Are Underrated Bonds Underpriced? Biased Ratings and Corporate Bond Pricing

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Credit rating agencies have suffered a serious loss in credibility in light of their role in the recent mortgage credit crisis of 2008. The documented bias in credit ratings confronts financial markets with uncertainties regarding their relevance. Should investors continue to rely on credit ratings in their portfolio allocation decisions? Should banks use ratings to evaluate credit risk of collateral? Should corporate managers consider the impact on ratings when formulating financial policies? This study addresses one aspect of this broad issue and evaluates if and how rating biases affect corporate bond pricing and yield spreads. If bonds receive better (worse) ratings than justified and bond markets rely on these biased ratings, then bonds would be over (under) priced and thus trade at smaller (larger) yield spreads. Using a large sample of initial bond ratings from Standard and Poor's, Moody's and Fitch between 1995 and 2010, this study discovered that credit ratings continue to elicit informational value beyond financial and issue-related characteristics. However, the yield spreads of bonds—which are subject to rating biases—suggests that capital market participants recognize and correct for these biases through bond pricing.

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1. Introduction

The primary interest in this article is to evaluate the relevance of credit ratings issued by Standard and Poor's (S&P), Moody's and Fitch between the years 1995 and 2010 for corporate bond yield spreads. Credit ratings are intended to be unbiased measures of credit quality and default risk of debt issuers; in fact, there is a vast array of empirical literature which has shown that investors use the informational signals contained in credit ratings to price debt securities[1]. When ratings become unreliable due to rating biases, this could have serious implications for bond yields and for the broader economy[2]. There is limited evidence in the current literature on the issue of if and how rating biases affect yield spreads on bonds. This study advances the extant literature by testing for the existence of rating biases in corporate debt ratings, examining the dynamic relationship between spreads and ratings over time, and also documenting how the existence of rating biases influences bond pricing. The inflation in credit ratings of structured finance products, such as Collateralized Debt Obligations (CDOs) and Mortgage Backed Securities (MBS), has played a significant role in the unraveling of the recent sub-prime mortgage crisis and ultimately in the economy-wide financial meltdown[3]. There is now a growing body of research which examines the extent and causes of this rating inflation. For example, Griffin and Tang (2011) provided direct evidence of rating inflation in

[1] See Kliger and Sarig (2000) for a comprehensive review of the literature and evidence on the informational value of credit ratings to bond pricing.

[2] The term rating bias here is intended to describe the deliberate practice of assigning better (or worse) credit ratings than warranted by objective risk analysis.

[3] According to a quote from the Financial Crisis Inquiry Commission's report of January 2011, Page 25, "The three credit rating agencies were key enablers of the financial meltdown. The mortgage-related securities at the heart of the crisis could not have been marketed and sold without their seal of approval. Investors relied on them, often blindly. In some cases, they were obligated to use them, or regulatory capital standards were hinged on them. This crisis could not have happened without the rating agencies. Their ratings helped the market soar and their downgrades through 2007 and 2008 wreaked havoc across markets and firms."

CDO ratings issued prior to 2007. They found that an overwhelming majority of these CDOs received high ratings from a top rating agency but were all subsequently subject to massive downgrading. The study further reported that the initial ratings assigned to these securities were deliberately inflated beyond what the rating agency's own quantitative models implied, thus bringing into question the efficacy of credit ratings. He, Qian and Strahan (2012) found that the bond pricing and yields of MBS securities prior to the financial meltdown reflects a discount for rating inflation, especially for large issues. Another study by Cornaggia, Cornaggia and Hund (2011) compared ratings across different asset classes and found that ratings of structured finance products are in general more generous than that of corporate, municipal and sovereign debt issues.

In contrast to the empirical evidence on rating inflation of structured finance products, however, previous research on corporate credit ratings has found evidence consistent with rating deflation[4]. An early study by Blume, Lim and Mackinlay (BLM) (1998) of a sample of firms rated by S&P found that holding firm credit quality attributes consistent to the ratings of these firms worsened over the time period between 1978 and 1995. While BLM's sample predated the recent credit crisis by over a decade, other studies have documented that this rating stringency in corporate ratings has continued into more recent time periods[5]. Rating agencies that become overly conservative could result in the perverse effect of increasing the cost of borrowing for firms whose credit ratings do not reflect their credit quality adequately. In other words, when bonds are underrated they could end up being underpriced and therefore trade at higher yields. The evidence in the current literature is relatively silent on the implications of rating biases to corporate bond yields. The aim of this study then is to evaluate the yield-rating relationship and test whether the yield spreads of corporate bonds have been materially affected by rating biases. If the downward bias is not recognized by the bond markets then it is possible that bond prices will be lower and spreads will be larger. However, if informed trading in the bond markets recognizes the rating bias, there could be a price correction which would result in lower spreads.

Following BLM, the majority of the existing research on corporate credit rating standards typically focuses on the issuer level ratings issued by S&P[6]. Gonis and Taylor (2004), who also studied the rating standards issue for just a sample of U.K. firms, used the ratings issued by S&P as well. However, recent research has found that split ratings are not necessarily equivalent, when a debt issue/issuer is rated by multiple rating agencies. Therefore results found in the context of ratings issued by one agency may not be generalizable (see Bongaerts, Cremers and Goetzman, 2012; Jewell and Livingston, 2000; and Livignston, Wei and Zhou, 2010). This study complements the existing body of research by using issue level initial ratings as opposed to issuer ratings from all three major rating agencies, including S&P, Moody's and Fitch ratings[7].

A battery of tests to evaluate the yield spread-credit rating relationship establishes three main findings. First, credit ratings from S&P, Moody's and Fitch explain a significant portion of the residuals from yield spread regressions on various issue/issuer characteristics and time fixed effects. This finding ratifies the informational value of credit ratings despite the criticism levied against rating agencies in the recent past. Second, the credit ratings issued by S&P and Fitch display progressively stronger negative correlations with yield spreads over the sample period. If ratings

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[4] While there is some evidence of rating inflation the consensus seems to be in favor of rating deflation in corporate ratings. In an analytical model, Bolton, Freixas and Shapiro (2012) demonstrated that when issuers can shop for ratings from different agencies this in itself can result in inflated ratings. Becker and Milbourn (2011) provided empirical evidence that increased competition in the credit rating industry has indeed led to rating inflation in corporate credit ratings.

[5] See Amato and Furfine (2004). Alp (2010) and Baghai et al. (2011) also presented evidence on rating deflation in corporate ratings for more recent sample periods.

[6] Becker and Milbourn (2011) tested the impact on ratings issued by S&P as well as Moody's as a response to increased competition; they found that the rating quality of these agencies declined as Fitch's market share increased. The analysis in the current study, however, suggests that the rating biases are unilaterally applicable to all three rating agencies.

[7] The Securities and Exchange Commission recognizes at least ten credit rating agencies whose opinions on the credit worthiness of fixed income issues and issuers are recognized for regulatory purposes. Three of these rating agencies, Standard and Poor's (S&P), Moody's and Fitch ratings, dominate the credit rating industry, especially for corporate bonds.

have become less relevant, then their effect on yields should dissipate—not strengthen— over time. Finally, measures of rating bias obtained from predictive rating models show that corporate ratings have indeed been subject to a negative rating bias in the latter half of the sample period. However, the bonds which are subject to a negative rating bias experience a further reduction in yield spreads controlling for their actual credit rating and other issuer/issue characteristics. This last finding suggests that rating biases are not counted for in the bond markets.

2. Credit Ratings Data

The credit ratings data used in this study is drawn from the Mergent FISD database for the period 1995–2010. Becker and Milbourn (2011) also focused on the ratings after 1995 in their study due to the non-availability of issue level ratings prior to 1995 in the Mergent database**.** The final sample used in this study includes senior bonds which were assigned a rating from S&P, Moody's or Fitch at the time of issue and for whom yield spread data are available. Additionally, only bonds with a fixed coupon rate are included, and bonds which are putable, exchangeable or convertible are excluded. Also, foreign currency denominated bonds and yankee bonds (i.e. bonds issued by foreign companies in the U.S.) are excluded.

S&P uses rating assignments that range from AAA, AA, A, BBB and so forth, to a CC rating. A rating of C or D is assigned to an issue/issuer that has filed for bankruptcy or is in default. Bonds issued by firms in default or bankruptcy are excluded from the study. S&P also assigns positive and negative signs to their letter ratings to denote the relative standing of a firm within a rating class. All ratings better than a BBB rating are considered to be investment grade and those that are below are considered to be speculative grade or junk rated issues/issuers. Both investment and speculative grade ratings are considered here but the study excludes defaulted issuers. Moody's also uses letter ratings that go from Aaa, Aa, A, Baa, Ba, B, Caa, Ca, to a C. Similar to S&P, Moody's also assigns relative ranking within each rating class with the numbers 1, 2, and 3. Fitch ratings follow the same scale as S&P. Each letter credit rating class from these three rating agencies is assigned a numerical rank from 1 for the lowest rating class to 7 for the highest rating class. Thus, by this standard, rating values greater than or equal to 4 would represent investment grade ratings, and all ratings below 4 would represent speculative grade ratings[8]. Different researchers use different schemes for these rankings but the scheme used in this study most closely resembles that found in the research conducted by Ashbaugh-Skaife, Collins and LaFond (2006). This numerical ranking, or ordering, is the primary dependent variable in the empirical tests designed to test for rating standards.

The frequency distribution across the sample period of the issue level ratings from each of three rating agencies thus obtained is presented in Table 1**.** As noted earlier, some past studies use firm level ratings issued by S&P, which is available in the COMPUSTAT database. However, Amato and Furfine (2004) found that the S&P issuer rating dataset suffers from a rating staleness problem. The issuer ratings in the COMPUSTAT database do not reflect the deliberate assessment of the credit quality of the issuer as S&P does not periodically re-evaluate a credit rating unless specific events occur which could significantly alter the credit profile of the firm. The issue level ratings do not suffer from this rating staleness problem and is more reliable data to detect relevance of rating to bond pricing at issuance[9].

3. Univariate Analysis of Yield Spreads and Ratings

The yield spread variable extracted from Mergent is calculated as the yield of the bond at issue

[8] In the empirical tests conducted in this paper, investment grade and speculative grade bond issues are pooled together. All the analysis and results obtained are discussed in the context of this aggregate sample. However, the empirical tests were also conducted for investment grade and speculative grade bonds separately. The results obtained are qualitatively similar across the two groups and hence not reported.

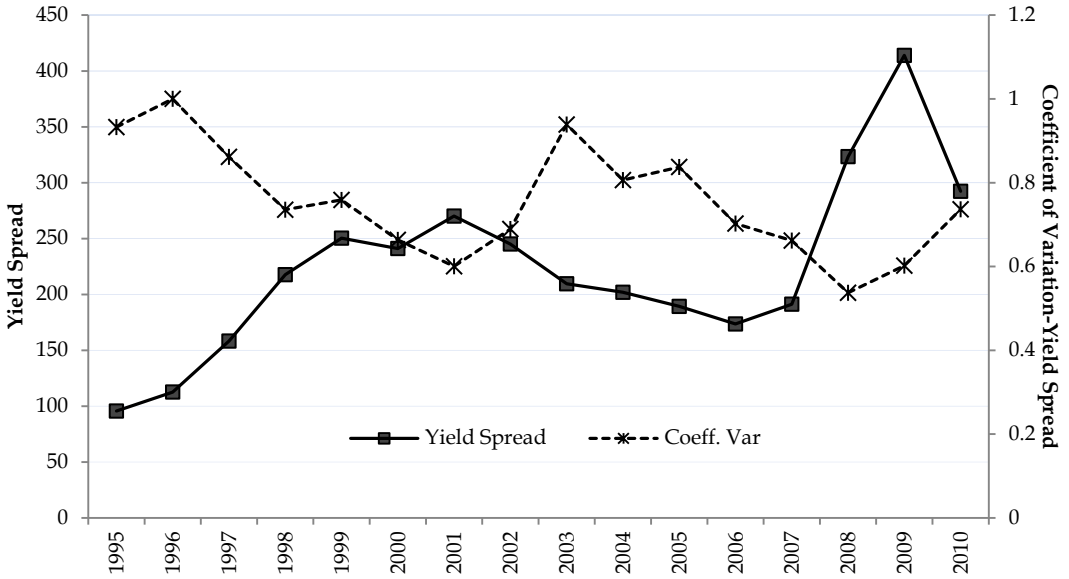
[9] All the results presented in this study have been verified for robustness using issuer level credit ratings from S&P as well. These results were included in previous versions of this study. The conclusions drawn from the issue level analysis here are qualitatively similar to those obtained using the issuer level credit ratings.

minus the yield on a benchmark treasury security. This variable is expressed in the number of basis points. Figure 1 plots the time series average of the yield spread for all the bonds in the sample considered here and the coefficient of variation (standard deviation/mean) of the yield spread as well.

Table 1
Distribution of issue level bond ratings

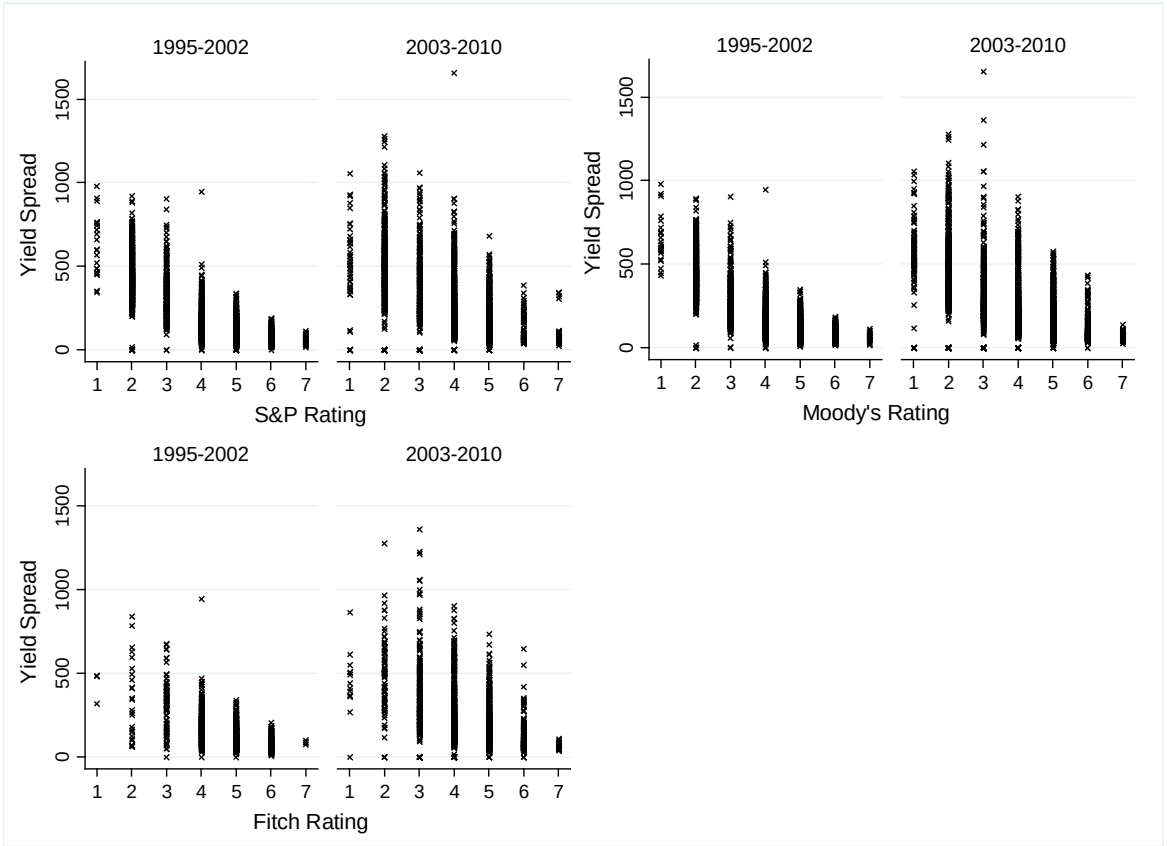
Panel A. S&P	AAA	AA	A	BBB	BB	B	Below B	Total
1995	8	48	128	75	14	14	2	289
1996	4	28	108	107	12	35	0	294
1997	4	30	125	155	39	126	1	480
1998	6	39	130	132	62	126	6	501
1999	5	34	110	100	29	99	1	378
2000	0	14	96	59	18	26	7	220
2001	4	26	129	155	56	61	3	434
2002	0	24	99	124	31	60	1	339
2003	7	13	99	167	52	99	18	455
2004	0	12	61	96	46	65	11	291
2005	0	6	32	41	15	32	2	128
2006	1	6	41	46	19	17	6	136
2007	3	3	61	69	15	17	3	171
2008	3	12	109	104	18	12	1	259
2009	8	20	155	220	60	57	2	522
2010	6	17	121	186	74	89	8	501
Total	59	332	1,604	1,836	560	935	72	5,398
Panel B. Moody's	AAA	AA	A	BBB	BB	B	Below B	Total
1995	5	29	88	72	18	10	2	224
1996	4	23	132	76	32	31	0	298
1997	2	26	132	139	55	125	1	480
1998	1	37	124	138	60	134	9	503
1999	5	31	121	102	33	97	2	391
2000	0	19	92	59	23	28	3	224
2001	4	37	137	152	62	68	4	464
2002	0	36	124	149	39	65	3	416
2003	8	39	161	195	84	140	14	641
2004	2	24	76	126	57	100	14	399
2005	2	25	84	112	45	60	10	338
2006	4	21	83	137	41	39	12	337
2007	4	36	112	155	37	48	16	408
2008	3	23	141	133	24	13	3	340
2009	4	21	146	227	57	74	7	536
2010	6	27	103	179	68	90	22	495
Total	54	454	1,856	2,151	735	1,122	122	6,494
Panel C. Fitch	AAA	AA	A	BBB	BB	B	Below B	Total
1995	0	15	61	32	2	1	0	111
1996	0	16	51	33	3	2	0	105
1997	0	13	43	44	12	2	0	114
1998	0	16	31	38	15	10	0	110
1999	2	10	25	41	4	0	1	83
2000	0	12	37	35	12	3	0	99
2001	2	32	91	108	24	2	0	259
2002	0	18	85	93	12	6	2	216
2003	7	23	105	140	52	10	2	339
2004	2	21	61	83	28	10	3	208
2005	0	20	60	69	18	5	1	173
2006	3	21	79	98	30	10	2	243
2007	3	33	94	119	23	7	4	283
2008	1	18	118	94	14	1	0	246
2009	0	18	117	160	43	9	0	347
2010	2	11	98	124	33	28	2	298
Total	22	297	1,156	1,311	325	106	17	3,234

Figure 1



Time series means of Yield Spreads and Coefficient of Variation of Yield Spread- 1995-2010

Figure 2



Distribution of Yield Spreads by Credit Rating Class and Sub-sample periods, 1995-2002 and 2003-2010. Ratings are coded as 1 for Below B, 2 for B, 3 for BB, 4 for BBB, 5 for A, 6 for AA and 7 for AAA

As Figure 1 shows the yield spread's display, a cyclical but a generally rising trend with two peaks reflecting the two economic growth cycles is contained within the sample period 1995-2010[10]. The coefficient of variation of the yield spread also displays some cyclicality. The troughs in the time series of the coefficient of variation coincides roughly with the peaks of the yield spread variable. This implies that in economic downturns, yield spreads across different types of debt securities tend to converge and during expansions are more widely distributed.

Table 2 for the two sub-sample periods, 1995-2002 and 2003-2010, respectively. These summary statistics indicate that the mean rating levels for all three rating agencies have declined over the sample period. This decline is statistically significant as indicated by the difference in the mean t-statistic. While ratings have declined, the average yield spreads have increased. This is consistent with the conjecture that worse ratings indicate increasing default risk and therefore result in larger yield spreads. However, indicators of default risk, such as issuer leverage and profitability, do not fully support the decline in credit ratings. For example leverage levels, both long term and total debt, have declined over the sample period while profitability, measured as interest coverage ratios and operating margins, have remained unchanged. This univariate evidence complements the findings in BLM and other studies that rating agencies may be employing stricter rating standards and issuing worse ratings even though firm credit quality has not declined[11].

Table 2
Summary statistics

	1995-2002				2003-2010				Diff in Mean
	Mean	Median	SD	N	Mean	Median	SD	N	t-test
S&P Rating	4.03	4.00	1.28	2,935	3.88	4.00	1.20	2,463	4.31
Moody's Rating	3.99	4.00	1.27	3,000	3.89	4.00	1.26	3,494	3.39
Fitch Rating	4.51	5.00	0.92	1,097	4.31	4.00	0.97	2,137	5.49
Yield Spread	203.58	145.00	163.96	3,127	255.20	185.00	203.96	3,571	-11.47
Maturity (Yrs)	11.97	10.00	11.34	3,127	11.29	10.00	7.88	3,571	2.82
Offering Amount	350,849.40	250,000.00	402,054.50	3,127	498,165.30	350,000.00	475,341.40	3,571	-13.74
Total Debt/Assets	0.41	0.37	0.22	2,895	0.35	0.32	0.21	3,514	10.66
LT Debt/Assets	0.31	0.30	0.18	2,915	0.30	0.27	0.18	3,517	3.08
Operating Margin	0.24	0.20	0.44	2,770	0.23	0.21	0.45	3,405	1.16
Int. Coverage	11.47	3.55	22.93	3,022	12.31	4.35	21.89	3,558	-1.51
Beta	0.78	0.74	0.51	2,385	1.06	0.98	0.49	2,805	-20.03
Mkt. Model Std. Err	0.02	0.02	0.01	2,385	0.02	0.02	0.01	2,805	8.48

Notes: This table presents the summary statistics for the issue/issuer characteristics for the sub-sample periods 1995-2002 and 2003-2010. The data used in the computation of issuer characteristics are from the COMPUSTAT database except for the market model beta and standard errors which are computed using price and return data from CRSP. Int. Coverage is defined as COMPUSTAT data item (shown in italics) *oiadp* divided by *xint.* Operating Margin is defined as *oibdp* divided by *sale*. LT debt/Assets is defined as *dltt* divided by *at*. Total debt/Assets is defined as *dlcc+dltt* divided by *at*. Size is defined as the log of book assets, *at*. Beta and Std. Error are the market model slopes and residuals respectively. The credit spread, here expressed in basis points, is extracted from the Mergent FISD database and is defined as the difference between the yield of a bond at issuance minus the yield on a benchmark treasury security.

[10] According to the business cycle data published on www.nber.org, the sample considered here includes two recessionary periods: the first was between first quarter in 2001 until the last quarter in 2001 and the second lasted between the fourth quarter in 2007 until the second quarter in 2009.

[11] The summary statistics also show that the systematic risk of equity, measured as the market model beta, has increased over the sample period while the idiosyncratic risk in equity returns, measured as the market model standard error, has reduced. These patterns are not entirely consistent with rating deflation as they present mixed support.

4. Multivariate Analysis of Yield Spreads and Credit Ratings

Empirical Models

The preceding analysis presents some evidence that rating agencies are becoming stricter in their ratings of corporate debt issues. As noted by BLM, there is a possibility, however, that the observed patterns simply indicate the changing nature of credit risk over the sample period and what was once considered metrics of good credit do not apply in the new economic order of the late 1990s and 2000s. In this section the impact of ratings on yield spreads, if any, is evaluated in three steps. First, the marginal explanatory power of ratings to yield spreads is tested. See Eq. (1) and Eq. (2). In these tests the residuals from yield spread regressions, Eq. (1), on relevant factors, X_{it}, other than ratings, are obtained. The focus on the residuals allows for the evaluation of the informational value of ratings beyond that contained in other publicly available information on the issue/issuer. The X_{it} variable set includes issue level variables, such as time to maturity, issue size and year fixed effects[12]. Following Becker and Milbourn (2011), these variables are log transformed. In addition, issuer level measures of profitability, interest coverage and operating margins, measures of leverage, long term and total debt, a measure of firm size, and two measures of equity risk, market model beta and standard errors are included in the X_{it} variable set. Summary statistics for all variables used in the study are presented in Table 2. The residuals, ε_{it}, represent the unexplained component of the yield spreads. These residuals are then regressed on the actual credit ratings, CR_{it}, issued by S&P, Moody's and Fitch in turn. The coefficient γ is expected to be negatively associated with yield spreads as higher ratings signify lower credit risks and hence these bonds should trade with lower yield spreads.

$$YS_{it} = C + \beta X_{it} + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = C + \gamma CR_{it} + \vartheta_{it} \quad (2)$$

Second, the temporal stability of the rating-yield relationship is evaluated using a dummy variable interactions model (see Eq. (3)). Using the time series midpoint in the sample, the year 2002, as a demarcating point, an interaction term between an indicator variable for the latter half of the sample with the credit ratings is included as an explanatory factor in yield spread regressions[13]. The coefficient on this interaction variable, γ_3, would indicate whether or not the rating-yield relationship has changed over time. If this coefficient carries a negative sign, this would indicate that the relationship between ratings and yields is strengthening; a positive sign would indicate a weakening relationship; and if the coefficient is statistically insignificant, this would imply that the correlation between ratings and yields has remained unchanged over the sample period.

$$YS_{it} = C + \beta X_{it} + \gamma_1 CR_{it} + \gamma_2 Post2002Dummy + \gamma_3 CR_{it} * Post2002Dummy + \varepsilon_{it} \quad (3)$$

Finally the impact of rating biases on yield spreads is directly evaluated in a third set of tests. See Eq. (4) and Eq. (5). In these tests the first half of the sample, 1995-2002, t^*, is used to create predictive models of credit rating[14]. The explanatory variable set, X_{it}, includes a subset of the variables used in the yield spread regressions. The estimated coefficients from Eq. (4) are then used to predict ratings in the second half of the sample period, 2003-2010. The difference between the predicted ratings and the actual ratings, $\widehat{CR_{it}} - CR_{it}$, is then used to measure the extent of the rating bias. Positive differences between predicted and actual would denote negative rating biases. This rating bias proxy variable is then introduced in the yield spread regressions to evaluate the impact, if any, rating standards have on yield spreads.

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[12] All the regressions estimated in this paper were checked for robustness to include month/year fixed effects as opposed to the year fixed effects. Qualitatively similar results were obtained in these estimations. In addition, industry fixed effects at the 2-digit SIC level were also included for robustness. The results remained unaltered.

[13] While choosing 2002, the midpoint in the sample, is somewhat arbitrary, regressions estimated with alternate cut points do not materially alter the results obtained. However, since the empirical evidence on rating biases shows a temporal trend, examining the relevance of ratings around the midpoint of the sample does make intuitive sense. See Amato and Furfine (2004).

[14] The predictive models are estimated using OLS in the results reported here. For robustness, the predictive models were also estimated using Ordered Probit regressions. The results remain qualitatively similar to those reported in the paper.

$$CR_{it^*} = C + \beta X_{it^*} + \varepsilon_{it^*} \quad (4)$$

$$YS_{it} = C + \beta X_{it} + \gamma_1 CR_{it} + \gamma_2(\widehat{CR_{it}} - CR_{it}) + \varepsilon_{it} \quad (5)$$

The coefficient γ_2 is expected to be negative if bond markets recognize and correct for rating deflation bias. A positive γ_2 would signify that the capital markets view the deflation bias to be insufficient. A statistically insignificant γ_2 coefficient would mean that bond markets do not recognize any rating biases and consider the actual rating to be accurate as well as the prices the debt issues.

Marginal Effect of Credit Ratings on Yield Spreads

Table 3 presents the estimates from regressions of Eq. (1) and Eq. (2). Panel A shows the results from estimating Eq. (1). All models in Panel A include year fixed effects to control for time varying macro-economic factors. In Model 1, the regression includes only bond issue characteristics, such as time to maturity and the offering size. These variables are log-transformed. In addition, squared values of these variables are also included to allow for nonlinearities in extreme values. As expected, longer maturity is positively associated with yields but with bonds there is some nonlinearity present in this variable. The offer size variables enter the regressions with insignificant coefficients. The r-square for Model 1 is 0.25, implying that only a small portion of the total variation in yield spreads is captured by these bond issue characteristics and year fixed effects, and more than three-quarters of the variation in the yield spreads are unexplained. Next, in Model 2, issuer characteristics at the time of issue—such as profitability and leverage measures—are included. This increases the r-square value substantially to 0.44, leaving only a little more than half in unexplained variation.

Table 3
OLS Regressions of Yield Spreads on Issue/Issuer Characteristics and Credit Ratings

Panel A.	Model 1	Model 2	Model 3	Model 4
Log Time to Maturity	298.13***	120.11***	93.82***	114.96***
Log Time to Maturity-Squared	-65.21***	-27.70***	-19.88***	-25.75***
Log offering amount	-62.67	-152.05***	-158.21***	-207.30***
Log offering amount-Squared	0.59	7.08***	6.36***	8.58***
Int. Coverage		0.13	-0.11	-0.03
Operating Margin		-37.88***	-19.32***	-49.03***
Long Term Debt/Assets		145.00***	58.01**	49.64**
Total Debt/Assets		86.75***	96.45***	178.50***
Log Assets		-45.45***	-31.66***	-42.26***
Beta			28.00***	
Mkt. Model Std. Err			5,250.49***	
Year Fixed Effects?	Yes	Yes	Yes	Yes
R^2	0.25	0.44	0.56	0.45
N	6,698	6,156	4,900	4,900
Panel B.	Model 1	Model 2	Model 3	
S&P Rating	-30.80***			
Moody's Rating		-28.48***		
Fitch Rating			-22.31***	
Constant	121.04***	112.23***	93.01***	
R^2	0.09	0.08	0.04	
N	3,949	4,767	2,370	

Notes: Panel A of this table shows the results obtained from regression the bond yield spreads on various issue and issuer characteristics. All models include year fixed effects. Intercepts are not reported. Panel B shows the results obtained from OLS regressions of the residuals from Model 3 on the credit ratings issued by S&P, Moody's and Fitch in columns (1) ,(2) and (3) respectively. Coefficient t-stats are reported in parentheses below coefficients. ***,** and * indicate significance at the 10%, 5% and 1% levels.

Additionally, in these models the offering size variables become statistically significant and carry the expected signs. Larger offerings have lower spreads. The issuer characteristics also reveal new information: more profitable firms have lower yields, more leveraged firms have higher yield spreads, and larger firms have smaller spreads. Next, in Model 3, the variables which capture issuer's equity risk are included. These variables are the market model beta and standard errors. This model results in an even higher r-square of 0.56, thus reducing the unexplained variation to less than half. The equity risk measures are positively associated with yield spreads. However, in Models 2 and 3, there is a significant reduction in sample size as not all issuers covered in Mergent have data available in COMPUSTAT and CRSP. To ensure the robustness of the estimates and r-square value of Model 2, another regression is run with the issue and issuer characteristics only for the sample of firms which have the necessary data available through CRSP to compute the equity risk measures. The result from this regression is reported as Model 4. The coefficients and r-square values are similar to that found for Model 2. The residuals from Model 3 are used going forward to evaluate Eq. (2) to test the marginal explanatory power of credit ratings.

Panel B reports the estimates from Eq. (2). The residuals from Model 3 represent the unexplained part of the yield spreads that issue/issuer characteristics and year fixed effects were unable to explain. These residuals are regressed on the ratings issued by S&P, Moody's and Fitch in turn and are reported in Columns 1, 2 and 3 respectively. All three ratings have significant explanatory power as they enter the regressions with negative coefficients. While the r-square values are relatively low (ranging between 0.04 and 0.09), the marginal effect of ratings on yield spreads ranges between 22 and 31 basis points. Relative to the mean yield spreads reported in Table 2, this marginal effect is economically significant. It should be noted, however, that this finding applies only to the primary market yields and secondary market yields are not evaluated here.

Temporal Stability of The Rating-Yield Spread Relationship

Table 4
OLS Dummy Variable Interaction Regressions of Yield Spreads

	1	2	3
S&P Rating	-72.62***		
S&P Rating x Post 2002 Indicator	-9.63***		
Moody's Rating		-75.79***	
Moody's Rating x Post 2002 Indicator		-3.58	
Fitch Rating			-47.26***
Fitch Rating x Post 2002 Indicator			-19.55***
Post 2002 Indicator	167.18***	139.55***	197.83***
Log Time to Maturity	34.28**	27.85**	46.34***
Log Time to Maturity-Squared	-5.96**	-4.46	-8.60**
Log offering amount	-166.40***	-286.93***	-229.53***
Log offering amount-Squared	6.72***	11.38***	9.03***
Int. Coverage	-0.11	0.17**	0.16
Operating Margin	-18.43***	-20.81***	-4.53
Long Term Debt/Assets	-120.79***	-101.40***	4.93
Total Debt/Assets	88.41***	103.72***	72.02***
Log Assets	-13.99***	-7.75***	-4.50**
Beta	13.35***	9.71**	10.45*
Mkt. Model Std. Err	3,135.43***	3,388.20***	4,215.29***
Year Fixed Effects?	Yes	Yes	Yes
R^2	0.66	0.66	0.61
N	3,949	4,767	2,370

Notes: This table presents the OLS Yield Spread regressions to evaluate the temporal shifts in the yield spread-credit rating correlations. All columns include year fixed effects. Intercepts are not reported. Coefficient t-statistics are reported in parentheses below the coefficients. *, ** and *** represent significance at the 10%, 5% and the 1% levels.

The next set of tests turns to evaluating whether the rating-yield spread relationship has changed over the sample period considered here. Part of the criticism levied against the rating agencies is that agencies are providing biased rating assignments and in the case of corporate ratings there is a negative bias. Corporate ratings are worse than they were, holding firm credit quality constant. If rating biases cause the bond markets to weigh credit ratings less in their valuation models, then ratings should become less relevant and the negative correlation established in the previous tests should dissipate over time. As discussed earlier, Eq. (3) constructs a dummy variable interactions model in which the credit ratings are interacted with an indicator variable for the latter half of the sample period. This interaction term is meant to capture the relative effect of ratings on yields in the latter half of the sample period over and above the overall sample effect.

The results from estimating Eq. (3) are presented in Table 4. Columns 1, 2 and 3 show the results for each of the three ratings agencies, S&P, Moody's and Fitch, respectively. First, the indicator variable for the post-2002 time period is positive and statistically significant for all three ratings. This result ratifies the univariate evidence presented earlier that yield spreads in general are higher in more recent time periods. Second, all the three rating variables are significantly negatively correlated with yields, as reported in Table 3. The marginal effects are, however, larger as these models regress the actual yield spreads on ratings as opposed to the residuals from yield spread regressions. The coefficients on the rating variables show a marginal effect between 47 and 73 basis point-change in yield spreads. Therefore, ratings for the overall sample are not only statistically significant, but economically significant determinants of yield spreads as well. Third, the interaction terms are negative and statistically significant for both the S&P and Fitch rating models, but not for Moody's ratings. This last finding on aggregate indicates that the relevance of credit ratings to yield spreads has only strengthened over time. The insignificant coefficient on the interaction term for Moody's rating indicates that its relevance to yield spreads has not changed over the sample period.

Rating Bias and Yield Spreads

The previous sections presented tests to evaluate the relevance of credit ratings to yield spreads and established that ratings are an important determinant of yield spreads and that their relevance has only increased over time. The next set of tests evaluates if and how rating biases have affected yield spreads. There is abundant evidence that rating agencies have a negative bias in their corporate credit rating assignments. As was seen in the previous tests, investors factor in and significantly weigh credit ratings in their bond valuations. If rating agencies are indeed issuing biased ratings, then this could result in the perverse effect of increasing bond yields and hence the cost of borrowing for firms for whom credit ratings do not adequately reflect their default risk. To evaluate this aspect of the yield-rating relationship, the regression models illustrated in Eq. (4) and Eq. (5) are estimated. In the first step the ratings data in the first half of the sample, the time period between 1995-2002, is used to create a predictive model of ratings with issuer characteristics, such as interest coverage, operating margin, leverage, size and equity risk. Then the estimated model is used to predict credit ratings in the second half of the sample, the time period between 2003-2010. The time series of the means of the predicted and actual ratings are presented in Table 5. As Table 5 shows in every case (S&P, Moody's and Fitch), the predicted ratings are systematically higher than the actual ratings received. The overall difference in mean t-statistic shows that the predicted ratings are significantly larger than the actual ratings. This finding confirms the existing evidence that rating agencies are imposing tougher rating standards in their corporate rating assignments[15]. As noted previously, it is possible that the fundamental nature of how various credit quality factors affect ratings have changed over time. However, taken at face value the evidence here is supportive of the general conclusion in the literature that rating agencies have a negative bias in evaluating corporate

[15] The evidence in support of rating deflation in corporate ratings here is not meant to be a rigorous examination of rating standards. However, in unreported tests similar to BLM's Ordered Probit, regressions reveal that the sample studied in this paper also demonstrates evidence consistent with rating deflation.

ratings.

Table 5
Rating Bias: Predicted – Actual Credit Rating

Year	S&P Predicted	S&P Actual	Moody's Predicted	Moody's Actual	Fitch Predicted	Fitch ctual
2003	3.95	3.65	3.92	3.78	4.02	4.28
2004	4.23	3.57	4.18	3.58	4.26	4.25
2005	4.51	3.68	4.46	3.84	4.48	4.40
2006	4.70	3.89	4.64	3.95	4.64	4.3
2007	4.83	4.11	4.77	4.04	4.74	4.42
2008	4.91	4.37	4.88	4.40	4.81	4.57
2009	4.26	4.07	4.25	3.95	4.21	4.27
2010	4.38	3.79	4.34	3.72	4.33	4.10
Overall Mean	4.42	3.88	4.38	3.89	4.39	4.31
Diff in Mean t-test		25.53		34.43		21.21

Notes: This table presents the means of the predicted ratings obtained from estimating Eq. (4) for 1995 to 2002 along with the means of the actual ratings on a year to year basis between 2003 and 2010. The bottom of the table shows the difference in overall mean t-statistic between the predicted and actual credit rating issued by each of the three rating agencies: S&P, Moody's and Fitch.

Next, the difference between the predicted credit rating and the actual credit ratings, $\widehat{CR_{it}} - CR_{it}$, is introduced in the yield spread regressions as an additional explanatory variable. If the rating bias is not recognized by the bond markets, then this variable would be a statistically insignificant determinant of yield spreads. However, if bond markets are cognizant of the negative rating biases and correct for this bias in bond pricing, then this variable should enter the regression model with a negative coefficient.

Table 6
OLS Regressions of Yield Spreads on Rating Bias Proxies

	1	2	3
S&P(Predicted-Actual Rating)	-55.33***		
S&P Rating	-127.15***		
Moody's (Predicted-Actual Rating)		-50.65***	
Moody's Rating		-122.68***	
Fitch (Predicted-Actual Rating)			-50.64***
Fitch Rating			-115.03***
Log Time to Maturity	12.38	17.08	32.35
Log Time to Maturity-Squared	-4.12	-4.06	-6.29
Log offering amount	-207.43**	-314.56***	-234.02**
Log offering amount-Squared	8.90**	12.76***	9.63***
Int. Coverage	-0.63***	-0.05	0
Operating Margin	-24.76*	-25.45**	27.62
Long Term Debt/Assets	-307.09***	-266.90***	-159.95**
Total Debt/Assets	122.32**	155.88***	88.14**
Log Assets	-3.29	6.39**	4.18
Beta	2.77	-3.41	-7.15
Mkt. Model Std. Err	2,265.04***	2,796.48***	3,117.78***
R^2	0.61	0.62	0.6
N	1,875	2,609	1,569

Notes: This table presents the OLS regression of Yield Spreads on proxies for rating bias. Intercepts are not reported. All columns include year fixed effects. Coefficient t-statistics are reported in parentheses below the coefficients. *, ** and *** represent significance at the 10%, 5% and 1% levels.

The results from the estimation of Eq. (5) are reported in Table 6. Columns 1, 2, and 3 show the

results for each of the three rating agencies— S&P, Moody's and Fitch, respectively. The rating bias variable is negative and statistically significant in all three models. This finding implies that bond market participants recognize the negative bias in credit ratings and in fact discount for this bias in their bond valuations. They also assign lower yields to the bonds subject to the rating bias. The estimated coefficients indicate that the marginal impact of the rating bias results in approximately a 50 basis-point reduction in yield spreads.

4. Conclusion

This study examined a comprehensive data set of senior bond issues rated by the three dominant credit rating agencies—S&P, Moody's and Fitch. The extant literature has found that rating standards in corporate ratings have become more stringent over time and has resulted in a negative rating bias. This naturally raises the question of how this practice affects bond prices and yields. If rating agencies are deliberately deflating the credit rating of debt issuers then this could result in the perverse effect of increasing the cost of borrowing for firms (larger yield spreads) for whom the ratings do not adequately reflect default risk. This effect, if present, would be a blessing in disguise for bond portfolio managers and investors in general as they could now earn a rate of return higher than that warranted by true default risk. The focus of this study is to evaluate this relationship between yield spreads and ratings. The tests conducted here shed light on three aspects of this relationship: first, ratings are a significant determinant of yield spreads and contain information beyond that contained in other publicly available information; second, the negative correlation between ratings and yield spreads has strengthened over time, indicating that bond markets continue to consider ratings as a relevant input in bond valuation models; and third, the negative rating bias in corporate ratings is recognized and corrected for in the bond markets. Bonds that are underrated experience a further reduction in yield spreads to correct for the rating bias. Overall these findings suggest that credit ratings continue to be relevant for bond pricing and yields.

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