SPLIT RATINGS AND THE PRICING OF CREDIT RISK

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Abstract

Despite the fact that over fifty percent of all corporate bonds have different ratings from Moody's and Standard and Poor's at issuance, most bond pricing models ignore these differences of opinion. Our work compares a number of different methods of accounting for split ratings in estimating bond pricing models. We find that pricing rules that use only the Moody's or Standard and Poor's ratings produce unbiased but highly inefficient forecasts. If models rely instead on simply the higher or lower of the two ratings (but not both), greater bias is introduced with insignificant gains in efficiency. In general, the average rating is the best guide to predicting yields in terms of both bias and forecast precision. However, the forecasting advantage from using the average rating rather than the lower rating derives almost entirely from the below-investment-grade subsample.

Key words: Credit Ratings, Credit Risk, Bond Yields, Bond Pricing

JEL Classification: G11, G12, G20, G23

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data, we examine a large sample of straight bond public offerings by U.S. corporations between 1983 and 1993, which amounts to more than 4399 issues, of which we document more than 2000 splits at the notch level. We examine six different rules specifying the use of credit ratings for split-rated issues, and ask which one generates the least biased prediction of yields. Finally, we measure the accuracy of each possible rule in terms of two efficiency criteria--the root-mean squared error and a root-mean squared error statistic that adjusts for the estimated mean bias.

Methodology: Rating Rules and Performance Criteria

We adopt a two-stage, out-of-sample approach to rank the performance of different rules for predicting spreads on split-rated issues. First, a sample of identically rated bonds is used to estimate a relationship between ratings, other variables, and yields. These estimates, along with some rule that applies them to split-ratings, are used to predict yields on a sample of split-rated bonds.[3]

More specifically, suppose our sample consists of M bonds with identical ratings and N bonds with split ratings. We estimate the determinants of the bond i's spread over treasuries, Y_i, for the identically rated sample.

(1) $Y_i = \alpha R_i + \beta C_i$ $\qquad\qquad\qquad$ $i = 1, \ldots, M.$

The explanatory variables consist of a vector of rating dummies, R_i--one for each rating category (AAA/Aaa, AA+/Aa1, AA/Aa, ...)--and a vector of controls, C_i, such

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Introduction

Empirical bond pricing models typically regress a cross-section of spreads over U.S. Treasuries against a set of variables which include the credit ratings of Moody's or Standard & Poor's.[1] However, these ratings differ more than 50 percent of the time, resulting in what are known in the industry as "split ratings." The empirical models do not account for split ratings because they generally use either the ratings of Moody's or Standard and Poor's, *but not both.* This paper examines the benefits to using both Moody's and Standard and Poor's credit ratings in bond pricing, and compares a number of different methods for accounting for split ratings in estimating bond pricing models.

The previous literature on split ratings provides conflicting evidence on the appropriate way to control for credit quality in bond yield models.[2] Some papers imply that taking the lowest rating in the case of a split rating gives an unbiased estimate of yield, while others imply that such a procedure would result in predicted yields on splits that are too high. None of this work evaluates the relative performance of alternative pricing rules such using only the Moody's rating, only the Standard and Poor's rating, or an average of their ratings. Moreover, this literature does not compare the efficiency, as opposed to the bias, of alternative pricing rules using multiple ratings.

Our study improves upon these aspects of the earlier literature. In terms of as callability and issue size. For each bond, a single rating dummy takes on the value one and the others take on the value zero. The two coefficient vectors, α and β, are estimated by ordinary least squares.

In the second stage, using the estimated coefficient vectors $\hat{\alpha}$ and $\hat{\beta}$ from equation (1), we calculate a predicted spread for each split-rated bond. Given $\hat{\beta}$, we can straightforwardly estimate the expected impact of the control variables on each split-rated bond. There are, however, a variety of ways in which $\hat{\alpha}$ might be used to predict the credit risk components of the spreads on split-rated bonds. We consider six different rules for using the estimated rating dummy coefficients from Equation (1) to predict spreads.

1. *Moody's. The value 1 is assigned to the dummy variable corresponding to the Moody's rating.*
2. *Standard and Poor's. The value 1 is assigned to the dummy variable corresponding to the Standard and Poor's rating.*
3. *High. The value 1 is assigned to the highest rating.*
4. *Low. The value 1 is assigned to the lowest rating.*
5. *Average. The value .5 is assigned to the dummy variables corresponding to both the Moody's and the Standard and Poor's ratings.*
6. *Bloomberg. The value 1 is assigned to the lower rating in the case of an one-notch differential, to a rating one notch above the lower rating in the case of a three-notch differential, and to the average rating in the case of even-notch differentials.*

The Moody's and Standard and Poor's rules are the most commonly used rules in the empirical bond pricing literature. The small literature on split ratings, however, tests whether split-rated bond yields are closer to the yields implied by their higher rating, lower rating, or in between. Our average rating rule equally weights the two coefficients of the respective rating dummies generated in the regression of Equation (1).[4,5] The sixth rule corresponds to the algorithm used by Bloomberg Financial Markets, a leading supplier of corporate bond yield information to institutional investors, to price split-rated issues when trader quotes are unavailable.[6]

For any one rule, r, the predicted yields on split-rated bonds, $\hat{Y}_i$, are given by,

$$(2)\quad \hat{Y}_i^r \equiv \hat{\alpha} R_i^r + \hat{\beta} C_i \qquad i = 1, \ldots N; \qquad r = 1, \ldots, 6.$$

For each rule, we obtain prediction errors for the split-rated bonds by subtracting the observed spreads from the predicted spreads,

$$(3)\quad \varepsilon_i^r \equiv \hat{Y}_i^r - Y_i \qquad i = 1, \ldots, N; \qquad r = 1, \ldots, R.$$

We then construct three statistics--mean bias, root mean squared error, and mean adjusted root mean squared error--by which we can compare the performances of the different rules for predicting spreads on split-rated bonds.

(4) $\Sigma_{i=1}^{N} \frac{\varepsilon_i^r}{N} \equiv \mu^r$ (Mean bias of rating rule r)

(5) $\sqrt{\frac{\Sigma_{i=1}^{N}(\varepsilon_i^r)^2}{N}} \equiv RMSE^r$ (Root mean squared error (RMSE) of rating rule r)

(6) $\sqrt{\frac{\Sigma_{i=1}^{N}(\varepsilon_i^r-\mu^r)^2}{N}} \equiv RMSEA^r$ (RMSE adjusted for bias of rating rule r).

While a tendency to under- or over-predict yield spreads is indicated by the bias criterion, many investors and dealers, particularly those who find diversification costly, are also concerned with the RMSE of a particular rule for pricing split-rated issues. We also calculate an adjusted RMSE statistic for each rule to give a lower bound on the RMSE that can be achieved by adjusting for known bias.[7]

The Data

Our sample consists of most straight bond, U.S. dollar-denominated public offerings by U.S. corporations between January 1983 and July 1993 that have ratings from Moody's and Standard and Poor's.[8] In addition to reoffering yields and credit ratings, our data source contains a number of items useful in explaining bond yields such as issue size, maturity, call features, sinking fund features, underwriting method, shelf registration, and the industry of the issuer. For estimation purposes, we drop from the sample those bonds with gross issuance less than $10 million; ratings from Moody's and Standard and Poor's below B3 and B-, respectively; equipment trust certificates, lease certificates, collateralized trust certificates, structured transactions such as CMOs, bonds having variable coupon rates, bonds guaranteed by the U.S. government, issues sold at a significant discount to par, bonds issued by ESOPs, and bonds with significant equity features.

The distribution of ratings for our final sample of 4399 bond issues between 1983 and 1993 is shown in Table 1. Moody's and Standard and Poor's agree 45.3 percent of the time on rating scales which contain 16 possible ratings (AAA/Aaa,AA+/Aa1,...B-/B3). While split ratings are in the majority, most of them are fairly small: 42.1 of the 54.7 percent of split ratings consist of only single notch differentials. Only 10.0 percent of the time do the agencies disagreed by two notches, 2.2 percent by three notches, 0.3 percent by four notches, and in no case were the ratings more than four notches apart. As shown in the first panel of Chart 1, there has been some increase in the degree of agreement between the agencies over time, with the proportion of identical ratings hovering around the 40 percent level in the mid-1980s, but moving around the 50 percent level in more recent years.[9]

When the agencies disagree over rating assignments, Moody's is somewhat less likely than Standard and Poor's to be the lenient one: only 45.4 percent of the split ratings have Moody's on the high end. The second panel of Chart 1 shows how the probability that Moody's rating higher than Standard and Poor's has varied over time, beginning at slightly less than 40 percent in 1983-1984, rising to around the 50 percent level during the 1985-1988 period, but returning to the 40 percent level in the 1990s. Whether Moody's or Standard and Poor's is likely to have the higher rating depends very much on whether the bond is investment or non-investment grade. Moody's rates higher than Standard and Poor's in only 42.4 percent of the split-rated investment-grade issues, but it rates higher more than 60 percent of the split-rated non-investment-grade bonds.

Determinants of Yield Spreads on Identically Rated Bonds

Before we can rank the performance of different rules for using split ratings, we use our identically rated sample to estimate the coefficients of the relationship between yields, other variables, and ratings. These coefficients are subsequently used to predict yields for our sample of split-rated bonds.

Table 2 presents summary statistics for our sample of identically rated issues. For each rating category, we present the mean and median yield spreads over comparable maturity Treasuries.[10] As expected, spreads generally rise as ratings decline. The one exception is the spread on BB/Ba2 rated bonds, which is higher than the spread on lower rated BB-/Ba3 bonds. This anomaly results from the extremely small sample of 5 bonds in the BB/Ba2 rating category, of which four were issued during the last two months of 1991, when spreads for junk bonds were relatively high. In the last section of this article, we show that our main results are robust to the exclusion of these bonds and split-rated bonds which might have similar implied ratings.

Table 3 presents the results of Equation (1), the OLS regression of spreads on identically rated bonds against a variety of the regressors that have been used widely in the bond pricing literature. The dependent variable is SPREAD, the issue's re-offering yield to maturity minus the yield on a Treasury security of comparable maturity, expressed in basis points. Credit ratings are expressed as zero/one dummy variables for each rating category Aaa/AAA to B3/B-. In addition to ratings, we include a number of control variables.

Specifically, we include three time-varying variables to control for market conditions prevailing at the time of issuance. QUALSPRD measures the yield spread in basis points between the Moody's Baa Corporate Composite Index and the Moody's Aaa index. TREAS30 measures the yield in basis points of the 30-year treasury bond on the day of a given issue's sale. TREASVOL is the 10-day rolling standard deviation of daily percentage changes in the 30-year Treasury bond and measures interest-rate uncertainty. We expect SPREAD to vary positively with movements in QUALSPRD, TREAS30, and TREASVOL.[11]

We include another seven variables to capture bond-specific characteristics that may affect reoffering yields. LMATUR is the natural logarithm of years to maturity and allows for differences between the term structure of risky debt and treasuries. Past work has identified a positive relationship between maturity and spread. LFACE is the natural logarithm of the bond's face value. Since larger issues should be more liquid and underwriting costs relatively smaller as a proportion of the issue, we would expect a negative coefficient on this scale variable (Chaplinsky and Ramchand, 1996). SHELF is a dummy variable indicating whether an issue is sold by shelf registration. As numerous studies have shown that shelf-registered issues sell for lower yields,[12] we expect a negative coefficient on this variable. COMPET is a dummy variable taking a value of zero for negotiated underwritings and one for competitive biddings. Bonds sold under competitive biddings have been shown to have lower yields (Fabozzi and West, 1981), so we expect a negative coefficient on this variable as well. CALL is a dummy variable taking the value of one for callable bonds which, *ceteris paribus*, should offer higher yields. Crabbe (1991a) shows that, at least since 1989, the option value of embedded call options has been priced in the market. Finally, FIN and UTIL are indicator variables that take a value of one for firms in the Finance and Utility industries respectively. The excluded industry dummy represents industrial firms. FIN and UTIL allow for cross-industry variation in bond spreads not captured in the other variables.[13]

Table 3 reports the estimated regression coefficients. The standard errors appearing parenthetically beneath the coefficients are corrected for heteroskedasticity using White's (1980) method. The coefficients on two of the control variables have unexpected signs. The coefficient on LFACE is positive and highly significant. Similar to Crabbe (1991a) and Lamy and Thompson (1988), we find a negative coefficient on the TREAS30, which is highly significant. All of the other estimated coefficients for the control variables have the expected sign, and two thirds are statistically significant at the 1 percent level. The credit curve implied by the estimated coefficients on the ratings dummies slopes upward as ratings decline, similar to the mean and medians yields presented in Table 2, with once again an anomalous coefficient generated by the five observations comprising the Ba/BB rating category dummy.

Which Rating Rule is Best for Predicting the Yield Spreads of Split-Rated Bonds?

Results for the Full Sample of Split-Rated Issues

As described above, for each of the proposed pricing rules, we predict yield spreads on split-rated bonds using the model estimated on the identically rated sample. Comparing the predicted spreads with the actual spreads, we construct relative accuracy measures for the different pricing rules. Table 4 presents the mean bias, RMSE, and adjusted RMSE for the six rules discussed above, based on the entire sample of split-rated bonds.

According to the mean bias statistics, rules that rely only on the rating of Moody's, Standard and Poor's, or a simple average of the two are all unbiased in a statistical sense. (Each agency's ratings can provide an unbiased guide if the market shares its view on average.) However, rules using the high or low rating alone are significantly biased. The rule using the high rating generates a predicted yield 13.4 basis points too low on average, and the low rating rule's predicted yield is on average 12.3 basis points too high. Although these results are intuitive, some of the empirical literature (Billingsley, et al, 1985; Liu and Moore, 1987) suggests that relying solely on the low rating leads to unbiased predictions.[14] In fact, using the high or low rating generates roughly the same absolute amount of bias, which explains why the average rating rule is unbiased. Using the Bloomberg rule results in an upwardly biased predicted spread (by 6.9 basis points). This result is not surprising since for one-notch splits the Bloomberg rule is identical to using the lower rating and for other splits it closely resembles the average rating rule.

While the rules using only Moody's or Standard and Poor's ratings give unbiased predictions, they perform much more poorly according to the root-mean squared error criterion. In this case, two of the rules that combine the information of both ratings generally perform better. The average rating rule produces the lowest RMSE among the six pricing rules, significantly lower in a statistical sense than all of the other pricing rules.[15] The rule with the second lowest RMSE, significantly lower than two of the other four rules, is the Bloomberg rule, which comes closest to the average rule in terms of using the information of both ratings. These results do not change even after adjusting for mean bias in the calculation of the RMSE.

Examining Subsamples Based on the Size of the Rating Split

In this section, we compare the relative performances of the alternative pricing rules across subsamples divided according to the size of the rating splits. Table 5 presents this detail for the one-, two-, three-, and four-notch split subsamples. More than three-quarters of the overall sample consists of ratings from Moody's and Standard and Poor's that differ by just one notch. Not surprisingly, the principal results that characterize the full-sample apply to this subsample as well. In particular, the Moody's, Standard and Poor's and average rating rule are all unbiased predictors, but the average rating rule clearly generates the minimum RMSE. By construction, the lowest rating and the Bloomberg rating rules are identical for one-notch splits, so there are now two (identical) second-best rules based on the minimum RMSE criterion.

Most of the principal results pertaining to the full sample also apply to the subsamples with rating splits which are larger. The average rating rule is unbiased, as are, with one exception, the Moody's and Standard and Poor's rating rules. (The Bloomberg rule is also unbiased for splits beyond one notch, as it becomes more similar to the average rating rule.) The high and low rules are biased in the expected directions, and the magnitudes of their biases increase as the rating notch differentials increase.

The average rating rule consistently provides the lowest RMSE and mean-adjusted RMSE, regardless of the number of ratings notches being considered. The superior performance of this rule against the RMSE criterion is statistically significant in each subsample, except in a few cases (particularly in comparison with Bloomberg) in which splits are wide and the sample size is small. Bloomberg is consistently the second-best rule with regard to the RMSE criteria, except for the fifteen four-notch cases where the low and the Standard and Poor's rules have smaller root-mean squared errors.

Examining the Above- and Below-Investment-Grade Subsamples

The relative performance rankings of the pricing rules vary between subsamples of different average credit quality. Table 6 compares their predictive accuracy in the above- and below-investment-grade subsamples.[16] In the investment-grade sample, only the Bloomberg rule is unbiased. Using the Moody's or Standard and Poor's rating alone gives a predicted yield which is 2.4 to 4.3 basis points lower on average than that observed in the marketplace. The rule using the high rating alone generates a predicted yield 10.4 basis points too low on average, while the predicted yields from using the low rating are 3.7 basis points too high on average. Given these differences, it is perhaps not surprising that average rating rule generates predicted yields that are lower than those observed in the market by an average of 3.3 basis points. Clearly, pricing in the investment-grade sector is more conservative--placing more weight on the lower rating than the higher rating--than pricing in the full sample.

In terms of the RMSE, both unadjusted and adjusted, the average rule, the hard rating rule, and the Bloomberg rule are statistically indistinguishable. All of these rules, however, are more accurate than the Moody's or Standard and Poor's rating rules. Thus, it appears that the Bloomberg rule--which is more conservative than the average rating rule, but more lenient than the low rating rule--dominates the other rating rules for investment-grade issues.

The relative performance rankings differ considerably in the below-investment-grade sample. Here, the lowest bias comes from using either the Moody's rating or the average rating, but both rules predict a higher yield than observed. The average rating rule predicts yields 10.5 basis points higher on average than observed: this bias, however, is insignificantly different from the bias of 8.6 basis points that comes from using the Moody's rating. All of the other rules have biases which are significantly larger in absolute terms than Moody's. In fact, all the rules tend to overestimate below-investment-grade yields except the rule which uses the highest rating alone. The absolute value of the high rule's bias (25.7 basis points) is much smaller than the low rule's bias (46.6 basis points). The Bloomberg rule is 30.2 basis points too conservative on average in its predicted yield.

In terms of the RMSE for non-investment-grade bonds, the average rating rule generates the lowest RMSE, both unadjusted and adjusted. Moreover, the difference between the average unadjusted RMSE and those of the other five rules are all highly significant, both statistically and economically. The adjusted RMSE of four of the five other rating rules are also all significantly higher than the average rating rule.

We also tested to see how strongly our results were influenced by the anomalous estimate for the implied credit risk on BB/Ba-rated bonds. The third panel of Table 6 presents the performance statistics for a below-investment-grade sample that excludes the ninety-seven split-rated issues with either BB ratings from Standard and Poor's, Ba ratings from Moody's, or BB/Ba average or Bloomberg ratings. The relative superiority of the average rating rule is even more evident in this sample. The average rule here has the lowest bias, insignificantly different from zero. Moreover, the average rating rule again has the lowest RMSE, both unadjusted and adjusted, and again the other rules are significantly less efficient except Bloomberg and the low rating rule for the adjusted RMSE.

Conclusion

We show that when bonds are split-rated by Moody's and Standard and Poor's, both ratings affect their yields. Pricing models that rely either on Moody's or Standard and Poor's ratings (but not both) produce unbiased but highly inefficient estimates. If models rely instead on simply the higher or lower of the two ratings (but not both), greater bias is introduced with insignificant gains in efficiency. Overall, the best results in terms of bias and forecast precision are obtained when yields are inferred from the average of the two ratings. This finding also holds across subsamples distinguished by the extent of the rating-notch differential.

The forecast efficiency gained by using the average rather than the lower of the two ratings arises primarily from the former's superior performance in the below-investment-grade sector. In the investment-grade sector, the market prices split-rated bonds between the yield implied by the lower rating and that implied by the average rating, and the efficiency of the two rules are similar. However, below-investment grade, the market prices at the average rating, and the average rating rule clearly results in the most efficient predictions. Investors in the non-investment grade sector apparently take a less conservative view of split ratings than investment-grade investors.

Endnotes

1. See Ma, Rao, and Peterson (1989) and Allen, Lamy, and Thompson (1990) for examples of the use of Moody's ratings in bond pricing models and the papers of Crabbe (1991a, 1991b) for an example of the use of Standard and Poor's ratings.

2. See Billingsley et al (1985), Liu and Moore (1987), Hsueh and Kidwell (1988), and Thompson and Vaz (1990).

3. Within the existing literature on split ratings, Liu and Moore (1987) apply the two-stage approach, but they do not control for determinants of spreads other than ratings. The rest of literature runs full-sample regressions with dummy variables for each type rating split (AAA/AA, AA/A, A/BBB, etc.) and other control variables. The estimated split-rating coefficients are then compared statistically to the estimated coefficients on the identical rating dummies. Although in-sample and out-of-sample approaches should yield similar results regarding bias, the latter approach lowers the risk of overfitting and makes forecast efficiency comparisons more transparent.

4. Ederington, et. al (1987) provides some evidence that is consistent with the hypothesis that the market weighs the ratings from the two agencies equally.

5. A similar rule would assign the value one to the coefficient of the average rating in terms of notch differentials of Moody's and S&P (e.g., A1/A- = A). However, this method can only be implemented in the subsample of even-notch differentials. Like Rule 5, this rule also weights ratings equally, but it implies the same predicted spreads for even-notch differential splits only if the relationship between ratings and spreads is a linear one.

6. Such "matrix" prices--also known as Bloomberg Fair Value (BFV) prices--are generally based on the average market prices for other bonds outstanding of similar maturity, and the same credit rating. Bloomberg also takes into account the value of any options embedded in a particular bond. In the case of split-rated issues, the Bloomberg pricing algorithm chooses comparable bonds at the ratings level determined by Rule 6, as defined above.

7. This adjustment is important because some rules, such the hard or low rules, predict spreads that may be highly correlated with actual spreads but are biased in an obvious direction. The adjusted RMSE criterion accounts for the fact that even naive investors might be able to improve upon a simple application of these rules. Calculation of an adjusted RMSE is, however, extremely generous because it assumes knowledge of the exact sample bias which is only measurable ex post. Thus, the adjusted RMSE statistic should be viewed as a lower bound.

8. The data was gathered over the years by the Capital Markets Section at the Federal Reserve Board, using a variety of sources including *Moody's Bond Survey, Moody's Bond*

Record, Standard & Poor's Credit Week, Standard and Poor's Bond Guide, Investment Dealer's Digest, and *Corporate Financing Week.*

9. For a May 1982 sample of 218 outstanding bonds for non-financial firms, Perry (1985) documents agreement between Moody's and S&P 41.7 percent of the time, which is lower than our 1983-1993 average, but higher than the agreement for new issues during the 1983-1987 period. For an analysis of the causes underlying split ratings, see Ederington (1986).

10. In cases where no comparable maturity exists, the Treasury yield is interpolated from existing maturities.

11. As Crabbe (1991a) notes, call options should have more value during periods when rates are higher and hence required spreads should be higher. The value of call options also implies a positive relationship between spreads and interest-rate uncertainty. Moreover, if ratings determine relative rather that absolute spreads, absolute spreads have to rise with interest rates to keep relative spreads constant (Lamy and Thompson, 1988).

12. See the literature cited in Crabbe (1991a, p. 16). He also finds a negative coefficient on this variable in a similar regression run only on investment-grade issues.

13. Longstaff and Schwartz (1995) demonstrate that bonds with the same credit rating but from different industrial sectors have consistently different credit spreads.

14. Billingsley, et. al. examined reoffering yields on 258 bonds between 1977 and 1983 of which 33 are split at the whole letter grade. In addition to the time period being different from ours, that paper's smaller sample implies its tests have less power to distinguish differences between the split rated and lower rating coefficients. Liu and Moore examine secondary market yields on 282 investment-grade bonds outstanding in 1984, of which 150 were split rated at the notch level (e.g., Aa2 vs. AA-). As mentioned in Footnote 3, their methodology does not control for determinants of spreads other than ratings.

15. The formal test measures whether the difference of the squared prediction errors between the average rule and another rule has a mean that differs significantly different from zero. See Diebold and Mariano (1995) for a general discussion of the statistical tests for comparing predictive accuracy.

16. In accordance with industry practice, we include the 83 bonds with ratings that are split between above- and below-investment-grade in the below-investment grade category. The results do not differ substantively if we delete these bonds altogether.

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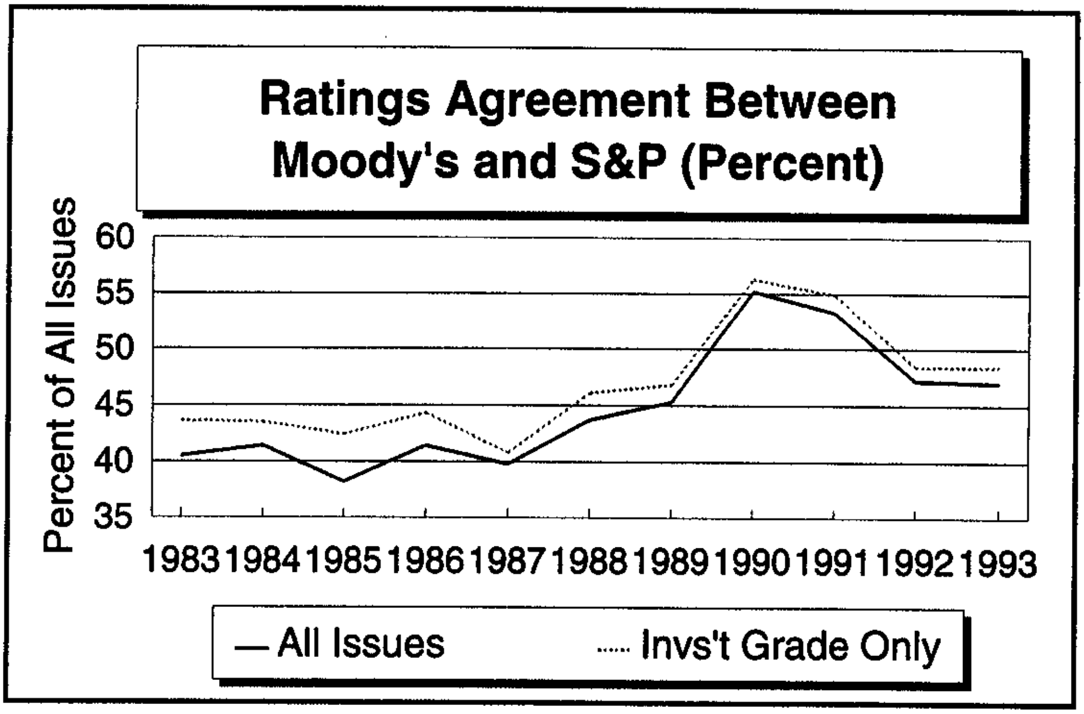
Table 1
Distribution of Moody's and S&P ratings

		Standard & Poor's																
		AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	Total
	Aaa	109	13	9	-	-	-	-	-	-	-	-	-	-	-	-	-	131
	Aa1	13	48	57	2	-	-	-	-	-	-	-	-	-	-	-	-	120
	Aa2	8	43	205	75	3	1	1	-	-	-	-	-	-	-	-	-	336
	Aa3	1	7	106	189	54	2	2	-	-	-	-	-	-	-	-	-	361
	A1	-	7	63	112	286	174	45	8	1	-	-	-	-	-	-	-	696
	A2	-	1	22	30	236	324	72	19	0	1	-	-	-	-	-	-	705
	A3	-	-	-	6	36	131	145	42	11	5	1	-	-	-	-	-	377
	Baa1	-	-	-	-	6	24	83	131	82	26	0	0	-	-	-	-	352
	Baa2	-	-	-	-	2	6	30	81	202	92	7	0	2	-	-	-	422
Moody's	Baa3	-	-	-	-	-	-	2	13	61	102	15	4	3	0	-	-	200
	Ba1	-	-	-	-	-	-	-	1	9	19	16	9	7	3	3	-	67
	Ba2	-	-	-	-	-	-	-	-	2	15	10	5	14	7	4	0	57
	Ba3	-	-	-	-	-	-	-	-	-	4	12	6	34	36	14	3	109
	B1	-	-	-	-	-	-	-	-	-	1	9	6	6	35	41	16	114
	B2	-	-	-	-	-	-	-	-	-	-	2	0	8	45	85	107	247
	B3	-	-	-	-	-	-	-	-	-	-	-	-	2	7	18	78	105
	Total	131	119	462	414	623	662	380	295	368	265	72	30	76	133	165	204	4399

Summary of Ratings Differences

	Number	Percent of Total
Identically Rated	1994	45.3%
One Notch	1853	42.1%
Two Notch	440	10.0%
Three Notch	97	2.2%
Four Notch	15	0.3%

CHART 1


Ratings Agreement Between Moody's and S&P (Percent)
Percent of All Issues
60
55
50
45
40
35
1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993
— All Issues
..... Invs't Grade Only

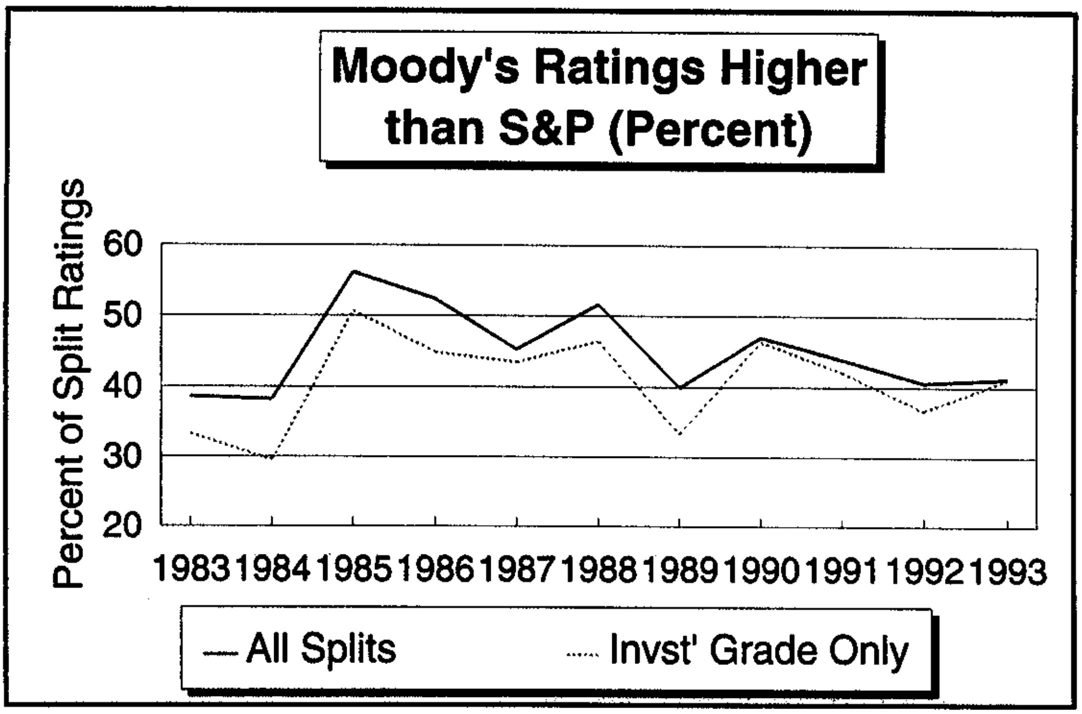

Moody's Ratings Higher than S&P (Percent)
Percent of Split Ratings
60
50
40
30
20
1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993
— All Splits
..... Invst' Grade Only

Table 2
Sample Statistics for Spreads by Rating

for identically-rated securities

S&P/Moodys rating	number of securities	Median spread	Mean spread	Std Error of the Mean
AAA / Aaa	109	39.3	47.8	2.7
AA+ / Aa1	48	59.5	63.7	5.2
AA / Aa2	205	62.5	67.8	2.5
AA- / Aa3	189	66.8	75.5	2.6
A+ / A1	286	78.9	83.6	2.4
A / A2	324	83.0	87.9	2.1
A- / A3	145	105.0	106.6	3.4
BBB+ / Baa1	131	109.0	119.6	4.4
BBB / Baa2	202	115.0	122.8	3.4
BBB- / Baa3	102	149.0	155.1	4.7
BB+ / Ba1	16	221.1	212.8	11.2
BB / Ba2	5	470.5	437.3	37.1
BB- / Ba3	34	332.8	336.9	17.3
B+ / B1	35	434.5	440.7	18.1
B / B2	85	450.5	452.6	12.2
B- / B3	78	485.1	496.2	12.0

Table 3
Explaining Yields on Identically-Rated Bonds
OLS Regression with White (1980) corrected standard errors
Dependent Variable: Spreads over Treasuries

Investment Grade Dummies		Below Investment Grade Dummies		Control Variables	
Variable	**Parameter Estimate**	**Variable**	**Parameter Estimate**	**Variable**	**Parameter Estimate**
AAA / Aaa	35.81 (15.83)	BB+ / Ba1	204.69 (20.21)	QUALSPRD	47.97 (5.03)
AA+ / Aa1	42.15 (16.25)	BB / Ba2	412.75 (40.82)	LMATUR	14.05 (1.58)
AA / Aa2	54.33 (15.75)	BB- / Ba3	314.60 (22.11)	LFACE	5.70 (1.88)
AA- / Aa3	64.14 (15.95)	B+ / B1	414.29 (25.51)	TREAS30	-10.93 (1.22)
A+ / A1	70.28 (15.52)	B / B2	427.48 (19.86)	TREASVOL	2.87 (3.73)
A / A2	77.94 (15.23)	B- / B3	471.86 (19.44)	SHELF	-16.85 (3.77)
A- / A3	90.56 (15.39)			COMPET	-3.36 (2.89)
BBB+ / Baa1	108.77 (15.39)			CALL	10.35 (2.87)
BBB / Baa2	112.47 (15.48)			FIN	8.63 (2.58)
BBB- / Baa3	144.00 (15.48)			UTIL	-4.35 (2.63)

Adjusted R-square	0.9325
Standard Error	135.42
Sample Size	1994

Table 4
Predicting Yields on Split-Rated Bonds

Sample: all split rated bonds (2405 observations)

	Accuracy Criteria		
Split Rating Rule	Mean Bias (A)	RMSE (B)	Adjusted RMSE (C)
1) Moody's	**-0.2**	62.8**	62.8**
2) S&P	-1.0	61.1**	61.1**
3) High	-13.4*	61.6**	60.1**
4) Low	12.3**	62.3**	61.1**
5) Bloomberg	6.9**	59.4**	59.0*
6) Average	-0.6	**56.8**	**56.8**

Note: The lowest absolute value under each criterion is marked in bold. The mean bias is the average basis point difference between the predicted and observed yield (Equation 3). The RMSE and adjusted RMSE are calculated as discussed in Eqautions 4 and 5. Differing tests of significance are run on the accuracy criteria. For mean bias, the test is of whether the statistic differs significantly from zero. For RMSE, both unadjusted and adjusted, the test is of whether the statistic differs significantly from the lowest RMSE. ** denotes significance at 1% level, while * denotes significance at 5% level.

Table 5
Predicting Yields on Split-Rated Bonds
(Divided by Size of Rating Split)

Split Rating Rule	Mean Bias (A)	RMSE (B)	Adjusted RMSE (C)
	Accuracy Criteria		
One-notch differential			
1) Moody's	-1.7	58.6**	58.6**
2) S&P	**0.5**	56.8**	56.8**
3) High	-9.4**	58.2**	57.5**
4) Low	8.2**	57.1**	56.5*
5) Bloomberg	8.2**	57.1**	56.5*
6) Average	-0.6	**55.1**	**55.1**
no. of observations:		1853	
Three-notch differential			
1) Moody's	**4.9**	78.9**	78.7**
2) S&P	-23.0**	79.9**	76.5**
3) High	-46.9**	86.4**	72.5*
4) Low	28.8**	71.8*	65.7
5) Bloomberg	7.3	65.0	64.5
6) Average	-9.0	**58.5**	**57.8**
no. of observations:		97	

Split Rating Rule	Mean Bias (A)	RMSE (B)	Adjusted RMSE (C)
	Accuracy Criteria		
Two-notch differential			
1) Moody's	5.9	72.8**	72.5**
2) S&P	-2.9	72.4**	72.3**
3) easy	-21.0**	67.2*	63.8
4) hard	23.9**	77.5**	73.8**
5) Bloomberg	1.6	66.6	66.5
6) Average	**1.5**	**63.0**	**63.0**
no. of observations:		440	
Four-notch differential			
1) Moody's	-21.5	117.4**	115.4**
2) S&P	11.5	73.1	72.2
3) High	-77.2**	93.9*	53.4
4) Low	67.3**	101.5*	76.1
5) Bloomberg	**-0.3**	75.5	75.5
6) Average	-5.0	**49.2**	**49.0**
no. of observations:		15	

Notes: A one-notch differential corresponds to the difference between an Aa2 and and AA- rating. Two, three, and four notch differentials correspond to the difference between an Aa2 and an A+, A, and A- rating, respectively. The lowest absolute value under each criterion is marked in bold. The mean bias is the average basis point difference between the predicted and observed yield (Equation 3). The RMSE and adjusted RMSE are calculated as discussed in Equations 4 and 5. Differing tests of significance are run on the accuracy criteria. For mean bias, the test is of whether the statistic differs significantly from zero. For RMSE, both unadjusted and adjusted, the test is of whether the statistic differs significantly from the lowest RMSE. ** denotes significance at 1% level, while * denotes significance at 5% level.

Table 6
Predicting Yields on Split Rated Bonds
(Divided by Above and Below Investment Grade)

Above Investment Grade

Split Rating Rule	Mean Bias (A)	RMSE (B)	Adjusted RMSE (C)
1) Moody's	-2.4**	40.7**	40.7**
2) S&P	-4.3**	41.0**	40.7**
3) High	-10.4**	41.7**	40.3**
4) Low	3.7**	40.0	39.9
4) Bloomberg	**1.1**	40.0	40.0
6) Average	-3.3**	**40.0**	**39.8**
no. of observations:		1927	

Below Investment Grade

Split Rating Rule	Mean Bias (A)	RMSE (B)	Adjusted RMSE (C)
1) Moody's	**8.6**	114.8**	114.5**
2) S&P	12.3*	109.6**	108.9**
3) High	-25.7**	110.0**	107.0**
4) Low	46.6**	114.4**	104.4*
4) Bloomberg	30.3**	106.3**	101.9
6) Average	10.5*	**98.9**	**98.3**
no. of observations:		478	

Below Investment Grade
But Excluding Ba/BB

Split Rating Rule	Mean Bias (A)	RMSE (B)	Adjusted RMSE (C)
1) Moody's	-4.7	104.0**	103.9**
2) S&P	13.8*	105.9**	105.0**
3) High	-27.5**	106.4**	102.8**
4) Low	36.6**	103.5**	96.8
4) Bloomberg	26.2**	101.1*	97.6
6) Average	**-4.5**	**96.8**	**96.7**
no. of observations:		381	

Notes: In accordance with industry practice, the bonds with ratings that are split between above and below investment grade are included in the below-investment grade sample. The lowest absolute value under each criterion is marked in bold. The mean bias is the average basis point difference between the predicted and observed yield (Equation 3). The RMSE and adjusted RMSE are calculated as discussed in Equations 4 and 5. Differing tests of significance are run on the accuracy criteria. For mean bias, the test is of whether the statistic differs significantly from zero. For RMSE, both unadjusted and adjusted, the test is of whether the statistic differs significantly from the lowest RMSE. ** denotes significance at 1% level, while * denotes significance at 5% level.

9710. Lopez, Jose. "Regulatory Evaluation of Value-at-Risk Models." March 1997.