Credit Ratings and Bond Yield Spreads: Continuous Risk Pricing at the Investment-Grade Threshold

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ABSTRACT

This study examines the relationship between credit ratings and bond yield spreads, focusing on the investment-grade to junk-grade threshold. While previous research has established that lower credit ratings correspond to higher yields due to increased default risk, less attention has been given to how these relationships differ systematically for junk-grade bonds. Using a dataset of 5,438 U.S. corporate bonds with maturities between 5 and 10 years, we employ interaction models to assess whether junk bonds face steeper yield penalties for credit downgrades and whether a discontinuity exists at the investment-grade threshold. Our findings reveal that the slope of the relationship between credit ratings and yield spreads is steeper for junk bonds, with a one-unit decrease in credit rating leading to a 15.9% increase in yield spreads for junk bonds compared to 12.2% for investment-grade bonds. However, we find no significant discontinuity in yield spreads at the threshold, suggesting a continuous pricing mechanism rather than an abrupt shift in investor behaviour. These results highlight the additional risk premium junk bonds bear beyond what credit ratings alone capture. While these findings provide insights into credit risk pricing, the analysis is limited by external validity concerns, as the dataset reflects a narrow temporal snapshot. Future research could extend these findings by incorporating global bond markets or exploring additional omitted variables such as market liquidity and issuer-specific financial metrics.

Replication Link: https://github.com/Jakub-Riha/ECO375-Replication.git

I. Introduction

Credit ratings significantly influence bond yields, investment decisions, and corporate financing. Assigned by agencies such as Moody's and S&P Global, credit ratings assess issuer creditworthiness, signal default risk, and affect the interest rates issuers must offer to attract investors. Lower ratings correspond to higher default risk, reflected in increased bond yields.

Existing literature provides several frameworks for explaining the dynamics between credit risk and yields. Credit ratings act as benchmarks for assessing the credit risk of issuers, with higher ratings (e.g., AAA) reflecting lower default risk and lower ratings (e.g., BB-) signalling greater default risk. Theoretical models, such as Merton's Structural Model of Default Risk, link bond yields to default probabilities, suggesting that declining creditworthiness raises yields to compensate for higher risk (Merton, 1974). Empirical studies have also explored the impact of credit ratings on bond yields. For instance, a study published in the *European Scientific Journal* finds that credit rating upgrades narrow bond credit spreads, while downgrades widen them, highlighting the influence of credit ratings on borrowing costs (Kurbonov et al., 2024).

While much of the existing literature has examined broad correlations between credit ratings and yields, fewer studies have investigated the transition from investment-grade to junk-grade status. This boundary is particularly significant due to its pronounced effects on funding costs, liquidity, and access to specific investor segments, such as pension funds and insurance companies, which are often restricted to holding investment-grade assets. Understanding the mechanisms driving these shifts is essential, as this transition often results in disproportionate changes in borrowing costs, investor behaviour, and market dynamics.

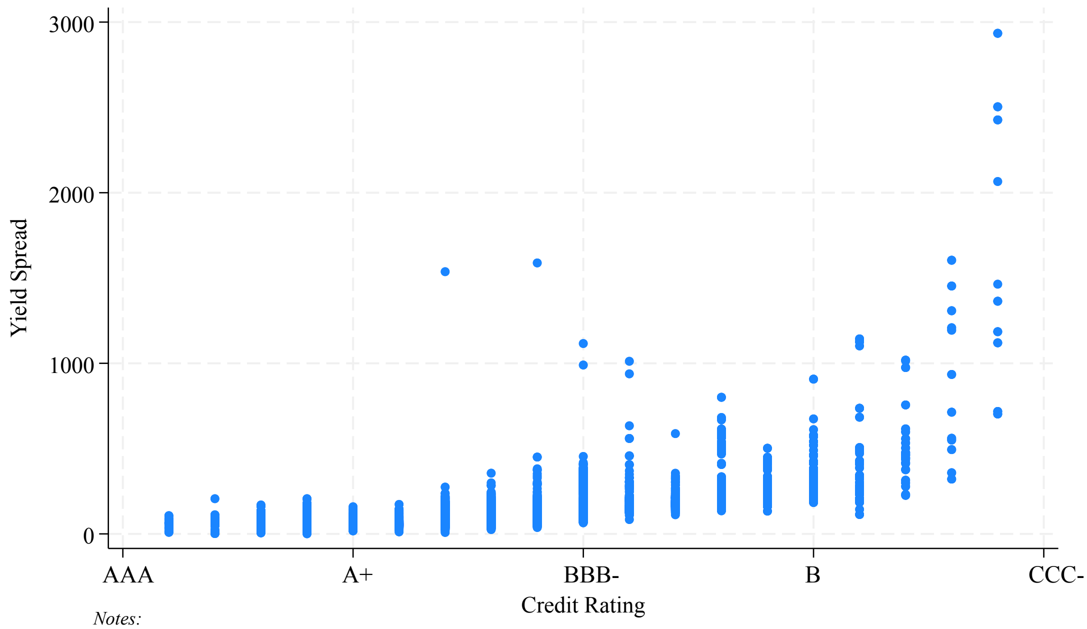
This study empirically examines the relationship between credit ratings and corporate bond yield spreads, focusing on the differential trends between investment-grade and junk-grade bonds. By analysing the cutoff point at the investment-grade threshold, we aim to identify potential discontinuities in yield spreads that arise from crossing into lower creditworthiness categories.

II. Context and Data

The data in this analysis were obtained from the Bloomberg Terminal via the Fixed Income Worksheet (FIW) and follow a cross-sectional structure. The dataset includes 5,438 U.S. corporate bonds with maturities ranging between 5 and 10 years as of November 7, 2024. Each observation corresponds to an individual bond issue, incorporating variables such as yield spread, S&P Global credit rating, coupon rate, maturity, and industry classification. Bonds with negative yield spreads and those with a negative natural logarithm of yield spread were removed from the dataset to ensure analytical consistency.

FIGURE I

RELATIONSHIP BETWEEN YIELD SPREADS AND CREDIT RATINGS



Notes:
The graph shows the relationship between Yield Spreads (in basis points) and Credit Ratings, where higher Credit Ratings indicate lower-quality (riskier) bonds (e.g., AAA = 1, CCC = 19). Yield Spreads are measured in basis points (bps), where 1 basis point equals 1/100th of a percentage point. Observations correspond to individual US Corporate bonds

The primary outcome variable is the natural logarithm of yield spread. Yield spread measures the difference in yield between a corporate bond and a comparable risk-free bond, expressed in basis points (bps), where one basis point equals 1/100th of a percentage point. The logarithmic transformation was applied to address skewness and interpret yield spreads as proportional changes. Figure 1 illustrates this relationship between raw yield spreads and credit ratings, showing substantial variability and heteroskedasticity across bonds with different credit qualities. The key independent variable is the credit rating assigned by S&P Global, which is a discrete ordinal measure of creditworthiness. These ratings were converted into a numeric scale for analysis, ranging from 1 (AAA) to 19 (CCC). Additional covariates include bond maturity, expressed in years to expiration, and annual coupon rate, expressed as a percentage. Industry fixed effects, modelled using dummy variables for each classification, account for unobserved heterogeneity across industries.

TABLE I
SUMMARY STATISTICS OF KEY VARIABLES

	Observations	Mean	Standard Deviation	Min	Max
Yield Spread	5438	154.463	162.108	1.955	2934.418
Log Yield Spread	5438	4.785	0.670	0.670	7.984
Credit Rating	5,434	8.847	2.943	1	19
Maturity	5438	7.232	1.470	5.013	9.999
Coupon	5438	4.891	1.861	0	14

Notes:
Yield Spread is measured in basis points (bps). A basis point equals 1/100th of a percentage point. Log Yield Spread is the natural logarithm of Yield Spread. Credit Rating is an ordinal variable, where higher values represent lower-quality (riskier) bonds (e.g., AAA = 1, CCC = 19). Maturity is measured in years to bond expiration. Coupon is the annual coupon rate, expressed as a percentage.

Table 1 presents summary statistics of the key variables used in the analysis. Yield spreads exhibit considerable variability, with a mean of 154.463 basis points and a standard deviation of 162.108, suggesting heterogeneity in corporate bond risk. The natural logarithm of yield spread ranges from 0.670 to 7.984, with a mean of 4.785 and a standard deviation of 0.670, reflecting the log-transformed distribution of spreads. Credit ratings range from 1 to 19, with a mean of 8.847, indicating a dataset skewed toward lower-investment-grade and junk bonds. Maturity is relatively concentrated, with an average of 7.232 years and limited variation, while coupon rates exhibit a broader distribution, averaging 4.891%.

III. Regression Analysis

The first step in this analysis involves estimating a simple linear regression to examine the relationship between corporate bond yield spreads and credit ratings. The regression specification for the simple model is as follows[1]:

$$Log\ Yield\ Spread_i = \beta_0 + \beta_1 Credit\ Rating_i + \varepsilon_i$$

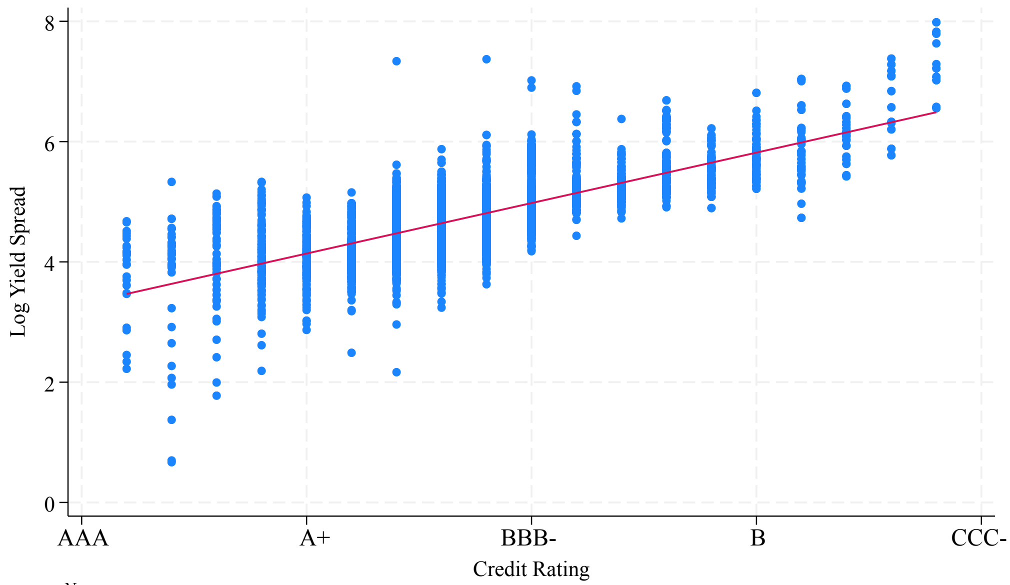
From specification (1) in Table 2, the estimated coefficient for credit rating β_1 is 0.168, which is statistically significant at the 1% level. This indicates that a one-unit decrease in credit rating, reflecting a move toward lower-quality bonds, is associated with an average increase of

[1] In this model:
Log Yield Spread$_i$ is the natural logarithm of the yield spread of bond i, measured in basis points.
Credit Rating$_i$ is the S&P Global credit rating for bond i.

16.8% in the yield spread. Figure 2 visualises this relationship, showing a clear upward trend in the log-transformed yield spread as credit ratings decline, consistent with the theoretical expectation that higher credit risk leads to increased compensation for investors. The R^2 suggests that credit ratings alone explain approximately 55% of the variation in log yield spreads, indicating their importance as a determinant of US corporate bond yields.

FIGURE II

RELATIONSHIP BETWEEN LOG YIELD SPREAD AND CREDIT RATINGS



Notes:
This graph illustrates the relationship between the natural logarithm of Yield Spread and Credit Ratings. The y-axis represents the natural logarithm of Yield Spread, where a 1-unit increase corresponds to a percentage change in the Yield Spread. Credit Ratings are ordinal, with higher values indicating riskier bonds (e.g., AAA = 1, CCC = 19). The regression line reflects the fitted relationship for the transformed data.

The regression analysis incorporates clustered standard errors and log transformations to improve model accuracy and address key econometric assumptions. Standard errors are clustered at the industry level to account for within-industry correlations in residuals and ensure reliable inference. This addresses potential issues of underestimated standard errors due to unobserved industry-specific effects. However, while the clustered standard errors and the transformation to log yield spread address heteroskedasticity problems and ensure a more linear relationship, there is still potential for omitted variable bias due to the exclusion of factors such as maturity, coupon rate, and industry effects. The zero conditional mean assumption $E(u \mid X = x) = 0$ may not hold if omitted variables are correlated with credit ratings, potentially biasing the coefficient estimate.

Moving forward, the analysis extends this baseline model to incorporate additional controls and interaction terms to explore whether this relationship varies across different segments of the credit spectrum. The detailed regression results, including additional specifications incorporating controls for maturity, coupon rate, and industry fixed effects, are summarised in Table 2 below:

TABLE II

REGRESSIONS OF LOG YIELD SPREAD ON CREDIT RATINGS, MATURITY, COUPON, AND INDUSTRY FIXED EFFECTS

	Ratings Only (1)	+ Maturity (2)	+ Coupon (3)	+ Industry FE (4)	Full Model (5)
Credit Rating	0.168*** (0.011)	0.172*** (0.011)	0.148*** (0.011)	0.168*** (0.009)	0.152*** (0.011)
Maturity	-	0.045*** (0.009)	-	-	0.001 (0.005)
Coupon	-	-	0.072*** (0.008)	-	0.054*** (0.008)
Industry Fixed Effects	-	-	-	Yes	Yes
Constant	3.299*** (0.097)	2.931*** (0.130)	3.127*** (0.094)	2.934*** (0.096)	2.832*** (0.105)
Number of Observations	5,428	5,428	5,428	5,428	5,428
R^2	0.550	0.560	0.582	0.733	0.749
Root MSE	0.447	0.442	0.431	0.350	0.339

Notes:
*The dependent variable is the natural logarithm of Yield Spread. Yield Spread is measured in basis points (bps). A basis point equals 1/100th of a percentage point. Log Yield Spread is the natural logarithm of Yield Spread. Credit Rating is an ordinal variable, where higher values represent lower-quality (riskier) bonds (e.g., AAA = 1, CCC = 19). Maturity is measured in years to bond expiration. Coupon is the annual coupon rate, expressed as a percentage. Industry Fixed Effects are included in Models 4 and 5 to account for unobserved heterogeneity across industries. Standard errors are clustered at the industry level and are reported in parentheses. Statistical significance is as follows: ***p < 0.01, **p < 0.05, *p < 0.10.*

Specification (5) in Table 2 builds on the simple linear regression by incorporating additional controls—maturity, coupon rate, and industry fixed effects—to address omitted variable bias and to more accurately estimate the relationship between credit ratings and log yield spreads. This specification is represented as follows[2]:

$$Log\ Yield\ Spread_i = \beta_0 + \beta_1 Credit\ Rating_i + \beta_2 Maturity_i + \beta_3 Coupon_i + \gamma Industry_i + \varepsilon_i$$

[2] In this model:
Maturity$_i$ is the time to maturity for bond i, measured in years.
Coupon$_i$ is the coupon rate of bond i, expressed as a percentage.
γIndustry$_i$ represents industry fixed effects of the issuing bond i.

Specification (5) now controls for additional covariates. While the coefficient for credit rating β_1 decreases slightly from specification (1) to an estimated value of 0.152, it remains statistically significant at the 1% level, suggesting that a one-unit decrease in credit rating results in an average increase of 15.2% in the yield spread, holding all factors constant. This is consistent with the previous model and theoretical expectations. The coupon rate is also positively and significantly associated with log yield spread, with a β_3 coefficient of 0.054. This finding aligns with expectations, as bonds with higher coupon rates often compensate investors for elevated risk, reflected in wider yield spreads. Including industry fixed effects further improve the model fit, as evidenced by an R^2 value of 0.749, indicating that the full model explains approximately 75% of the variation in log yield spreads. Interestingly, bond maturity, which is significant in Specification (2) with a coefficient of 0.045, becomes statistically insignificant in the full model ($\beta_2 = 0.001$). This shift suggests that bond maturity is correlated with other covariates included in Specification (5), as credit ratings or coupon rates may already account for the same risk factors associated with bond maturity. Overall, the findings demonstrate that credit ratings are a significant determinant of corporate bond yield spreads, with lower credit ratings consistently associated with higher spreads.

To better understand the effects of credit ratings on bond yield spreads at the boundary between investment-grade and junk-grade bonds, we employ a regression model with an interaction variable for junk bonds. The transition from investment-grade to junk-grade status marks a significant change in market dynamics, theoretically accompanied by shifts in investor behaviour, borrowing costs, and liquidity constraints. For instance, a study by the World Bank found that such downgrades increased Treasury bill yields by an average of 138 basis points (Hanusch et al., 2016). By including interaction terms that capture differences in slopes or discontinuities at this threshold, the analysis can provide deeper insights into whether the relationship between credit ratings and yield spreads of US corporate bonds follows similar behaviour, with systematic differences across credit categories.

The first model used in this analysis is a simplified regression focusing exclusively on the interaction effect between credit ratings and junk-grade status without incorporating additional controls. This allows us to isolate the direct relationship and observe whether junk bonds face a systematic yield premium beyond what is captured by their credit ratings. The specification for this model (6) can be visualised in figure 3 and is represented as follows[3]:

$$Log\ Yield\ Spread_i = \beta_0 + \beta_1 CreditRating_i + \beta_2 Junk\ Grade_i + \beta_3 (Credit\ Rating_i\ \times\ Junk\ Grade_i) + \varepsilon_i$$

Specification (6) focuses on the interaction between credit ratings and junk-grade status, providing an initial understanding of the differential effects at the threshold between investment-grade and junk bonds. The results of this specification, along with an extended model incorporating controls for maturity, coupon rate, and industry fixed effects, are summarised in Table 3 below.

TABLE III

REGRESSIONS OF LOG YIELD SPREAD ON CREDIT RATINGS, MATURITY, COUPON, AND INDUSTRY FIXED EFFECTS, WITH AN INTERACTION FOR JUNK BONDS

	Interaction Only (6)	Interaction with Controls (7)
Credit Rating	0.154*** (0.028)	0.122*** (0.015)
Junk Grade	-0.093 (0.348)	-0.202 (0.211)
Credit Rating x Junk Grade Interaction	0.015 (0.035)	0.037* (0.019)
Maturity	-	0.009* (0.005)
Coupon	-	0.046*** (0.007)
Industry Fixed Effects	-	Yes
Constant	3.395*** (0.200)	3.028*** (0.122)
Number of Observations	5,428	5,428
R^2	0.552	0.756
Root MSE	0.446	0.335

Notes:
*The dependent variable is the natural logarithm of Yield Spread. Yield Spread is measured in basis points (bps). A basis point equals 1/100th of a percentage point. Log Yield Spread is the natural logarithm of Yield Spread. Credit Rating is an ordinal variable, where higher values represent lower-quality (riskier) bonds (e.g., AAA = 1, CCC = 19). Junk Grade is a dummy variable equal to 1 for bonds rated below investment grade (BBB-) and 0 otherwise. The interaction term (Credit Rating x Junk Grade) captures the differential effect of Credit Rating on Yield Spread for junk-grade bonds compared to investment-grade bonds. Maturity is measured in years to bond expiration. Coupon is the annual coupon rate, expressed as a percentage. Industry Fixed Effects are included in Model 7 to account for unobserved heterogeneity across industries. Standard errors are clustered at the industry level and are reported in parentheses. Statistical significance is as follows: ***p < 0.01, **p < 0.05, *p < 0.10.*

[3] In this model:
Junk Grade is a dummy variable equal to 1 for bonds rated below investment grade (BBB-) and 0 otherwise.
Credit Rating x Junk Grade is an interaction variable of Credit Rating and the Junk Grade dummy variable.

Table 3 shows that the interaction term (0.015) suggests a steeper slope for junk bonds, though not statistically significant. The credit rating coefficient (0.154) confirms the positive relationship between lower ratings and higher spreads. However, the junk-grade dummy coefficient (-0.093) is insignificant, indicating that crossing into the junk-grade category does not independently affect spreads in this simplified model. These results suggest that while credit ratings are a significant driver of bond yields, the interaction effect and junk-grade status alone require additional context for clearer interpretation.

Specification (7) incorporates controls for bond maturity, coupon rate, and industry fixed effects to refine this analysis and address potential omitted variable bias. The model is represented as:

$$Log\ Yield\ Spread_i = \beta_0 + \beta_1 CreditRating_i + \beta_2 Junk\ Grade_i + \beta_3 (Credit\ Rating_i \times Junk\ Grade_i) + \beta_4 Maturity_i + \beta_5 Coupon_i + \gamma Industry_i + \varepsilon_i$$

The credit rating coefficient (0.122) is positive and significant at the 1% level. At the same time, the β_3 interaction term (0.037) is also statistically significant, although only at the 10% level, indicating that the slope of the relationship between credit ratings and yield spreads is steeper for junk bonds (15.9%) compared to investment-grade bonds (12.2%) after controlling for all covariates. This finding suggests that the market penalises junk bonds more severely for declines in credit quality. From a financial perspective, this implies that investors demand disproportionately higher compensation for assuming the additional risk associated with lower credit ratings in the junk-grade segment. The steeper slope may reflect greater sensitivity to small changes in creditworthiness for junk bonds, as they are perceived to be at higher risk of default, leading to higher required returns.

Interestingly, the β_2 coefficient on the junk-grade dummy variable is insignificant, suggesting there is no significant level shift in yield spreads upon transitioning from investment-grade to junk-grade status. This result indicates the absence of a clear discontinuity at the investment-to-junk-grade threshold, meaning that the market does not impose an immediate yield penalty solely due to the categorical reclassification of a bond as junk. As a result, the lack of a significant level shift reinforces the idea that yield spreads of US corporate bonds are influenced more by gradual changes in credit quality than by categorical thresholds.

IV. Limitation of Results

While the results provide valuable insights into the relationship between credit ratings, junk-grade status, and bond yield spreads, several limitations should be considered. First, there are external validity concerns due to the nature of the dataset. The data were collected from all outstanding U.S. corporate bonds with maturities between 5 and 10 years as of November 7, 2024. This narrow snapshot limits generalisation to other maturities, geographies, or market conditions. For example, macroeconomic factors like interest rate environments or liquidity conditions during data collection could disproportionately influence the observed relationships, limiting the applicability of the results to other periods or global bond markets.

Second, potential omitted variable bias remains a threat to the internal validity of the regression models. While Model 7 incorporates controls for bond maturity, coupon rate, and industry fixed effects, other factors influencing yield spreads may remain unaccounted for. For instance, Unobserved factors like market liquidity or issuer health could bias estimates.

Finally, the lack of discontinuity at the investment grade to the junk-grade threshold raises questions about the assumptions underlying this cutoff. While the results suggest a continuous relationship between credit ratings and yield spreads, institutional factors such as regulatory requirements or investor mandates to hold only investment-grade bonds may still affect bond market behaviour in ways not fully captured by the models.

V. Conclusion

This paper examines the relationship between credit ratings and bond yield spreads, focusing on the investment-grade to junk-grade threshold dynamics. The findings confirm that credit ratings are a significant determinant of yield spreads, indicating that a one-unit decrease in credit rating increases yield spreads by approximately 12.2% for investment-grade bonds. Additionally, the interaction term of 0.037 suggests that this relationship is even steeper for junk bonds, where a similar decrease in credit quality results in a 15.9% increase in spreads, reflecting heightened risk premiums demanded by investors.

Interestingly, the lack of a significant level shift in yield spreads at the investment-grade cutoff implies a continuous relationship between credit ratings and yields, with no abrupt pricing changes driven solely by reclassification into the junk-grade category. This result suggests that market participants price bonds primarily based on their underlying credit quality rather than institutional boundaries.

While these results provide valuable insights, limitations such as omitted variable bias and the dataset's narrow temporal scope highlight the need for caution in interpreting these findings. Future research could expand this analysis by incorporating panel data, addressing potential endogeneity, and examining global bond markets to enhance the generalisability of these results.

VI. References

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