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# Moody's Bond Ratings in Historical Perspective; Their Purpose and Performance

## Abstract:

The securities rating industry has been heavily criticized for its subprime mortgage ratings that performed so poorly during the 2007-9 subprime crisis. This chapter traces the history of Moody's bond ratings since their inception in 1909. The stated purpose of the ratings was as an aid in investment analysis with the large number of U.S. securities outstanding at the time. However, evidence is reviewed that the Great Depression was a turning point for ratings, with a switch in focus from investment analysis to default analysis. The ratings during this period were compared with a structural default analysis in terms of their ability to rank order defaults that occurred during the Great Depression. The conclusion is that advances in finance has created technologies that tend to outdate the ratings technology.

Key words: Moody's, bond ratings, through-the-cycle, structural default analysis, Great Depression

## 1. Introduction

John Moody founded the securities rating industry in 1909. The ratings industry has since grown worldwide and has remained fundamental to the global financial system. However, the dominance of the industry has been heavily criticized, a point of view in part pursued here. Below evidence is reviewed that the purpose of Moody's ratings has changed over time, the ratings have become increasingly cyclical since inception, and the technology of ratings has seemed to become outdated, in the sense that finance research has developed sophisticated alternatives to the use of ratings.

In particular, evidence is discussed that the ratings industry has not kept up with the financial technology that has developed since 1909. Moody originally intended his ratings to serve as an investment approach, an area in its infancy at the time. Moody intended his ratings to help investors identify which securities would show appreciation in the future as the underlying railroad firm improved its financial results. However, the understanding of investment technology has significantly improved since 1909, with the development of sophisticated approaches to evaluate security risk (such as duration and convexity) and how to combine these risks into portfolios.<sup>1</sup> Evidence is also presented that the purpose of Moody's ratings then moved away from investment analysis, and towards default analysis, as a result of the Great Depression.

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<sup>1</sup> See, for example, [1].



In the context of default analysis, evidence is discussed from a comparison of the ability of Moody's bond ratings to rank order defaults, compared to the default predictions developed from a structural default analysis. The structural default analysis is based on the development of modern option pricing theory. Data for the comparison was taken from the period: 1925-1933, which includes the Great Depression period when firms were under a great deal of stress. The two approaches are compared in terms of their predictive accuracy with rank ordering corporate defaults over the period. The results show that the structural model significantly outperformed the Moody's ratings, in terms of the predictive accuracy at rank ordering defaulted firms. The implication would be that the development of finance theory has outdated the traditional approaches to bond ratings taken by Moody's and other bond rating services.

## **2. Moody's at inception**

John Moody invented the securities ratings industry in 1909, shortly following the influential Panic of 1907. As opposed to a ranking analysis of default risk, Moody intended his ratings at inception to provide an investment analysis of the multitude of U.S. bonds and other securities outstanding at the time. As Moody stated, his intention in founding his ratings system was to provide: "a complete explanation of the proper principles to be employed for analyzing railroad investment values" (see [2] p. 14). An analysis of these early bond ratings is provided in [3].

At the time corporate bonds played a special role in the U.S. economy. Banks were required to purchase U.S. government bonds as backing for their bank note issues, which absorbed much of the government issues outstanding, and which thus created a relatively illiquid market for government bonds. Due to the absence of a liquid risk-free sovereign market, this gap was filled by corporate bonds, which created one source of demand for high quality bonds, which could be identified with the help of Moody's bond ratings once they became available. Indeed, Moody rated 38.94 percent of railroad bonds as Aaa, and 85.25 percent of these bonds as A, Aa and Aaa.<sup>2</sup> Wilson in [3] performed a structural default analysis on these bonds, which showed that default risk was indeed quite low at the time. These results substantiate Moody's intention that his ratings reflect the future investment potential of a bond, rather than an analysis of default risk.

Moody's introduced a formal system of security analysis with his ratings. He based his ratings on two factors. The first factor was the "security" of an issue, which reflected (1) the corporate assets backing the particular issue and (2) the permanency of the corporate income available to make required payments (thus a type of interest coverage ratio). The second factor was the "salability" of the issue, which Moody intended to reflect the liquidity of the issue. Wilson in [3] uses an ordinal regression analysis to analyze the assignment of bond ratings by Moody in 1909.

The study showed that the security and salability factors did account for most of the variability in ratings. The study also investigated additional explanatory factors, such as size, profitability and leverage factors constructed from the data presented in the Moody's manual, and default measures constructed during the Panic of 1907. Study results showed that these additional factors explained little additional

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<sup>2</sup> According to Fortune (4/26/2016) in 2016 Microsoft and Johnson & Johnson were the only two AAA-rated U.S. corporate firms.



variation in ratings. Thus these additional factors did not successfully reflect the personal judgement that Moody might have incorporated into his ratings. Finally, the explanatory power of the model was much greater for bond issues that were also followed by public financial-news sources such as the *Commercial and Financial Chronicle*, which may imply that Moody's ratings were particularly important for the large number of bond issues not followed in the financial press of the time.

An important element of Moody's ratings was the use of a "through-the-cycle" approach to ratings. That is, rather than ratings reflecting the nuances of changes in risk throughout a business cycle, Moody based his analysis on 10-years of detailed corporate data on the firm whose securities were being rated. Thus ratings were intended to reflect a bond's potential investment performance through an entire business cycle. Banks at the time held bonds as secondary reserves, and so were more interested in holding high-quality securities, rather than in actively trading bonds in response to business-cycle changes. Indeed, the performance of bonds during the 1907 panic had little impact on the bond ratings at their inception in 1909 [3]. This lack of focus on default analysis is also supported by the more modern analysis of [5], which showed that bond yield spreads are unrelated to default risk but are related to the same risk factors that affect equity pricing. Moody's rating system also incorporated ratings on preferred and common stock, reflecting Moody's view that common and preferred equity were alternative claims on the same underlying corporate assets as the bonds that were rated.

In a related study, [6] shows that U.S. corporate bonds were held and traded throughout major financial centers in Europe at the time Moody established his ratings. This international trading of U.S. bonds was facilitated by the bearer form that was common for these securities. That study sourced bid and ask prices for U.S. bonds from the Amsterdam, Frankfurt and London bond markets, along with U.S. bond market prices taken from *The Commercial Financial Chronicle*. International trading of U.S. bonds would at times provide arbitrage opportunities that resulted in gold inflows into the U.S. This was the case when the U.S. suffered a financial crisis in 1907. The study results indicate that some \$12 million in gold inflows into the U.S. was consistent with the bond arbitrage that had developed between these international markets in 1907. The resulting inflow of gold to the U.S. helped to bring an end to the liquidity crisis of 1907.

Note that the ratings industry developed in the U.S. in the early twentieth century despite the much older and more developed bond markets in Europe. I would speculate that this development occurred in part as a result of the U.S.'s extensive bank-branching restrictions that had created a banking system with a large number of small banks. Corporate bonds were held by these banks as secondary reserves, but the vast majority of banks did not have the in-house expertise to evaluate bond investment quality. In contrast, many European countries at the time had more consolidated financial systems that would have allowed for greater in-house analysis of bond and stock securities. Moody [2] made the following comment.

"For the railroads are not owned by a small group of capitalists of great wealth, as is erroneously assumed in some quarters, but by a large number (between one and two millions) of individuals in this and other countries, whose average holdings range from \$700 to \$1,500 each."



The Moody's manuals filled this information gap through their extensive presentation of data and analysis of U.S. corporate bonds and stocks. Since at the time the profitability of Moody's service depended on selling annual volumes, the large number of U.S. banks represented one such component of demand. However, the data produced in Moody's manuals was largely public data taken from Interstate Commerce Reports.<sup>3</sup> As Moody in [2] states:

“The records of the Interstate Commerce Commission embrace nearly all the facts that are necessary, but they are not presented in a very satisfactory form for intelligent and accurate usage”

The quote would seem to imply that Moody's inception of bond ratings realized informational economies of scale that were available within the U.S. financial system, as suggested by [7].

Finally, since investment analysis was in its infancy at the time, John Moody likely made an important contribution to the developing area of investment analysis. His annual volumes systematically presented the data required for analysis. Moody had also developed his own system for analyzing the investment quality of these securities. However, the development of more sophisticated investment theories since 1909 has mostly displaced the investment approach utilized by Moody's. In the decades since the 1909 inception, Moody's and other ratings agencies have generally not pursued more sophisticated investment approaches to security analysis.

In the next section evidence is presented that the focus of Moody's bond ratings changed from investment analysis – where the focus was to identify undervalued bonds that might appreciate in value over time - to a greater focus on default analysis. This change to default analysis would seem to move the purpose of bond ratings toward a more modern focus. The study also analyzes how aspects of Moody's judgement impacted his ratings assignments during the Great Depression.

### **3. The Impact of the Great Depression on Moody's bond ratings**

The U.S. Great Depression of the early 1930s would have created a significant test of the accuracy and stability of Moody's bond ratings process. As outlined above, Moody's ratings were a combination of quantitative analysis plus the judgement of John Moody, the founder of the rating system. John Moody had experienced many of the U.S. financial crises to that date, so his judgement was potentially quite valuable in understanding the economic crisis that was unfolding.<sup>4</sup>

As already discussed Moody's ratings had been constructed using a “through the cycle” approach that would reflect secular but not cyclical trends in the investment quality of bonds. The Great Depression,

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<sup>3</sup> These reports were from the Interstate Commerce Commission which was a U.S. regulatory agency created in 1887 to regulate common carrier aspects of U.S. railroads.

<sup>4</sup> John Moody was born in 1868. His earliest publications in 1904 included *The Truth About the Trusts: A Description and Analysis of The American Trust Movement* and *The Art of Wise Investing*. According to [8] there were 13 banking panics in the U.S. between 1814 and 1914, and among these the Panic of 1907 was the worst.



perhaps more than any previous economic crisis in U.S. history, would put that concept to a test. This issue is analyzed in [9].

As discussed above, Moody based his ratings on two factors: (1) the “security” factor, a type of interest coverage ratio and (2) the “salability” factor which reflected the liquidity of the bond issue. The analysis in [9] uses an ordinal regression approach to analyze the assignment of bond ratings. Since these two factors were readily available from the Moody’s manual, the residuals from the ordinal regression analysis would then represent the judgement that Moody impounded into the ratings, along with these two statistical factors. The analysis covers the period: 1925-1933. By separating the ratings into structural and judgmental factors and estimating these separately for each year, the study analyzed how the weightings on systematic factors, and the influence of Moody’s judgement, changed over this period.

The judgement that Moody embedded into his rating assignments was reflected in the distribution of the error terms from the ordinal regression analysis. If the mean of the residuals became increasingly negative over time, then the impact of Moody’s judgment would be to increasingly downgrade ratings as the Great Depression occurred. As well, if ratings errors became increasingly left skewed, then Moody’s judgement was to downgrade low-rated securities more than higher-rated securities. Finally, an increase in the kurtosis of the residuals from the analysis might imply that judgement had tended to downgrade low-rated securities while upgrading high-rated securities. Therefore, examining the residuals from the ordinal regression analysis may yield insights into Moody’s judgement, and how Moody’s judgement was impacted by the deteriorating economic conditions of the Great Depression, as reflected in his ratings assignments.

The security and salability factors represent the “statistical” or quantitative part of the ratings model. The results in [9] show that the weightings on these two statistical factors changed over the study period: 1925-33. In particular, over the depression years 1931-33 the weight of the solvency variable increased, while the weight of the salability factor decreased. The statistical aspect of the ratings became increasingly focused on solvency, and thus on a default analysis of the securities. An additional implication is that as a result, rating stability had diminished and that ratings had become increasingly cyclical.

Thus the context of Moody’s bond ratings appeared to have changed sharply during the Great Depression. The increased weighting on the solvency factor was in contrast to the through-the-cycle approach used previously to create ratings. Thus ratings increasingly took on a strong cyclical component. In addition, the focus of Moody’s ratings changed from an investment analysis to a greater focus on default analysis.

Next analyzing the residuals from the statistical portion of the analysis, while the volatility, skewness and kurtosis of the residuals did not show much change over the sample period, there was a mean shift that occurred in Moody’s judgement. Over the pre-depression years: 1925-1929 the impact of Moody’s judgement tended to inflate the ratings relative to the statistical model results. Then during the depression years in 1931-33 the mean shift in judgement was towards lower ratings. Thus Moody’s judgment was to inflate ratings pre-depression, and then to increasingly downgrade all securities in the depression years: 1931, 1932, and 1933, beyond what was indicated by the statistical model. This pattern would seem to mirror the movement of ratings surrounding the Great Recession, where critics have pointed out that ratings were inflated pre-crisis, and then downgraded rapidly during the crisis.

In addition, the lack of a significant change in residual volatility, skewness and kurtosis, imply respectively that (1) Moody believed that all bonds would be equally impacted by the Great Depression since the residual variance did not significantly increase, (2) that low rated bonds would not be more



impacted than high-rated bonds and (3) that Moody did not anticipate “Black Swan” effects, which might result in the large down-grade or up-grade of securities.

The next section builds on the results discussed above that show a transition in the Moody’s ratings process from investment analysis to a greater focus on default analysis. The next section discusses evidence from an analysis of the accuracy of Moody’s bond ratings in correctly rank ordering the occurrence of default among rated railroad firms during the Great Depression.

#### 4. Technology Then and Now

As shown in [9] one apparent impact of the Great Depression on Moody’s bond ratings was to make the ratings process more cyclical, with a greater focus on bond default analysis. In this case a relevant question becomes how well does Moody’s bond ratings serve as a basis for default analysis? Moody’s published manuals contained extensive amounts of data and analysis. As well, Moody was a leading financial observer of his time, with over 20 years of publishing the ratings by the time of the Great Depression.

In contrast, the technology of default analysis has advanced greatly since the founding of Moody’s ratings, particularly with the development of option pricing theory, which gives a structural framework for default analysis. This approach uses the information contained in equity prices to model default risk. In contrast, this information may only imperfectly be reflected in bond credit spreads.<sup>5</sup> In [10] a structural modeling approach is used taken from [11] (hereafter VX), which builds on Merton's option pricing model to compute default measures. The structural approach models a firm’s outstanding equity as a call option on its assets, with strike price given by the firm’s outstanding debt level. If the firm’s asset value declines to its debt value, the equity holders have the option to turn ownership of the firm over to the debt holders and suffer no further losses.

The inputs to the structural model include the firm’s market equity value, its nominal debt level and its equity volatility. From these inputs a “distance-to-default” measure is calculated to yield the number of standard deviations from the current value of  $\ln(V_A/X)$  to a value of zero (where insolvency occurs). The distance-to-default measure (DD) is given as follows

$$DD = [\ln(V_{A,t}/X_t) + (\mu - 1/2\sigma_A^2)T] / (\sigma_A\sqrt{T})$$

where

$V_A$  is the firm’s asset value,

$X_t$  is the book value of debt at time  $t$  that matures at time  $T$ ;

$\mu$  is the mean asset return, estimated from daily observations on  $V_{A,t}$ ,

$\sigma_A$  is the volatility of assets,

and

$T$  is the timeframe of the default likelihood estimation, here taken to be one year.

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<sup>5</sup> The research in [5] shows that bond yield spreads are unrelated to default risk but reflect the same risk factors that affect equity pricing.



Note that the asset-to-debt ratio ( $V_A/X$ ) and asset volatility ( $\sigma_A$ ) are the inputs to the analysis. The asset-to-debt ratio reflects how leveraged the firm is. The asset volatility measures reflects how much the asset value can potentially move over time.

The research in [10] uses the Moody's accuracy ratio to compare the accuracy of the Moody's bond ratings and the VX structural approach in measuring bankruptcy risk in their sample of railroad firms during the Great Depression. The data sample for the analysis was taken from Moody's manuals and consisted of railroad firms with listed equity from the period, which firms were a traditional focus of bond ratings. Using the accuracy ratio, railroad firms are ranked ordered under each default measure from most-at-risk to least-at-risk. For the Moody's bond ratings this would be an ordering from lowest to highest ratings for the particular railroad. For the VX approach the ranking would be from smallest to largest distance-to-default.

Then along each rank ordering the cumulative number of failed firms to a particular ranking is recorded and divided by the total number of failed firms in the sample. This process continues up to the last observation, at which observation all the defaulted firms have been recorded. The result is a curve from 0 (before the first failure observation) to unity at the last failure observation. Ideally the curve would accumulate all the defaulted firms at the front end of the curve. One advantage of the accuracy ratio is that it considers the entire sample of firms, rather than simply the sample of failed firms.

Recall that Moody's ratings analysis was based on the enormous amount of data presented by Moody's, plus the expert judgement that Moody had gained over previous decades. In contrast, the structural default model is based solely on the distance-to-default measure. The empirical results of the analysis showed that despite the thousands of pages of analysis dedicated to the Moody's analysis, the option-pricing approach with its simpler inputs outperformed the Moody's ratings in rank ordering default probabilities.

The results suggest that the VX structural modeling approach generally accumulates actual failures at a faster rate (thus a better rank ordering) than the Moody's rating approach, and thus VX tends to dominate the Moody's approach. The VX approach accumulated failures at a 7.66% higher average rate, which was significantly different from zero at  $p=0.000$ .

## **5. Conclusions**

Moody's bond and stock ratings began their inception as an investment tool for the multitude of bankers and other investors that required information on U.S. investments. The rapid U.S. industrialization had provided a vast array of securities for investors to evaluate, which included the railroad securities which were the growth industry of the age. The ratings business started by John Moody filled this information gap by providing annual volumes that were filled with data and analysis. At the time the U.S. lacked a consolidated financial system, so dispersal of financial information was a valuable service.

However, over the past century the avenues for information dispersion have increased and investment analysis has become much more sophisticated. Has Moody's kept pace with these changes?

The research reviewed from [10] performed a comparison of Moody's bond ratings with a structural default analysis, representing relatively new technology that has developed out of option pricing theory. The study used data from the Great Depression period, when corporations were under a great deal of





default stress. The structural approach performed significantly better than the bond ratings in rank ordering the occurrence of default, using the Moody's accuracy ratio to assess the accuracy of the two approaches. There is a substantial and growing literature on the technology of default analysis, which has significantly improved over time. In contrast, there is little or no literature to suggest that the technology of bond ratings has significantly changed and improved over time.

The more modern bond rating studies in [12], [13] and [14] investigated bond ratings data from the 1960-70s. By this point Moody's no longer used a formal "statistical model", such as that described in the previous sections. Thus, these authors use financial and accounting data to replicate assigned ratings by the major rating agencies. The lack of a statistical model further obscured the construction of ratings.

The research in [9] was able to separately analyze the impact of Moody's statistical model and his judgement on ratings from the period: 1925- 1933, which period includes the Great Depression. The impact of both of these elements of Moody's ratings had changed over this time period. First, with the statistical model greater weight was put on the factor representing firm solvency, while less weight was reflected in the factor representing firm liquidity, as the Great Depression moved from being a liquidity crisis to being a solvency crisis. Second, the impact of Moody's judgement was to inflate ratings pre-Depression and then to downgrade ratings beyond the statistical results during the Great Depression. These results provided clear evidence that ratings had become more cyclical, as opposed to a "through-the-cycle" approach often discussed. As well, the results suggest that Moody's ratings had become increasingly focused on default analysis, as opposed to the investment analysis originally proposed by John Moody.

References;