

Furthermore, the random error hypothesis implicitly assumes that all firms are equally difficult to evaluate and split ratings happen randomly. In other words, there is no systematic difference between the two rating agencies and there is nothing special about firms with split ratings. Thus, a rational investor should weight both ratings equally and the yield for a split rated bond should be the average of the yields for the superior rating and yields for the inferior rating.

Alternatively, the information opacity hypothesis assumes greater difficulty in evaluating the default risk of firms with information opacity, resulting in a wider estimated default risk range. While neither rating agency may be superior in evaluating the firms, the two agencies are far more likely to assign different ratings to firms with information opacity due to the wider default risk range. Thus, the information opacity hypothesis suggests that a split bond rating is a signal that the issuing firm has greater information opacity. An implication is that even if investors weight both ratings equally in assessing default risk, a yield premium is required to compensate for information opacity; that is, the yields for split rated bonds should be higher than the average of yields for the superior rating and yields for the inferior rating.

Now, let us consider how investors will react to split ratings. Will investors assume that split ratings are merely random errors, or will investors interpret split ratings to be indicators of ambiguity about the true default risk? Suppose that investors have only information about ratings. These investors do not know whether splits in ratings are caused by a random error or by information opacity, resulting in a pooling equilibrium. Rational, risk-averse investors can plausibly assume that a split rating is a possible signal of considerable ambiguities about a bond's risk. Consequently, when a split rating is observed, rational and risk-averse investors would demand an opacity premium. Hence, our first hypothesis is:

H1: The yield on a given split rated bond is higher than the average of the yield on a bond with the superior rating and the yield on a bond with the inferior rating.

While it may be hard to distinguish whether split ratings are due to random errors or to information opacity, the probability of information opacity increases with the magnitude of the rating differences. In the case of one-notch splits, the random error hypothesis argues that the issuing firm's estimated default risk crosses the border between two rating categories. Conversely, in the case of two- or three-notch splits, the random error hypothesis implies that the issuing firm's estimated default risk spans three or four rating categories, which is highly unlikely for firms without underlying information opacity problems. Thus, the probability of information opacity problems is higher for firms with multiple-notch split ratings. In other words, multiple-notch split ratings send a stronger signal of information opacity, and rational investors should ask for higher opacity premiums than one-notch splits. As such, our next hypothesis is:

H2: The information opacity premium on split rated bonds increases with the magnitude of the rating difference.

II. Data Collection and Description

We collect data on fixed rated, US domestic, nonfinancial public and Rule 144A corporate bond issues from the Thomson Financial SDC database. We use the data on original bond issues for two reasons. First, bond ratings on new issues reflect the most up-to-date information about the issuers.[9] Second, split ratings on existing bond issues can be caused by asynchronous changes in ratings by the two rating agencies in response to changes in underlying default risk.[10] Thus, split ratings on outstanding bonds may merely be the result of one agency's slow updating of its rating and not a signal of information opacity.

The sample period covers 1983-September 2008. We start in 1983 because Moody's began issuing notch ratings after April 1982, instead of just letter ratings.[11] All bond issues in our sample have ratings from both Moody's and S&P.[12] Perpetual bonds, bonds with credit enhancements, and putable bonds are excluded. We also exclude several issues that are rated CCC− by at least one rating agency and a small number of issues where the two ratings differ by five notches or more.[13] Our final sample consists of 14,005 bond issues.

Table I describes the sample. It shows that 7,138 bond issues (50.97% of the sample) have the same ratings from Moody's and S&P, while 6,867 issues (49.03% of the sample) have split ratings. Among the split rated bonds, 5,530 issues (39.49%) are one-notch splits, 1,069 issues (7.63%) are two-notch splits, 236 issues (1.69%) are three-notch splits, and 32 issues (0.23%) are four-notch splits.

[9] Some research has found that rating agencies tend to lag financial markets in reflecting new information (Holthausen and Leftwich, 1986; Ederington and Goh, 1998).

[10] Güttler and Wahrenburg (2007) document a lead-lag correlation between the ratings of Moody's and S&P.

[11] S&P started to issue notch ratings in 1974 (Cantor and Packer, 1995).

[12] Theoretically, it would be interesting to compare split rated bonds with bond issues rated only by one rating agency. However, very few bonds have only one rating, making statistical analysis unreliable.

[13] We exclude these issues as a data quality filter. It is highly unlikely that firms with a CCC− rating are able to access the public bond market. Also, it is rare to have the two ratings differ by five or more notches without some peculiar reason. Inclusion of these issues in our sample does not, however, change our results.

Table I. Descriptive Statistics

This table reports the descriptive statistics for the sample. Treasury spread is the spread (in basis points) of the initial bond yield in excess of the yield for a Treasury security of a similar maturity. Maturity is the number of years to maturity. Proceeds is the gross proceeds of the bond issue in millions of dollars. Moody's (S&P) rating is an ordinal number ranging from one for CCC rated bonds by Moody's (S&P) to 18 for AAA rated bonds by Moody's (S&P). The numbers in parentheses are standard deviations.

	Whole Sample	Nonsplit Sample	Split Sample	One-Notch Split Sample	Multiple-Notch Split Sample
Treasury spread	205.14	196.27	214.37***	211.91***	224.55***
	(177.76)	(174.09)	(181.04)	(180.47)	(183.12)
Maturity	12.40	12.28	12.52	12.44	12.86**
	(8.97)	(9.03)	(8.90)	(8.88)	(9.01)
Proceeds (in $ million)	224.53	220.36	228.87*	227.68	233.79*
	(272.75)	(267.26)	(278.31)	(279.11)	(275.02)
Moody's rating	10.07	10.29	9.84***	9.88***	9.65***
	(4.09)	(4.11)	(4.05)	(4.03)	(4.11)
S&P rating	10.16	10.29	10.02***	9.98***	10.18
	(4.11)	(4.13)	(4.10)	(4.04)	(4.35)
% of callable bonds	35.00%	34.24%	35.79%	35.77%	35.90%
% of senior bonds	87.17%	87.53%	86.79%	87.00%	85.94%
% of utility issues	38.80%	37.27%	40.40%	38.73%	47.27%
% of shelf reg. issues	63.02%	66.00%	59.92%	61.19%	54.67%
% of Rule 144A issues	23.02%	22.39%	23.02%	23.02%	26.40%
No. of obs.	14,005	7,138	6,867	5,530	1,337

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

Table I reports that split rated bonds have slightly longer maturities and larger issue sizes than nonsplit rated bonds. To summarize the credit quality of the sample, we create two numerical variables, Moody's rating and S&P rating, which range from 1 (for CCC rated bonds) to 18 (for AAA rated bonds). The whole sample has average Moody's and S&P ratings of 10.07 and 10.16, respectively, or between BBB+ and BBB. Split rated bonds have slightly lower average ratings, about one-third of a notch lower.

To compare the bond yields, we subtract the yield for Treasury securities of similar maturity from the yield to maturity of each bond to get the Treasury spread. The average Treasury spread for the split rated sample is about 18 basis points higher than the nonsplit rated sample. The difference is statistically significant at the 1% level.

III. Analysis of Two-Notch Split Rated Bonds

Two-notch split rated bonds have a special feature. There are three ratings: 1) the superior rating, 2) the inferior rating, and (3) the rating in the middle. For example, if a bond is rated A+ by one rating agency and A− by another rating agency, the rating A is directly in the middle of the two ratings. Given this unique feature, we examine the yields on two-notch split rated bonds relative to the yields on nonsplit rated bonds with middle ratings. If split ratings are a signal of information opacity, two-notch split rated bonds should have a yield premium over nonsplit rated bonds with middle ratings.

A. Univariate Analysis

To examine the yields for two-notch split rated bonds, we first calculate the mean Treasury spreads of nonsplit rated bonds for each rating category. We use them as benchmarks. Next, we calculate, for each rating category, the average of the mean Treasury spreads of its two immediately adjacent rating categories (one superior rating category and one inferior rating category). For example, for the A+ rating category, we take the average of the mean Treasury spreads of AA− rated bonds and A rated bonds. Finally, we categorize two-notch split rated bonds by the rating in the middle. For example, we group all AA−/A rated bonds into the A+ group, BBB+/BBB− rated bonds into the BBB group, etc. Then, we find the mean Treasury spreads for the two-notch split rated bonds for each group. The three series of mean Treasury spreads for each rating category are plotted in Figure 1.

Out of the 16 rating categories, split rated bonds have higher mean Treasury spreads in 12 cases.[14] This finding suggests that a two-notch split rated bond (e.g., an A+/A− rated bond) is not equivalent in yield to a nonsplit bond rated at the middle rating (e.g., a bond rated A by both rating agencies). In addition, the yields on split rated bonds tend to be higher than the average of the yields for the inferior ratings and superior ratings.[15] These findings are consistent with our first hypothesis that investors require a yield premium on split rated bonds.

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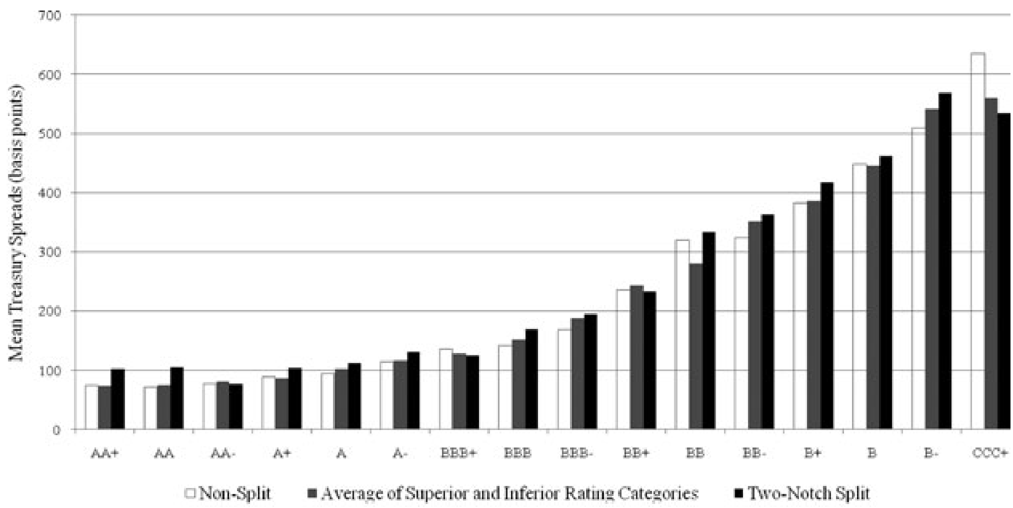
[14] The differences between the two-notch splits and nonsplits are statistically significant in 10 of the 12 rating categories.

[15] Among the four rating categories that split rated bonds have lower mean treasury spreads, three of them are in letter-rating-plus category (BBB+, BB+, and CCC+). The lower mean Treasury spreads of these split rated bonds may be explained by the regulatory role of bond ratings. In these cases, one of the two ratings is at a higher letter rating (A, BBB, and B, respectively). Investors subject to restrictions on the ratings allowed in a portfolio may be able to include these bonds in their portfolios since regulators often consider the higher of the two ratings (Cantor and Packer, 1995). These rules may increase the demand for these split rated bonds compared to their benchmark nonsplit rated bonds, resulting in lower Treasury spreads.

Figure 1. Average Treasury Spreads of Nonsplit Rated Bonds and Two-Notch Split Rated Bonds

This figure depicts three mean Treasury spreads by rating category. First, the mean Treasury spreads of nonsplit rated bonds are depicted. Second, for each rating category, the average of the mean Treasury spreads of its adjacent superior and inferior rating categories is indicated. Finally, for two-notch split rated bonds, the mean Treasury spreads by their middle rating is reported.



B. Regression Analysis

This subsection analyzes the impact of two-notch split ratings in a multivariate regression model. The dependent variable is the Treasury spread (*TS*). The explanatory variables include 17 *RATING* dummy variables. For two-notch split rated bonds, we use the rating in the middle to create the *RATING* dummy variables. For example, for BBB+/BBB− rated bonds, we assign the value one to the BBB dummy variable, and zero to all other rating dummy variables. To distinguish between split and nonsplit rated bonds, we add the *SPLIT* dummy variable in the regression. If the two-notch split rated bonds have higher yields than the nonsplit rated bonds at the middle ratings, the coefficient for *SPLIT* should be significantly positive.

The other explanatory variables include eight control variables and 25 *YEAR* dummies.[16] The eight control variables are

MAT = natural logarithm of maturity.
PROC = proceeds of the bond issue.
SENIOR = one for senior bonds and zero otherwise.
CALL = one for callable bonds and zero otherwise.
UTIL = one for utility issues and zero otherwise.
SHELF = one for shelf registered bonds and zero otherwise.
R144A = one for Rule 144A issues and zero otherwise.
RISK_PREM = Moody's AAA Corporate Bond Index Yield − 10-year Treasury yield.

[16] In all regression models, we use AAA rated bonds and 2008 as the base case.

Table II. Two-Notch Splits versus Nonsplits: Regression of Treasury Spreads

The dependent variable is the Treasury spread in basis points. The base case is AAA rated bonds. The sample includes all nonsplit and two-notch split rated bonds. *SPLIT* is equal to one for split rated bonds and zero otherwise. *MAT* is the natural log of the number of years to maturity. *PROC* is the gross proceeds of the bond issue in millions of dollars. *SENIOR* is equal to one for senior bonds and zero otherwise. *CALL* is equal to one for callable bonds and zero otherwise. *UTIL* is equal to one for utility issues and zero otherwise. *R144A* is equal to one for Rule 144A issues and zero otherwise. *SHELF* is equal to one for shelf registered issues and zero otherwise. *RISK_PREM* is the difference (in basis points) between Moody's AAA Bond Index Yield and the 10-year Treasury yield. For the two-notch split rated bonds, we use the middle ratings to construct the rating dummy variables. The *p*-values (in parentheses) have been adjusted for potential clustering problems that might arise from multiple bond issues by same firm.

	Full Sample	**Full Sample**	**1983-1995**	**1996-2008**
Intercept	−51.41 (0.00)	−51.46 (0.00)	−122.42 (0.00)	−131.47 (0.00)
SPLIT	14.58 (0.00)	15.80 (0.00)	13.27 (0.00)	15.43 (0.00)
SPLIT ∗ *JUNK*		−3.66 (0.68)		
AA+	14.16 (0.14)	13.67 (0.16)	8.62 (0.34)	17.43 (0.49)
AA	24.13 (0.01)	23.96 (0.01)	17.68 (0.01)	31.81 (0.01)
AA−	25.76 (0.01)	25.49 (0.01)	23.03 (0.00)	27.53 (0.01)
A+	38.80 (0.00)	38.66 (0.00)	31.24 (0.00)	45.23 (0.00)
A	49.62 (0.00)	49.49 (0.00)	44.81(0.00)	54.51 (0.00)
A−	67.22 (0.00)	67.07 (0.00)	51.24 (0.00)	78.12 (0.00)
BBB+	83.90 (0.00)	83.73 (0.00)	66.17 (0.00)	94.79 (0.00)
BBB	98.18 (0.00)	98.09 (0.00)	82.89 (0.00)	109.53 (0.00)
BBB−	126.10 (0.00)	126.02 (0.00)	116.14 (0.00)	133.43 (0.00)
BB+	191.72 (0.00)	192.46 (0.00)	171.82 (0.00)	202.06 (0.00)
BB	275.49 (0.00)	276.42 (0.00)	285.98 (0.00)	273.68 (0.00)
BB−	285.80 (0.00)	286.25 (0.00)	322.33 (0.00)	272.09 (0.00)
B+	351.53 (0.00)	352.06 (0.00)	394.78 (0.00)	333.87 (0.00)
B	422.10 (0.00)	422.64 (0.00)	446.14 (0.00)	409.60 (0.00)
B−	503.83 (0.00)	504.06 (0.00)	518.01 (0.00)	498.36 (0.00)
CCC+	576.86 (0.00)	577.92 (0.00)	490.30 (0.00)	596.58 (0.00)
CCC	561.76 (0.00)	561.87 (0.00)	452.31 (0.00)	589.65 (0.00)
MAT	19.46 (0.00)	19.44 (0.00)	20.74 (0.00)	20.03 (0.00)
PROC	−0.01 (0.07)	−0.01 (0.07)	−0.01 (0.13)	−0.01 (0.06)
SENIOR	68.25 (0.00)	68.30 (0.00)	62.14 (0.00)	77.21 (0.00)
CALL	13.08 (0.00)	13.08 (0.00)	9.22 (0.00)	21.27 (0.00)
UTIL	−9.89 (0.00)	−9.93 (0.00)	−3.75 (0.08)	−11.26 (0.00)
R144A	8.26 (0.16)	8.21 (0.16)	19.93 (0.01)	51.42 (0.00)
SHELF	−15.37 (0.00)	−15.36 (0.00)	−11.96 (0.00)	21.69 (0.00)
RISK_PREM	0.79 (0.00)	0.79 (0.00)	0.40 (0.00)	0.94 (0.00)
YEAR dummies	Yes	Yes	Yes	Yes
No. of obs.	8,207	8,207	2,980	5,227
R^2	0.82	0.82	0.88	0.79

Table II reports the regression results.[17] The coefficient for *SPLIT* is 14.58 and is significant at the 1% level, suggesting that yields for two-notch split rated bonds are, on average, about 15

[17] Multiple bond issues by the same issuing firm may create the clustering problem (Wooldridge, 2002, 2003). We use the Cluster option in STATA to adjust for the potential clustering problem and report the cluster-robust *p*-values.

basis points higher than the yields of nonsplit rated bonds with a rating in between the two split ratings.

We also estimate a regression model with an interaction term between the variables *SPLIT* and *JUNK*, a dummy variable for junk bonds, to test whether the impact of split rating is different between investment grade and junk bonds. The coefficient for the interaction term is insignificant, suggesting that two-notch split ratings have a similar impact on bond yields for both investment grade and junk bonds.

As a robustness check, we break the full sample into two different time periods: 1983-1995 and 1996-2008. Columns 3 and 4 of Table II report the regression results for the two subsamples. The coefficients for *SPLIT* in both sample periods are positive and significant.

IV. Analysis of All Splits

A. Methodology

For a large portion of split rated bonds, specifically one-notch and three-notch splits, there is no rating precisely in the middle of the superior and inferior ratings. Therefore, we use a different methodology to examine the general impact of splits upon bond yields. Specifically, we use two regression models to estimate the impact of split ratings on bond yields.

In the first regression model, we evaluate the Treasury spreads for split rated bonds against nonsplit rated bonds with superior ratings. Specifically, for the split rated bonds, we use their superior ratings to create the 17 rating dummy variables: SUP_RATING_j ($j = 1$ to 17). Thus, the *SPLIT* variable reflects the fact that a split rated bond has an inferior rating not captured by the rating dummy variables. The regression model is as follows:

$$TS_i = \alpha + \beta_s * SPLIT_i + \sum_{j=1}^{17} \gamma_j * SUP\_RATING_{ji} + \sum_{j=1}^{8} \delta_j * \text{Control Variable}_{ji} + \sum_{j=1}^{25} \lambda_j * YEAR_{ji}. \quad (1)$$

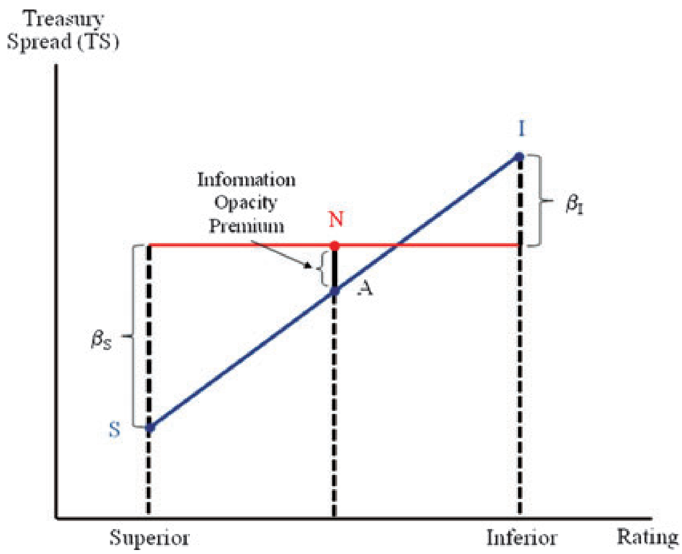
We call Equation (1) the Superior Rating Model. If the yields for the split rated bonds are determined by the superior rating alone and the second rating has no impact, β_S should be insignificant. Alternatively, if investors price the inferior rating as well, β_S should be significantly positive; that is, the inferior second rating should increase the yields since it conveys additional negative information. Thus, the coefficient for *SPLIT*, β_S, can be interpreted as the difference between the actual Treasury spreads of split rated bonds and the estimated Treasury spreads of these bonds if both rating agencies had assigned the same superior rating.

Then, the procedure is reversed. In the second regression model, we evaluate the yields for split rated bonds based on the inferior rating. Specifically, for the split rated bonds, we use their inferior ratings to create the rating dummy variables: INF_RATING_j ($j = 1$ to 17).[18] Thus, the *SPLIT* variable reflects the fact that a split rated bond has a superior rating not captured by the

[18] For nonsplit rated bonds, there is no difference between the *SUP_RATING* and *INF_RATING* variables.

Figure 2. Illustration of Information Opacity Premium

I is the estimated Treasury spreads on split rated bonds if both rating agencies had assigned the same inferior rating. *S* is the estimated Treasury spreads on split rated bonds if both rating agencies had assigned the same superior rating. *A* is the average of *I* and *S*. *N* is the actual Treasury spreads of the split rated bonds. The difference between *N* and *A* is the information opacity premium (*PREM*).



rating dummy variables. The regression model is as follows:

$$TS_i = \alpha + \beta_I * SPLIT_i + \sum_{j=1}^{17} \gamma_j * INF\_RATING_{ji} + \sum_{j=1}^{8} \delta_j * \text{Control Variable}_{ji} + \sum_{j=1}^{25} \lambda_j * YEAR_{ji}. \quad (2)$$

We call Equation (2) the Inferior Rating Model. Similarly, the coefficient for *SPLIT*, β_I, can be interpreted as the difference between the actual Treasury spreads of split rated bonds and the estimated Treasury spreads of these bonds if both rating agencies had assigned the same inferior rating.

The final step compares the two coefficients, β_S and β_I. Let *N* be the actual Treasury spreads of split rated bonds and *S* (*I*) be the estimated Treasury spreads if both rating agencies had assign the same superior (inferior) rating. Then, as illustrated in Figure 2,

$$S = N - |\beta_S|$$
$$I = N + |\beta_I|. \quad (3)$$

The difference between the yields for the superior rating and yields for the inferior rating is

$$I - S = |\beta_I| + |\beta_S|. \quad (4)$$

In other words, the sum of the absolute values of the two coefficients is the difference between the yields for the superior rating and yields for the inferior rating. Further, let A be the average of S and I, or

$$A = (\mathrm{S} + \mathrm{I})/2 = (N - |\beta_S| + N + |\beta_I|)/2 = N + (|\beta_I| - |\beta_S|)/2.$$

Thus, the information opacity premium of split rated bonds is

$$PREM = N - A = N - (N + (|\beta_I| - |\beta_S|)/2) = (|\beta_S| - |\beta_I|)/2. \quad (5)$$

That is, the information opacity premium (*PREM*) is the difference in the absolute values of the two coefficients divided by two. The information opacity premium is shown in Figure 2 as the distance between N and A.

If there is no information opacity premium on split rated bonds, then, per Equation (5), the absolute values of the two coefficients, $|\beta_S|$ and $|\beta_I|$, should be same. Conversely, if there is an information opacity premium on split rated bonds, then $|\beta_S|$ should be larger than $|\beta_I|$.

B. Regression Results

Table III reports the results of the regression models. In the superior rating model, the coefficient for *SPLIT* (β_S) is 26 basis points and significant, suggesting that an inferior second rating significantly increases bond yields. The yields for split rated bonds are typically 26 basis points higher when compared to the estimated yields for these bonds if both rating agencies had assigned the same superior rating. In the inferior rating model, the coefficient for *SPLIT* (β_I) is -12 basis points and significant, indicating that the yields for split rated bonds are, on average, 12 basis points lower than the estimated yields for these bonds if both rating agencies had assigned the same inferior rating.

Note that $|\beta_S|$ is more than twice the size of $|\beta_I|$, suggesting that the impact of superior and inferior ratings are not symmetric. The information opacity premium (*PREM*) is about 7 basis points (i.e., (26 – 12)/2 = 7). This result supports our first hypothesis that investors demand higher yields for split rated bonds to compensate for information opacity.[19]

Next, we break the *SPLIT* variable into four split rating dummy variables, *SPLIT_ONE*, *SPLIT_TWO*, *SPLIT_THREE*, and *SPLIT_FOUR*, corresponding to one-, two-, three-, and four-notch split rated bonds. We observe similar patterns of asymmetric impact for superior and inferior ratings upon bond yields. Furthermore, the difference in the magnitude of the coefficients on split rating dummies between the two regression models is increasingly larger for one-notch, two-notch, and three-notch split rated bonds. For the one-notch split rated bonds, a difference of about 10 basis points between the absolute values of the two coefficients indicates a 5-basis-point information opacity premium on one-notch split rated bonds. For the two-notch (three-notch)

[19] An alternative explanation for the results is that the Treasury spread is a concave function of bond rating. With a concave function, the yield for a split rated bond should be higher than the average of the yields for the superior rating and the yields for the inferior rating. However, Figure 1 indicates that the average (treasury spread) of the superior and inferior rating categories is generally higher than or equal to the (Treasury spread of) nonsplit, suggesting that the Treasury spread is a slightly convex function of ratings.

Table III. All Splits versus Nonsplits: Treasury Spread Regressions

The dependent variable is the Treasury spread in basis points. The base case is AAA rated bonds. *SPLIT* is equal to one for split rated bonds and zero otherwise. *SPLIT_ONE* (*SPLIT_TWO, SPLIT_THREE, and SPLIT_FOUR*) is equals to one for one-notch (two-, three-, four-notch) split rated bonds and zero otherwise. *MAT* is the natural log of the number of years to maturity. *PROC* is the gross proceeds of the bond issue in millions of dollars. *SENIOR* is equal to one for senior bonds and zero otherwise. *CALL* is equal to one for callable bonds and zero otherwise. *UTIL* is equal to one for utility issues and zero otherwise. *R144A* is equal to one for Rule 144A issues and zero otherwise. *SHELF* is equal to one for shelf registered issues and zero otherwise. *RISK_PREM* is the difference (in basis points) between Moody's AAA Bond Index Yield and the 10-year Treasury yield. In the Superior (Inferior) Rating Model, we use the superior (inferior) rating of split rated bonds to construct the rating dummy variables. Thus, the coefficient for *SPLIT* measures the impact of the Inferior (Superior) second rating on the Treasury spreads of split rated bonds. The *p*-values (in parentheses) have been adjusted for potential clustering problems that might arise from multiple bond issues by same firm.

	Superior Rating Model		**Inferior Rating Model**	
Intercept	−43.82 (0.00)	−51.11 (0.00)	−47.36 (0.00)	−47.37 (0.00)
SPLIT	26.38 (0.00)		−12.31 (0.00)	
SPLIT_ONE		20.76 (0.00)		−10.62 (0.00)
SPLIT_TWO		47.57 (0.00)		−17.86 (0.00)
SPLIT_THREE		64.25 (0.00)		−23.83 (0.00)
SPLIT_FOUR		71.36 (0.00)		−62.38 (0.00)
AA+	11.72 (0.19)	11.54 (0.16)	24.97 (0.02)	24.00 (0.03)
AA	16.61 (0.03)	18.57 (0.01)	30.18 (0.00)	30.01 (0.00)
AA−	20.63 (0.01)	21.45 (0.00)	37.53 (0.00)	37.17 (0.00)
A+	30.81 (0.00)	33.01 (0.00)	47.71 (0.00)	47.78 (0.00)
A	45.89 (0.00)	48.36 (0.00)	55.41 (0.00)	55.21 (0.00)
A−	60.85 (0.00)	63.72 (0.00)	68.19 (0.00)	68.15 (0.00)
BBB+	82.07 (0.00)	85.91 (0.00)	89.22 (0.00)	89.40 (0.00)
BBB	101.25 (0.00)	105.09 (0.00)	102.79 (0.00)	102.66 (0.00)
BBB−	133.50 (0.00)	135.63 (0.00)	132.79 (0.00)	132.51 (0.00)
BB+	221.75 (0.00)	222.39 (0.00)	181.42 (0.00)	181.80 (0.00)
BB	244.23 (0.00)	247.15 (0.00)	250.44 (0.00)	250.73 (0.00)
BB−	301.28 (0.00)	304.54 (0.00)	270.75 (0.00)	271.70 (0.00)
B+	364.79 (0.00)	368.97 (0.00)	341.79 (0.00)	342.44 (0.00)
B	430.97 (0.00)	437.63 (0.00)	407.77 (0.00)	408.03 (0.00)
B−	503.99 (0.00)	509.02 (0.00)	482.74 (0.00)	482.96 (0.00)
CCC+	627.97 (0.00)	634.95 (0.00)	580.58 (0.00)	581.17 (0.00)
CCC	557.80 (0.00)	562.68 (0.00)	591.18 (0.00)	595.40 (0.00)
MAT	18.67 (0.00)	18.80 (0.00)	19.21 (0.00)	19.27 (0.00)
PROC	−0.01 (0.05)	−0.01 (0.06)	−0.01 (0.03)	−0.01 (0.03)
SENIOR	63.06 (0.00)	64.57 (0.00)	61.96 (0.00)	62.20 (0.00)
CALL	14.54 (0.00)	14.52 (0.00)	14.62 (0.00)	13.48 (0.00)
UTIL	−12.54 (0.00)	−13.53 (0.00)	−11.70 (0.00)	−11.33 (0.00)
R144A	8.29 (0.05)	8.22 (0.06)	10.65 (0.01)	10.61 (0.01)
SHELF	−17.93 (0.00)	−16.22 (0.00)	−15.83 (0.00)	−16.02 (0.00)
RISK_PREM	0.81 (0.00)	0.82 (0.00)	0.82 (0.00)	0.82 (0.00)
YEAR dummies	Yes	Yes	Yes	Yes
No. of obs.	14,005	14,005	14,005	14,005
R^2	0.81	0.81	0.81	0.81

Table IV. All Splits versus Nonsplits: Robustness Checks

This table reports three variations of the Treasury spreads regressions reported in Table III. First, we break the sample into two subsample periods: 1983-1995, and 1996-2008. We report the coefficients for *SPLIT* in Panel A. Next, we exclude callable bonds, Rule 144A issues, and utility issues from the sample to form a subsample of publicly issued straight industrial bond issues. Panel B reports the coefficients for *SPLIT* for this subsample. Additionally, we add an interaction term between *SPLIT* and *JUNK*, a zero/one dummy variable for junk bonds. We report the coefficients for *SPLIT* and the interaction term in Panel C. The coefficients for other control variables are similar to those reported in Table III and we do not report them to save space. The *p*-values (in parentheses) have been adjusted for potential clustering problems that might arise from multiple bond issues by same firm.

Panel A. Two-Period Subsamples

	1983-1995		**1996-2008**	
	Superior Rating Model	**Inferior Rating Model**	**Superior Rating Model**	**Inferior Rating Model**
SPLIT	19.43 (0.00)	−10.61 (0.00)	30.16 (0.00)	−13.19 (0.00)
No. of obs. (R^2)	5,352 (0.87)	5,352 (0.87)	8,653 (0.78)	8,653 (0.78)

Panel B. Public, Straight, Industrial Bond Subsample

	Superior Rating Model	**Inferior Rating Model**
SPLIT	19.26 (0.00)	−4.42 (0.12)
No. of obs. (R^2)	4,524 (0.67)	4,524 (0.68)

Panel C. Interaction with Junk Bond Dummy

	Superior Rating Model	**Inferior Rating Model**
SPLIT	18.07 (0.00)	−5.86 (0.00)
SPLIT ∗ *JUNK*	32.64 (0.00)	−24.87 (0.00)
No. of obs. (R^2)	14,005 (0.81)	14,005 (0.81)

split rated bonds, the difference in the absolute values of the two coefficients is about 30 (40) basis points, demonstrating an information opacity premium of 15 (20) basis points on two-notch (three-notch) split rated bonds.[20] This result for the two-notch splits is identical to the findings reported in Table II. The information opacity premium increases with the size of the rating differences, supporting our second hypothesis that a multiple-notch split rating is a stronger signal of information opacity than a one-notch split rating.[21]

In addition, we perform four robustness checks. First, we break the sample into two subsample periods, 1983-1995 and 1996-2008, and estimate the Treasury yield regression models on the two subsamples. The coefficients for *SPLIT* are reported in Panel A of Table IV. Similar patterns are observed for the two subsamples although the impact of split ratings is larger in the latter period.

Second, we exclude callable bonds, Rule 144A issues, and utility issues from the sample. Panel B reports the coefficients for the variable *SPLIT* from the regressions for the smaller sample of

[20] In the case of four-notch splits, there are too few observations to make strong statements.

[21] Note that the sum of the absolute values of the two coefficients also increases with the difference of the two ratings. This is not surprising because, by Equation (4), the sum represents the difference between the yields for superior rating and yields for inferior rating. As the difference between the two ratings increases, the yield difference should also increase.

public straight bonds of industrial firms. While the coefficients are smaller (in absolute value) in both regressions, the estimated opacity premium (*PREM*) of split rated bonds, about 7 basis points, is similar to the full sample estimation.

Third, we add an interaction term between *SPLIT* and *JUNK* in the regressions. Panel C of Table IV reports the coefficients for *SPLIT* and the interaction term. For investment grade bonds, the sum of the absolute values of the two coefficients is 24 basis points, smaller than the estimated 38 basis points for the entire sample. This pattern is not surprising as the yield difference between different rating categories of investment grade bonds is smaller. The yield premium for the split rated investment grade bonds is about 6 basis points (i.e., $(18 - 6)/2 = 6$) above their similar nonsplit rated counterparts. Alternatively, an inferior second rating increases the Treasury spreads of junk bonds by about 51 basis points $(18 + 33)$, while a superior second rating decreases the Treasury spreads of junk bonds by about 31 basis points $(6 + 25)$. The larger impact of a second rating is consistent with the larger yield difference between different rating categories of junk bonds. The yield premium of split rated junk bonds over their nonsplit rated counterparts is about 10 basis points (i.e., $(51 - 31)/2 = 10$). The higher opacity premium for split rated junk bonds suggests that investors are more sensitive to the information opacity of junk bond issuers.

C. Economic Recession, Split Ratings, and Information Opacity Premium

Information opacity and/or investors' required premium for information opacity may fluctuate with the overall economy. During economic uncertainty, the information opacity of all issuers may increase, leading to a higher proportion of split rated bond issues. Alternatively, Bernanke, Gertler, and Gilchrist's (1996) financial accelerator models demonstrate that investors may, in a flight to quality, avoid investing in firms with significant information opacity or require a much higher yield premium during economic recession. As a result, firms with significant information opacity may not be able to access the bond market, leading to a reduction of the proportion of split rated bond issues. In addition, the required information opacity premium on split rated bonds is likely to be higher during economic recession as uncertainty about the future increases and/or investors become more risk averse. In this section, we investigate the relationship between split ratings, information opacity premiums, and economic recessions.[22]

We first calculate the monthly percentage of newly issued split rated bonds. For the entire sample (309 months), the average monthly percentage of split ratings is 51.12%. For nonrecession periods (283 months), the average is 51.76%. During periods of recession (26 months), the average is 44.17%. The difference between nonrecession and recession periods is statistically significant at the 1% level. In addition, for the 26 months of economic recessions, 19 months have below median monthly percentages of split ratings. To visualize these results, Figure 3 plots the monthly percentages of split ratings.

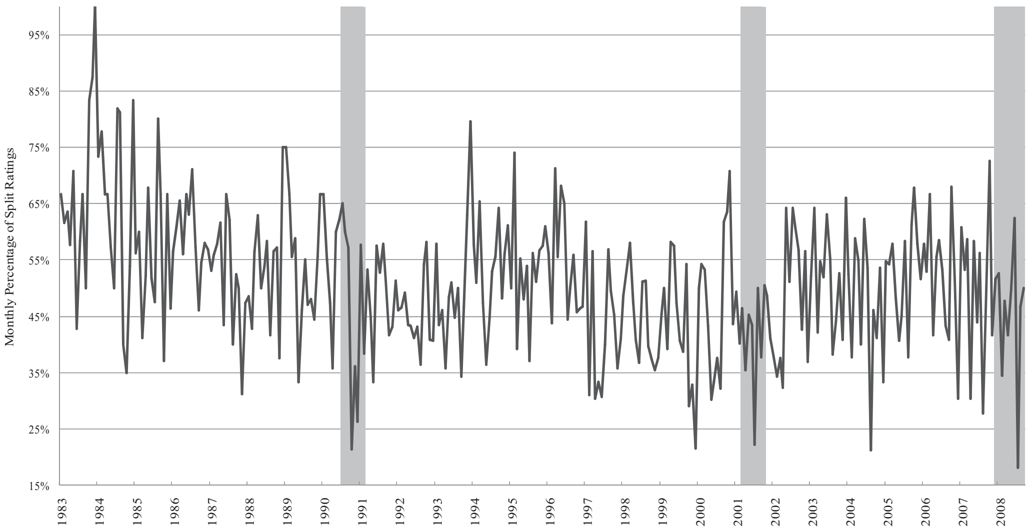
Next, the sample is divided into two subsamples, 1) recession and 2) nonrecession, and the information opacity premium for the two subsamples are estimated separately. For the nonrecession subsample, the β_S and β_I are 26.11 and -12.96, respectively. Thus, the information opacity premium for split rated bonds is about 7 basis points in nonrecession months, similar to the whole sample. For the recession subsample, the β_S and β_I are 27.77 and -4.56, respectively. Consequently, the information opacity premium for split rated bonds is about 12 basis points in recessions, almost twice as high as that in nonrecession months.[23]

[22] We would like to thank an anonymous referee for the suggestion to examine the relationship between split ratings, information opacity premiums, and economic recessions.

[23] The regression coefficients for other control variables are similar to those reported in Table III. We do not report them to conserve space. They are available upon request.

Figure 3. Decreasing Issuance of Split Rated Bonds in Recessions

This figure depicts the monthly percentages of split rated bond issues. The shaded areas are months in economic recession according to the data from NBER.



These findings indicate that firms with significant information opacity have a harder time accessing the bond market during economic downturns. For those that do issue split rated bonds in recession, investors require a much higher information opacity premium. Therefore, an initial shock to the economy leads to contraction of the capital market and higher costs of capital to firms, which, in turn, will deepen the economic recession. This evidence supports the financial accelerator models of Bernanke, Gertler, and Gilchrist (1996).[24]

V. Conclusion

This paper tests the joint hypotheses that: 1) a split rating is a signal of information opacity, and 2) information opacity is priced by bond investors. First, we find the yields for all split rated bonds are about 7 basis points higher than those of nonsplit rated bonds of similar credit risk. Second, the yield premium on split rated bonds increases from 5 basis points for one-notch splits to 20 basis points for three-notch splits. These findings support the hypothesis that a split rating is a signal of information opacity and the information opacity contained in split ratings is a risk factor that investors price in bond yields. Firms bear a cost for split ratings and for the information opacity implied by these split ratings. Furthermore, our paper finds that split ratings are less common during economic recessions, and the information opacity premium for split rated

[24] The current economic recession is a perfect example of the financial accelerator effect. The initial shock of the subprime mortgage crisis quickly froze the credit market, cutting off financing to firms outside the housing and mortgage industries. The ensuing credit crunch is most devastating to high-yield bond issuers, which have more severe information opacity problems.

bonds is higher. These patterns suggest that during recessionary periods, firms with significant information opacity encounter more difficult access to the capital markets and investors require greater opacity premiums. These findings support the financial accelerator models of Bernanke, Gertler, and Gilchrist (1996). ■

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