The Value of Ratings: Evidence from their Introduction in Securities Markets

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Abstract: We study the effects of the first-ever ratings for corporate securities. In 1909, John Moody published a book that partitioned the majority of listed railroad bonds into letter-graded ratings based on his assessments of their credit risk. These ratings had no regulatory implications and were largely explainable using publicly available information. Despite this, we find that lower than market-implied ratings caused a rise in secondary market bond yields. Using an instrumental-variables design, we show that bonds that were rated experienced a substantial decline in their bid-ask spreads, which is consistent with reduced information asymmetries and improved liquidity. Our findings suggest that ratings can improve information transmission, even in settings with the highest monetary stakes, and highlight their potential value for the functioning of financial markets.

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1 Introduction

Bond markets are unique, not only for their economic importance, but also for their unusually heavy reliance on ratings. In principle, bond ratings convey risk assessments to investors, thereby helping to solve problems related to asymmetric information. Yet in practice, it is unclear whether those ratings actually offer anything new to financial market participants, who would seem to have powerful economic incentives to obtain and process all information relevant to securities prices.

A vast empirical literature has established that ratings have significant impacts on a broad range of firm and market outcomes, and has generally cast these effects as evidence that ratings are an important instrument for information provision.[1] Yet since the 1930s, credit ratings have become inseparably intertwined with explicit and implicit financial regulations, investment mandates, and bond covenants (White, 2010), and it is these regulations and mandates that may explain the centrality of ratings in bond markets, and also their effects. Even if they conveyed no information about credit risks, ratings could still have large impacts through their effect on the demand for securities by investors that operate within the purview of ratings-based regulations or mandates.[2] It is therefore not possible to determine empirically whether the impact of modern ratings is the product of *information provision*, by which we mean that their risk assessments conveyed via partitioning would affect market participants' expectations in the absence of mandates and regulations.[3]

To isolate the role of information provision in ratings, one has to turn to historical contexts prior to the introduction of rating-based regulations and investment mandates. In this paper, we analyze the effects of the first-ever securities ratings, introduced by John Moody in 1909. What turned out to be one of the most significant financial innovations in U.S. history was simply offered for sale in a printed volume in April of that year, as the product of a novel business venture that was not anticipated by investors and was not linked to any regulation or mandate. We find that Moody's ratings caused changes in bond yields and a reduction in information asymmetries, as

[1] See, for example, Kaplan and Urwitz 1979; Hand et al., 1992; Holthausen and Leftwich 1986; Graham and Harvey 2001; Dichev and Piotroski 2001; Vassalou and Xing 2005; Kisgen 2006; Jorion and Zhang 2007; Sufi 2009; Ellul et al. 2011; Kisgen 2012; Aslan and Kumar 2015; and Almeida et al 2017.

[2] Any ratings change, even if completely exogenous, will lead investors to update the probability distribution over future ratings, distorting demand through future expected mandates and regulation, even if the change had no immediate regulatory implications. For example, a negative ratings watch, which has no regulatory implications, could increase the expected likelihood of falling below investment grade in the future, and impact expected demand for the security.

[3] This is distinct from whether ratings improve equilibrium information. A third-party evaluator might substantially impact markets using ratings, and yet happen to be mistaken ex-post, making prices less accurate.

reflected in a narrowing of bid-ask spreads. These results suggest an important role for ratings as tools for information provision, even in the high-stakes setting of financial markets. The potential for a simple, discrete risk assessment to transmit information to investors is highlighted by another important feature of the origins of ratings. Moody had previously operated a business that produced 'investor manuals' that presented much of the accounting data he later used to produce the ratings, and had even published a volume that explained the evaluation of the credit risk of bonds (Moody, 1906). His publication of ratings had significant market impacts above and beyond his earlier publications that conveyed much of the information on which the ratings were based. This suggests that what may have mattered was not only the level of information available, but the manner in which this information was presented to investors.

To identify the effect of Moody's 1909 ratings on market yields, we utilize a difference-in-differences design surrounding their publication, which compares the bond yields of firms whose ratings were likely to have been interpreted as a negative surprise to the yields of the bonds of other firms receiving the same rating but not as a negative surprise. We define negative surprises as cases where Moody's ratings were worse than investors' expectations, as implied by the risk assessments reflected in secondary market yields. In addition to estimating whether ratings surprises affected yields, this design also implicitly tests for convergence in yields within ratings levels. Our findings, however, are robust to the use of alternative empirical specifications in which we instead compare bonds with similar initial yields that did and did not receive negative surprises.

We find that negative surprises produced modest but appreciable changes in bond yields of about 14 to 26 basis points on an annualized basis, representing about a 2.9 to 5.3 percent increase relative to average yields. We show that there is no evidence of differential trends prior to the release of ratings and that yields rose steadily afterwards, consistent with a causal interpretation of our findings. We also show that a few months after Moody introduced his ratings, the financial press began to publish tables that compared the yields of different bonds that received the same rating, and recommended trading based on the differences. This evidence suggests that investors quickly started to perceive similarly rated bonds to be of equivalent risk, consistent with surprises leading to convergence in yields within rating levels.

The relatively high-frequency nature of the yield response reduces concerns about confounding events. Although our estimated effects are robust to the inclusion of a wide variety of controls, it is still possible that the firms that received negative surprises were different from the others along unobservable dimensions. If those firms happened to have differential exposure to a shock that coincided with the release of the ratings, that could potentially confound identification. To help address such concerns, we exploit within-firm variation by including firm fixed effects interacted with time trends, and utilize differences in surprises among the bonds of the same company. Although the thinness of the trading of individual bonds adds noise to the surprises calculated in this way, the results with this specification are similar, suggesting that differences in firm characteristics are unlikely to account for our findings.

As with modern ratings (e.g., Benmelech 2017), we find that Moody's 1909 ratings were largely explainable from readily available information. His volume focused only on railroads, which were the dominant securities issuers of the time, and several competing firms published annual investor manuals containing financial information for those firms. These data were detailed enough to calculate the financial ratios that Moody used in compiling his ratings, and we show that his ratings are largely reproducible using these data. Yet the differential effects of negative ratings surprises on bond yields survive the inclusion of a wide variety of ratings determinants in our regressions, including the bonds' yields prior to the introduction of the ratings (our measure of investors' expectations). If ratings were largely predictable, how could they have conveyed information to market participants? We posit that the simplicity of a rating system with easy-to-interpret letter grades helped marginal investors become better informed.

Of course ratings were not the only mechanism available to manage issues related to asymmetric information. The reputations of public companies in the early twentieth century were bolstered by the presence of elite investment bankers on their boards of directors, who monitored managers and represented the interests of securities holders (Frydman and Hilt, 2017). If ratings helped to moderate problems related to information asymmetries, we would expect the bond yields of firms with elite bankers on their boards should see smaller effects. Consistent with this, we find that firms connected through their boards with top underwriting firms did not experience much of an increase in yields when they received a negative surprise. These heterogeneous impacts indicate that the effects of ratings may have been mediated by a firm's reputation, bolstering the interpretation that the introduction of ratings may have helped to reduce information asymmetries.

We then more directly explore the extent to which ratings affect the degree of information asymmetries among market participants. To the extent that ratings are able to resolve these asymmetries, we would expect to see a decline in market-based proxies such as bid-ask spreads. For bid-ask spreads to tighten, ratings must reduce the advantage of the most informed traders (e.g. Glosten and Milgrom, 1985). This may be the case if less-informed investors had higher costs of information acquisition, and benefited differentially from the publication of ratings.

To assess how bid-ask spreads responded to the presence of ratings, we need a different empirical strategy than what we used for yields. Fortunately, Moody's volume did not rate all listed railroad bonds, and we can compare changes in the bid-ask spreads of rated bonds to those of railroad bonds that were not rated. The bonds Moody rated were, however, a selected group, with low initial yields and narrow bid-ask spreads on average. We address this selection problem by constructing an instrument based on Moody's rating procedure. Moody's volume rated all of the bonds of railroads that had at least some high-quality, low-yield bonds outstanding, and were therefore of great interest to investors. The railroads that had no such bonds outstanding tended not to be rated. But due to their origins as amalgamations of many smaller carriers, the railroad systems of 1909 often had complex capital structures with large numbers of bonds outstanding, and sometimes railroads that had high-quality bonds also had some low-quality bonds, with higher yields and bid-ask spreads.[4] These latter bonds were rated purely because they were part of the capital structure of a railroad that also had other, more important issues outstanding.

We therefore use the average yields of the other bonds issued by the same railroad as an instrument for whether a bond got rated. Results using this instrument in a two-stage least squares (2SLS) estimation show that the ratings resulted in substantially lower bid-ask spreads, consistent with more liquid and well-functioning financial markets. We also present suggestive evidence that ratings may have increased the trading of more illiquid securities by small investors, which is consistent with ratings helping marginal investors to become better informed.

Taken together, our results imply that Moody's letter-graded bond ratings constituted a valuable financial innovation that helped resolve problems related to asymmetric information. Institutional and retail investors quickly began to rely on them (Harold, 1938), and their later incorporation

[4]Railroad bonds were usually mortgage bonds; the bonds of the smaller railroads that were acquired by a larger system were backed by those railroads' specific railroad tracks, which could vary substantially in value. In many cases the smaller railroads' bonds remained outstanding after the railroad was acquired by a larger system, meaning that the larger system's capital stock consisted of many different bond issues with collateral of varying quality.

into financial regulations resulted from their credibility. Despite the historical focus of our analysis, our paper offers insights relevant for modern financial markets. In the conclusion, we discuss the broader lessons that can be gleaned from our study.

The results of this paper advance an extensive literature seeking to understand the determinants and effects of credit ratings. Recent contributions to this line of research have obtained convincing identification by focusing on credit rating refinements that introduced more granularity in established ratings systems (Kliger and Sarig, 2000; Tang, 2009). Since the refinements can be treated as exogenous ratings changes, this empirical strategy isolates the impact of ratings from the impact of factors that influence ratings. These studies have interpreted the effects of ratings on prices, liquidity and corporate outcomes as evidence that ratings convey information. However, this strategy cannot identify whether the effects of ratings are actually due to information provision as we have defined it, given the importance of ratings in financial regulations and investment mandates.[5] By focusing on a historical environment in which there were no ratings-based regulations or investment mandates of any kind, our paper provides strong evidence that credit ratings can actually transmit information to market participants and reduce information asymmetries.

Utilizing a historical event to gain insights into the role of credit ratings naturally raises the question of external validity. It may be tempting to conclude that the information-based effects of ratings we identify in 1909 would be irrelevant today, given the improvements in financial disclosure, data availability and information processing technologies that have emerged since then. However, it is important to note that the modern reliance on credit ratings by regulators and investors also affects information *production* in bond markets. Modern financial institutions other than credit rating agencies have limited incentives to invest resources in performing their own risk assessments, especially for highly-rated securities (see, among others, Dang et al., 2020; Johnston et al., 2009; Hanson and Sunderam, 2013).[6] Modern credit ratings may therefore continue to have significant information-based effects, although for somewhat different reasons than they did in 1909.

[5] Any change in a rating to a level closer to (or further from) a threshold such as investment grade would change the current or future expected demand for a bond, even if it had no influence on investors' expectations of the likelihood of default. For evidence of rating-related regulation affecting investor demand, see, for example, West 1973; Moreau 2008; Lemmon and Roberts 2009; Partnoy 2010; Kisgen and Strahan 2010; Chernenko and Sunderam 2012; Bongaerts et al. 2012; Flandreau and Sławatyniec 2013; White 2013; Bernstein 2017; Bao et al. 2018; and Baghai et al. 2022.

[6] Benmelech and Bergman (2018a, 2018b) and Johnston, Markov and Ramnath (2008) provide evidence consistent with the view that institutions other than credit rating agencies do not have a well-developed infrastructure for information gathering about bonds issued with high ratings.

Our study also connects to a body of research studying how the institutional structure governing the production of modern ratings affects the quality of information production. In the wake of the Great Recession, modern credit rating agencies came under harsh criticism, and serious concerns were expressed about the quality of the ratings they produce, as well as the heavy reliance on ratings by both investors and financial regulators. A sizable literature shows that the issuer-pays business model that was adopted by ratings agencies beginning in the 1970s created perverse incentives that distorted the ratings given to many securities (Benmelech and Dlugosz 2009, 2010; Becker and Milbourn, 2011; Bolton et al., 2012; He and Strahan 2012; Griffin and Tang 2012). The results of our paper suggest that when implemented simply as an evaluation of securities that were sold to investors, not issuers, and with no role in financial regulations, ratings were influential, and likely beneficial for bond markets.

Our paper also speaks to a theoretical literature that has sought to understand the use of ratings or grades by information intermediaries. In these models, a third party in possession of private information will optimally choose to release only a coarse signal.[7] Although these models help inform our analysis, none of them are entirely consistent with the settings for the 1909 securities ratings. Moody relied primarily on publicly available data to construct his ratings, did not charge railroads for rating them, likely had no reason to seek to influence railroad outcomes, and did not need to induce railroads to participate in his ratings system. The influence of Moody's innovation suggests that discrete ratings may have simplified the interpretation of data that were accessible but complex and difficult to evaluate, even in the context of a market in which participants had strong financial incentives to incorporate information into prices.[8] Although we lack the data to test for these specific mechanisms, it is possible that by simplifying complex information Moody's ratings may have helped small investors overcome complexity aversion (Puri, 2022) or make better investment decisions in the face of a potentially overwhelming range of bonds and bond characteristics (e.g., Carpenter et al., 2021).

[7]Prominent contributions to this literature have shown that a coarse signal maximizes revenue from fees charged to rated firms (Lizzeri, 1999); maximizes outcomes of all graded students (Ostrovsky and Schwartz, 2010); balances the value of the signal to rated firms and to investors (Goel and Thakor, 2015); and expands participation in the rating system (Harbaugh and Rasmusen, 2018), often in the context of a cheap talk game (eg, Crawford and Sobel, 1982; Martel et al., 2022).

[8]These results relate to Luca and Smith (2013), who show in the context of college ratings that the order in which these ratings are listed has very different effects on college applications, even when the data and methodology to construct these ratings are provided.

Finally, our paper also contributes to a significant literature analyzing the origins and effects of historical financial innovations in the United States.[9] A number of related works have focused on early mercantile and securities ratings agencies (Carruthers, 2022; Chandler, 1956; Sylla, 2002; White, 2010, 2013; Flandreau and Mesevage, 2013; Bernstein, 2017; Penet, 2019), and the predictive power of historical securities ratings (Harold, 1938; Hickman, 1958; Hempel, 1971; Flandreau et al, 2011). Yet surprisingly, despite their transformative effects on bond markets, Moody's first-ever securities ratings have not been the focus of much empirical analysis. One notable exception is Wilson (2011), who analyzes the determinants of Moody's 1909 ratings. Our paper focuses instead on empirically estimating the effects that those ratings had, and shows that ratings can improve the functioning of bond markets and market access.

2 Origins of the First Letter-Graded Security Ratings

2.1 Early Twentieth Century Bond Markets

Well before the introduction of credit ratings, the corporate bond market in the United States grew to become quite extensive. Figure 1 presents data on the market's evolution from 1880 to 1910. The left panel shows that total outstanding corporate debt securities grew from $2 billion to $15 billion over this period (nominal GDP in 1910 was about $30 billion). Railroads dominated the market, although after 1900 the volume of bond issues of utilities and industrials grew rapidly.

Whereas today bonds are primarily traded over the counter, during this period they were generally listed on the NYSE and traded within a special section of the exchange floor. The right panel of the figure shows that the volume of trading in bonds on the NYSE grew substantially, but not as rapidly as the volume of outstanding bond issues. Retail investors accounted for a substantial share of the trades executed on the exchange (Meeker, 1930: 260), and single-lot trades, which were likely to have been ordered by retail investors, accounted for around 20 percent of trades.[10]

[9]Noteworthy examples include securities markets (Rousseau and Sylla, 2005; Atack and Neal, eds., 2009), bank clearinghouses (Gorton, 1985; Tallman and Moen, 2012; Jaremski, 2018), commercial paper markets (James, 1993; Calomiris et al., 1995), shadow banks (Gorton and Metrick, 2010; Rockoff, 2018; Frydman Hilt and Zhou, 2015), central banks (Sylla, 2010; Bordo and Roberds, eds., 2013), and collateralized banknotes (Rolnick and Weber, 1983; Gorton, 1996; Jaremski 2010).

[10]The face value of bonds at the time was typically $1,000, which was more than twice nominal GDP per capita at the time, so retail investors were wealthy individuals. We calculate the fraction of trades by size in our intraday trading data below; see Appendix Table A.5.

Institutional investors, such as insurance companies, also traded through brokers on the exchange floor.[11] In general trading was concentrated on a relatively small number of well-known railroad bonds; the vast majority of NYSE-listed bonds traded only infrequently.

As the bond market expanded, information resources for investors proliferated as well. By the turn of the twentieth century, several competing firms produced annual volumes of financial data on major corporations, which included Henry Varnum Poor's *Poor's Manual of Railroads,* Standard Statistics Service's *Manual of Statistics,* and John Moody's *Moody's Manual.* However, these investor manuals did not provide much assistance with interpreting the information they contained. They simply presented firms' financial statements, and offered little additional commentary or analysis. The volumes were sold at a relatively high price, and were marketed to sophisticated investors—most likely the bond departments of private banks, insurance companies, and commercial and savings banks—which possessed the requisite knowledge of accounting and finance to analyze the information presented.[12]

Perhaps as a consequence of the availability of these information resources, coupled with the widespread adoption of communications technologies such as the telephone and telegraph, early twentieth century bond prices generally reflected information on credit risks. For example, during the years 1899-1919, the correlation between the prices of high-quality bonds and corporate defaults in the following year was -18.3 percent. This is quite similar to the modern era; for the years 1996-2010, the correlation was -18.2 percent.[13]

2.2 Moody's Innovation and its Reception

In the wake of the Panic of 1907, John Moody was forced to sell his Moody Manual Company, and these manuals continued to be produced under his name by a competitor. To differentiate his product, he established a new business that was focused instead on providing investors with analysis, rather than just financial data. His new Analyses Publishing Company produced its first annual volume, *Moody's Analyses of Railroad Investments*, in April of 1909. The volume provided

[11] There was also an over-the-counter market in which institutional investors transacted directly with one another or with a broker over the telephone; this market grew significantly in importance during the 1920s. See Meeker (1930).

[12] The list price for most of these volumes was around $12 in 1909. Adjusting for inflation using the CPI, this is equivalent to more than $350 in today's money.

[13] These calculations were made using bond price data from Homer and Sylla (1996) and corporate default data from Giesecke et al., (2014).

data summarizing the financial statements of every major railroad, and applied a letter-graded rating system to categorize the credit risk their bonds, nearly 1,300 in total—quite akin to modern ratings. Importantly, the publication of the manual and, especially, the ratings it contained, were unanticipated by market participants.

The 1909 volume was quite different from a typical investor manual, in that it included long chapters explaining railroad financial statements and how they should be evaluated. And whereas typical investor manuals included large amounts of advertising, with ad sales producing a significant source of revenue (Chandler, 1956), Moody's volume of ratings contained no advertisements, which eliminated any possibility that ad spending might influence its content.

At the time, commercial credit reporting agencies such as R.G. Dun & Co. and Bradstreet's offered letter-graded ratings of the creditworthiness of individuals and firms, and these mercantile ratings likely inspired Moody. His innovation was to develop a quantitative system to rate the specific bond issues of railroads, in a volume that included clear descriptions of the specific data and methods used. Moody's ratings scale could take 11 different values ranging from Aaa to E, which offered investors a simple summary measure of the quality of a bond, in a hierarchy that was easily understood.

The methods Moody employed in his evaluation of the bonds were not new. Many published guides for investors available at the time noted that the safety of railroad bonds could be evaluated by comparing their interest obligations to the railroad's earnings, which, as we will show below, is essentially what Moody did. In fact, Moody himself published a volume in 1906 that argued for doing this, and described the approach he would later adopt in his volume of ratings (Moody, 1906). What was new was that Moody painstakingly calculated these statistics for most railroads, and developed discrete thresholds characterizing different levels of safety—his ratings. Other sources had suggested rules of thumb for what constituted a safe bond or a risky bond, but no investor guide had ever developed a consistent rating system, much less actually applied it systematically.[14]

For each railroad in the manual, Moody presented ten years of earnings and expense data, and compared their values (scaled by mileage) to other railroads in the same region. Moody then

[14]Nelson (1907) is an example of the former, and stated that "A first-class bond investment necessitates that a road should earn double its fixed charges." Another example is Hall (1906: 32), who stated that "from 60 to 65 percent of the profits should pay all fixed charges, that is to say, taxes and interest on the funded debt. If 80 percent is required, an investor should take advice as to the propriety of selling his bonds and going into some other security."

presented simple tables that listed the railroads' bonds, and offered a rating based primarily on its 'factor of safety'—the share of earnings remaining after interest on the bond and all bonds senior to it had been paid.[15] Summary descriptions of Moody's ratings are presented in Table 1. The overwhelming majority of the bonds rated in the volume received ratings of Aaa, Aa or A, reflecting the relatively high quality of the bonds of railroads, which were then the "blue chip" companies.

Similar to other investor manuals, Moody advertised his volume in the financial press. But he also appealed directly to retail investors, taking out ads in the *New York Times* that mentioned prominent railroads, and touted the volume's analysis of their securities. The ratings offered a convenient and comprehensive guide to the quality of different railroad bonds that was independent from the securities dealers who marketed bonds. As many commentators noted, this was particularly valuable to small investors (e.g., Johnson, 1909).

Moody's 1909 volume received high praise in the press for the care with which its statistics were calculated.[16] Some commentary about the volume also noted that the ratings were based on publicly available information, and that the value of Moody's system was that it could help investors evaluate that information.[17] Other commentary characterized the ratings as "merely opinions," which was an effective way to minimize potential liability, but noted that they "have the merit of being presented along with the facts that gave rise to them."[18]

Although we lack detailed sales data, we know the volume sold well, and that major public libraries and university libraries acquired it. Investment advisors' articles in the financial press, such as in *The Ticker*, commonly recommended that investors consult Moody's volume in response to questions related to valuing securities. The volume was also published in London, where insurance companies, which often held American railroad securities, reported that it was quite valuable.[19]

[15] See Appendix Figure A.5 for an example.

[16] For example, the *New York Times* praised its "complete original analyses of all the leading railroad systems," (30 April, 1909); the *Railroad Age Gazette* stated that "the work of calculation has been done in a careful and scholarly way" (30 April 1909); and *American Review of Reviews* called it "not a manual, but a commentary, ingenious, painstaking, and authoritative."

[17] "The book tries to give for each railway and for each bond the statement which would be asked from the statistician of a good private banking house by the partners, when the railway or the bond was under consideration. With the exception of certain kinds of transitory and confidential information which the statistician would probably possess, the record in this book is as complete as need be, and the book is far better adapted for the use of the intelligent private investor than is any railway manual that has come to our attention" (*Railroad Age Gazette*, 30 April 1909).

[18] *American Review of Reviews*, vol 39 (1909) p. 757.

[19] The *Insurance Record* of 3 December 1909 noted that "[Insurance companies] expecting a yield of at least 4 per cent. on foreign investments, would probably in future be disposed to invest in a somewhat lower, but nonetheless well-secured, class of American railway bonds, and the statistics in Mr. Moody's book were of great assistance in

Moody's ratings quickly became influential. In contrast to his ads for the 1909 volume, his advertisements for later editions led with the question: "How Are Your Bonds Rated?" suggesting that the potential value of bond ratings had become well understood among investors.[20] In a sign of the success of the concept, in 1914 Moody expanded his ratings to include public utility and industrial bonds. In addition, Moody's competitors also began to publish ratings in their volumes. The first was Poor's, which published its first ratings in 1916, then Standard Statistics followed in 1922, and finally Fitch began to publish ratings in 1923. Each of these firms rated securities according to a letter-graded scale similar to that of Moody, and each followed Moody in selling the ratings to investors rather than having issuers pay for the ratings, as is done today.

The success of ratings also contributed to their use by financial regulators. This process began in the fall of 1931, when the Office of the Comptroller of the Currency (OCC) held that national banks could hold highly rated bonds on their balance sheets at their book values, whereas lower-rated bonds had to be marked down to their market values.[21] Over subsequent decades, ratings were incorporated into a wide variety of financial regulations, including rules governing money market mutual fund investments, the capital requirements of insurance companies, the investment criteria of pension funds, the investments of S&Ls, and computations of net capital for broker-dealers (Langohr and Langohr, 2009; White, 2010).[22] It is precisely this reliance on credit ratings in financial markets that makes it infeasible in modern settings to disentangle the effects of information embedded in ratings from changes in investors' demand due to ratings-based regulations and mandates.

2.3 Empirical Predictions

We analyze two potential consequences of the introduction of ratings. The first focuses on the content of the ratings, and its effect on bond yields. As noted above, prior to the emergence of ratings investors had access to detailed financial data on all railroads; contemporary commentators noted that bond yields were influenced by reasonably well-informed assessments of their risks.[23] We

forming a fair estimate of their security" (p. 575).

[20] *Wall Street Journal,* 8 March 1912, p. 1.

[21] Flandreau and Sławatyniec (2013) argue, however, that U.S. courts began to rely on the judgments of ratings agencies in the 1920s, giving them a form of legal authority at an earlier date.

[22] Credit ratings are now ubiquitous, and their role in the structure of the market goes well beyond regulations. For example, they are typically incorporated to the credit annexes of OTC derivatives contracts.

[23] For example, Pratt (1908:173) noted that "The prevailing price of railroad bonds bears 4 percent interest, and if of undoubted standing they command a premium."

therefore focus on cases where ratings conveyed new information relative to investor expectations, as embodied in pre-ratings market yields, and test for yield responses to the introduction of the ratings.

There is evidence that investors may have used Moody's ratings to guide their bond trading in ways that are consistent with this hypothesis. Beginning in November 1909, the popular investing magazine *The Ticker* began to publish a bond "Buyer's Guide" that compared the yields of different bonds with the same rating from Moody.[24] This suggests that investors may have accepted Moody's ratings as a measure of risk that they could compare with yields, and that lower-yielding bonds of a given rating may have been regarded as having unattractive prices.

Our second test focuses on the effects of the ratings on quoted bid-ask spreads for bonds. As in any financial market, it is likely that problems related to asymmetric information reduced liquidity, as reflected in the bid-ask spreads quoted by dealers. Trading in bonds on the NYSE was facilitated by dealers known as specialists, who would make a market in particular issues. Investors wishing to purchase or sell bonds would place their order with an NYSE-member firm, which would telephone the order to the NYSE floor, where one of the firm's brokers would receive it and go to the specialist who handled trading in that issue to try to negotiate a sale.

The dealers on the NYSE floor would have had an informational advantage over relatively uninformed investors, but on the other hand, there were also investors who possessed private information about market conditions or railroads who had an informational advantage over dealers. Dealers knew that trades with the former would likely be profitable, but trades with the latter would likely be unprofitable. The fundamental problem faced by the dealers was they could not distinguish the two within the order flow they received.[25] This likely widened quoted bid-ask spreads, an implication that is largely consistent with modern theoretical underpinnings of drivers of the bid-ask spread (e.g. Glosten and Milgrom, 1985). The introduction of securities ratings may have improved liquidity by changing the expected value of the informational disadvantage dealers faced with regard to their counterparties trading on the exchange. If the ratings increased

[24] November 1909 issue, p. 16. The table grouped all recently traded bonds by their rating levels, and was described as presenting data on "the relative cheapness of principal railroad issues." Similar tables were printed in each subsequent issue over the following year. An example is included in the Appendix as Figure A.1.

[25] Appendix Figure A.7 illustrates this issue; dealers transacted with brokers on the exchange floor, and the brokers executed orders sent to them by investors. But the dealers could not know whether particular investors placing orders were uninformed or possessed an informational advantage.

participation in the market by small investors, who were likely to have been less informed than the dealers, or if they improved the dealers' position relative to investors with private information, then quoted bid-ask spreads would have fallen.

Our analyses of the effect of ratings surprises on market yields, and of the effect of receiving a rating on quoted bid-ask spreads, both constitute tests of information provision by ratings. In the absence of any ratings-based financial regulations or investment mandates, any impact on yields will be an outcome of the ratings shaping investors' expectations of the riskiness of bonds, and any impact on bid-ask spreads will be the result of the ratings influencing the perceived informational advantage of better-informed investors of the market.

3 Data and Descriptive Statistics

Our analysis is based on novel, hand-collected data from various sources. In this section, we briefly describe our main sources and variables.

3.1 Bond Transactions

To analyze the impact of securities ratings on bond yields we collect weekly closing prices for all railroad bonds traded on the NYSE, as reported on the Monday edition of the *New York Times*.[26] Appendix Figure A.2 presents a partial example of one week's worth of transactions. We collect these data for a total of two years, centered on the date when ratings were introduced. We restrict the data to the railroad bonds for which we observe at least one traded price before and after the introduction of ratings, resulting in an unbalanced panel comprised of 562 bonds corresponding to 67 different railroads. Appendix Table A.1 presents simple summary statistics for these data. About 90 percent of the transactions were for bonds rated by Moody (resulting in 454 bonds for 44 firms in our analysis that looks at surprises for rated bonds), corroborating our view that his 1909 volume assigned a credit rating for a large fraction of the railroad systems in the country.

[26]The fact that bonds were listed on the exchange enables us to observe prices for actual transactions. For a discussion of the later shift of bond trading off the exchange see Biais and Green (2005).

3.2 Market Microstructure

In 1909, a relatively large number of bonds were listed on the NYSE. Each day at 11 AM, the exchange printed and distributed quotations sheets that included all bid and ask quotations for listed bonds. Unlike the transactions data, this information was, to the best of our knowledge, only published in the press at a low frequency, rendering these sources unsuitable for our study. Instead, we access the original quotation sheets at the archives of the New York Stock Exchange. See Appendix Figure A.3 for a partial example of these bid and ask quotations. We digitized these data at a weekly frequency, for the 12 Wednesdays before and after the introduction of the ratings. We compute bid-ask spreads with these bonds, which will serve as our principal measure of liquidity, and restrict our data to the 381 bonds for which we observe at least one non-missing spread in the 12-week period before and after the publication of Moody's ratings in April 1909.[27]

Summary statistics for these data are presented in Panel A of Appendix Table A.3. About 94 percent of the quoted bond spreads in our sample were for bonds rated by Moody. There was a clear difference in liquidity and risk between rated and non-rated bonds. The mean bid-ask spread of the rated bonds was 1.1 percent, whereas it was 2.9 percent for the bonds that were not rated. In addition, the yields on the rated bonds were 4.3 percent on average, whereas they were 6.2 percent for the bonds that were not rated. Yet these differences in means mask substantial variation in the distribution of yields and spreads by rating status. For our analysis, it is important to note that there is substantial overlap in these distributions, with a high fraction of rated bonds having yields and spreads similar to those of non-rated bonds. For example the 25$^{\text{th}}$ percentile of unrated bonds had bid-ask spreads and yields of 69bps and 4.3 percent over the entire sample period, respectively, which are close to the median for rated bonds.

3.3 Ratings and Director Information

We utilize Moody's 1909 volume to collect the assigned rating, and all the information pertinent to how these ratings were assigned, at the bond level. We also collect the names of the directors of all railroads in the sample from the 1909 edition of *Moody's Manual*, the investor manual formerly published by Moody. As emphasized by Frydman and Hilt (2017), board interlocks between rail-

[27]Specifically, we estimate the spread as $\frac{(ask-bid)\times 2}{(ask+bid)}$, and it is therefore expressed as a percentage.

road firms and main financial intermediaries were common and of importance for easing financial constraints in the early twentieth century. In our analysis, we study how these relationships affected the impact of the introduction of credit ratings, by matching the names of railroad directors to lists of financiers. We use bond underwriting data from the 1913 edition of the *Fitch Bond Book* to determine the financial institutions that were the top underwriters at the turn of the century, and match the directors and partners of those financial firms to the boards of railroads.[28] Most investment banks were partnerships and were members of the NYSE; we obtain the names of their partners in 1909 from the NYSE Directory. For commercial banks and trust companies, director names were obtained from the 1909 edition of *Rand McNally Bankers' Directory*.

4 Determinants of Ratings

We start by presenting simple summary statistics to illustrate the key determinants of Moody's ratings. The first two columns of Table 1 present the ratings and their descriptions for all railroad bonds included in Moody's 1909 volume. Railroad bonds were considered to be relatively safe, with the vast majority of bonds being rated A or higher. The assigned ratings do appear to have been primarily a reflection of a bond's expected risk. While Aaa bonds were stated to be "not affected by any normal changes in the earnings capacity of the railroad," lower-rated bonds, like those rated B, were "[m]ore susceptible to fluctuations." This is consistent with simple summary statistics that we construct utilizing information for the securities that are included in our analysis, presented in the last four columns of the table. Better-rated bonds tended to have had a higher factor of safety (average percentage of earnings available after paying interest over the previous decade) and income per mile. They were also more senior and had a lower yield to maturity.

Not only were the ratings correlated with many simple measures of risk, but the ratings tables in Moody's 1909 volume indicate that some of these metrics, such as the factor of safety, were used in determining the ratings (e.g. Appendix Figure A.5). Moody based his assessment on many of these metrics using long-run data spanning primarily the decade prior to the issuance of the ratings volume (see Figure A.6). In Table 2 we analyze whether simple statistics help explain the observed variation in railroad ratings.

[28] Specifically, we collect the names of the lead underwriters (where available) for all outstanding debt issues of NYSE-listed corporations, and rank underwriters by volume in order to identify the top 10 firms.

We start by converting bond-level ratings into mean ordinal rankings across all issues within a given firm, and then we take the average across all issues to estimate an issuer-specific rating. Similarly, we average other bond-level characteristics. Weighting to match the sample in our primary regression analysis, we find that the absolute value of pairwise correlations between ratings and average factor of safety, pre-ratings bond yields, and average income per mile, are 85%, 56%, and 45%, respectively. These are incredibly high pairwise correlations for simple linear measures of each of these factors, which are primarily based on averages of multi-year lagged data originally reported in firms' annual financial statements that were then disseminated in investor manuals.[29] Combinations of these factors easily explain more than 80% of the total variation in the firm-level ratings within simple additively separable linear models, leaving limited room for factors other than public information in explaining the vast majority of the variation. That the first-ever ratings largely relied on observable firm characteristics may not be shocking, though, since John Moody tasked himself with rating almost 1,300 bonds. Yet credit ratings today, though much transformed, are also highly predictable with linear combinations of a small set of firm characteristics (Benmelech, 2017).

The especially predictive nature of pre-rating yields also motivates our empirical design. Bond yields can be thought of providing a plausible market-based proxy for perceived risk—all else equal, riskier bonds should have higher yields. A priori, it is unclear whether ratings should have any influence on markets above and beyond the information already contained in yields. To assess this possibility, we first study deviations between Moody's ratings assessments from pre-existing market expectations.

5 Ratings and Bond Yields

5.1 Empirical Methods and Predictions

We study whether Moody's ratings had any incremental effects beyond what the information already contained in bonds' yields. In order to test for this, we focus on cases in which the ratings may

[29] In unreported analysis we use two competing investor manuals to reconstruct measures of factor of safety and income per mile for the 10-year period ending on 1909. We find correlations ranging from 0.8 to 0.98 between these alternative sources and the data listed by Moody's in 1909; the differences are primarily due to variation in the number of years' data reported. This suggests that the data on which Moody based his ratings were generally known, or at least knowable.

have surprised market participants, relative to what their expectations on bond risk were prior to the ratings' existence. We proxy their expectations by the bond yields pre-ratings. We define surprises as cases in which the rating assigned by Moody to a railroad was different from the ratings assigned to other railroads whose bonds had similar yields. This market-based approach enables us to compute a measure of the surprise content of the ratings that is independent of the specific algorithm that Moody may have used to calculate credit ratings.[30]

To construct a measure of the surprises at the firm level, we first compute the mean yield to maturity of each railroad's bonds pre-ratings. We then classify the railroads into quartiles of the distribution of mean yields. Table 3 presents the resulting yield quartiles and their characteristics. Within each quartile, the railroads' bonds had very similar yields. In the second quartile, for example, yields ranged from 4.1 percent to 4.3 percent, indicating that the market regarded these securities as similar. We then look within each quartile, and identify any railroads whose median bond rating was higher or lower than the median bond rating within the quartile. We regard these as cases in which the rating assigned by Moody was likely to have been a surprise, or contained some new information. We then test whether railroads that received negative surprises in their ratings saw their yields change relative to other railroads with the same rating following the introduction of the ratings.

The data in Table 3 indicate that there were many surprise ratings. For example, whereas 84 percent of the bond-week observations in our sample in the lowest yield quartile ('Quartile 1') received the highest median firm-level rating (Aaa), 3 percent received a rating of Aa, and 13 percent received a rating of Baa or lower. The median rating in that quartile was Aaa, so the latter two ratings were negative surprises. We note, however, that nearly all the railroads receiving positive surprises in our sample had relatively low yields, consistent with a median rating of Aa, and they instead received a rating of Aaa. The low yields of these bonds indicate that they were already perceived to be extremely unlikely to default, and we would expect the effect of good news regarding the riskiness of those bonds to be fairly small. By contrast, it is possible that bonds receiving negative surprises may have been more sensitive to news about their credit risk. Many of these negative surprises were received by railroads whose bonds were already perceived as riskier

[30]We do not take up the question of the accuracy of the ratings here, but instead focus on the ratings' effect on markets. Hickman (1958), however, uses longer-run data to show that ratings had strong predictive power for subsequent defaults.

(i.e., in higher-yield quartiles), and the more negative assessments by Moody likely conveyed that these investments were more "speculative."[31] In addition, many of the negative surprises in the first quartile were several notches below the median rating. We also observe relatively fewer positive firm surprises in our data. We therefore focus our analysis on the effects of negative ratings surprises in our empirical analysis, relative to a control group of railroads receiving either no surprise or a positive surprise. In Appendix C, we present alternative specifications in which we separately test for the effects of positive surprises, and for large surprises.

We study the effect of these negative firm surprises in the context of a model with bond and week fixed effects, and also controls for rating levels interacted with trends. This structure has the added benefit that it not only tests for effects of plausibly measured surprises relative to market expectations, but it also implicitly tests for convergence in yields within ratings levels.[32] Our initial estimating equation will therefore be:

$$y_{ijt} = \alpha_i + \gamma_t + \delta_1 negsurprise_{jt} \times \text{postRatings}_t + \sum_n \pi_n \text{RatingLevel}_{ni} \times \text{trend}_t + \epsilon_{it}, \quad (1)$$

where y_{ijt} is the yield to maturity of bond i issued by railroad j in week t; α_i and γ_t are bond and week fixed effects; $negsurprise_{jt}$ is an indicator for whether or not railroad j's rating was worse than the median rating of their yield quartile, and was therefore a negative surprise; postRatings_t is an indicator equal to one for all weeks following the introduction of Moody's ratings, which occurred on 23 April 1909; RatingLevel_{nj} are indicators for the railroad rating level assigned by Moody; and trend_t is a time trend measured as weeks since the start of the sample. Our key parameter of interest is δ. We cluster standard errors at the bond level.

If ratings conveyed information, we would expect the yields of railroads receiving a negative

[31] We would expect bond prices to be especially sensitive to news when they are close to the default versus non-default region. Yet whether the negative surprises we identify in our sample were more informative about default and repayment than our positive surprises is ultimately an empirical question.

[32] Developments in the market for corporate debt that were ongoing at the time when ratings were introduced make it especially important to control for ratings levels interacted with trends. Appendix Figure A.9 illustrates the time path of the mean yields of bonds from April 1908 to April 1910, by the level of ratings they were eventually given. The yields of bonds at each rating level were clearly declining over the year prior to the introduction of the ratings, and the declines were greater for bonds that received lower ratings ex-post. This reflects a general pattern of declining credit spreads in the market for corporate debt during the recovery from the Panic of 1907 and the related economic downturn. Any empirical analysis that simply tests for differences in yield levels or credit spreads following the introduction of ratings would confound any effect of the ratings with the ongoing trend of declining yields.

surprise (that is, the treated railroads) to increase relative to those issuers that received no surprise or a positive surprise, after the 1909 manual was released.

5.2 Bond Market Response

5.2.1 Information Provision

We begin by comparing the week-by-week evolution in differential yields. Figure 2 plots the differences in yields between railroads that received a negative surprise and those that did not, over the two years of our data, as estimated from a regression like the one specified in equation (1) where δ is allowed to vary every week and all estimates are relative to the month when ratings were released (which is therefore the omitted group not shown in the figure).[33] The figure presents a clear indication that rating surprises did indeed change bonds' yields. Importantly, the difference between the average yield for the bonds of railroads that received a negative surprise in their rating, and those that did not (conditional on the rating level they would eventually receive) was stable over time and hovered around zero for the year prior to the introduction of the ratings. This suggests that there were no differential preexisting trends between the two groups, conditional on our controls. Yet immediately after the introduction of the ratings the difference begins to increase, with the railroads that received a negative surprise commanding higher yields. This differential increase in yields stabilizes at about six months after the publication of the ratings, with the yields on bonds whose ratings was a negative surprise being about 20 basis points higher relative to those of other rated bonds.

Notably, the effect displayed in the figure is not one of an instantaneous, discreet jump, but rather a gradual increase that starts just after ratings are introduced. This is consistent with the fact that it may have taken some time for Moody's volume to reach some institutions and traders (April 23 is the publication date of the volume, not necessarily the date when it was received), and that the significance of the ratings and the analysis underpinning the ratings may not have been understood immediately. Instead, the volume gradually became more influential over time, and its contents' influence over bond yields increased accordingly. Still the flat nature of the relative

[33] The regression used to produce the estimates in the figure is like Equation (1), except rather than estimating an average post-ratings effect of a negative surprise, a series of negative surprise $\times$ date interactions are included, to estimate the difference-in-differences relative to the excluded date—the month of the introduction of ratings, April 1909. The interactions between the ratings levels and time trends are also included, as are the bond fixed effects.

yield difference prior to ratings and the subsequent sharp change in the slope of the difference after ratings were introduced using relatively high frequency data, supports a causal interpretation of the effect of ratings surprises on bond yields.

Figure 2 also helps rule out the possibility that Moody was simply good at predicting future changes in yields, and that he rated bonds according to his expectations of these price changes. While the volume was published April 23, 1909, most of the information it contained and upon which the ratings were based was as of the end of the railroads' last fiscal year, which ended June 30, 1908. For some railroads, Moody included a brief description of changes in conditions that had occurred since the close of the fiscal year, which were likely added after the ratings tables had been created. These often stated that no events of significance had occurred, and even when some were described, the very latest date of the additional information was January 1, 1909. Since the ratings were computed well before April, the timing of the increase in yields following this date strongly points to a causal effect of the publication of the ratings on the market.[34] By contrast, the period during which the ratings were constructed but not yet released (depicted with the blue dashed lines), reveals no such response.

Next, we formalize the analysis from the figure in Table 4 where we present results from estimating variations of equation (1). In column (1), we start by regressing the yield to maturity on the interaction of a dummy variable equal to one if a firm received a negative surprise interacted with an indicator for the post-ratings period. Given that it took about six months for the effect of the ratings to be fully captured in yields, we present a 'donut' specification, where the post-ratings indicator is equal to one only for the second half of the post-ratings year to estimate the effects. The regression also includes bond and week fixed effects and rating fixed effects interacted with time trends. Consistent with the picture presented in Figure 2, we observe a 14 bps increase after 26 weeks in the yield of bonds among firms with negative ratings surprises.

These findings hold across a range of specifications, including utilizing alternative measures of yields, post-rating windows, and alternative measures of surprises. Focusing solely on the transactions that occur in the 6-12 months after ratings were released throws out a significant fraction of the observations, however, and can potentially affect estimates and standard errors. We next

[34]In addition, the results are nearly identical if we compute surprises using only yields prior to January of 1909 rather than April of 1909 (not shown). This is reassuring because it helps rule out concerns that any predictive power of the ratings between January and April can influence our measure of surprises and their effects on yields.

use a more flexible framework to incorporate the entire post-rating period. Specifically, in column (2) we interact the negative surprise indicator with a time trend, and then also include a time trend interacted with a post-ratings indicator. This specification allows for the effects of negative surprises to trend over time, instead of simply focusing on the average effect in the post period, and also estimates any preexisting differential trends in yields prior to the release of the ratings. Reassuringly, the results indicate that there was no ongoing differential trend in the yields of bonds that received a negative surprise, but that a differential trend emerged following the publication of ratings.

In column (3), we estimate a more parsimonious version of the specification of column (2), and interact our negative surprise variable only with a variable that measures the weeks since the ratings were released, capturing the post-ratings differential trend. Yields differentially increased for firms that received a negative surprise; the estimates imply a 20 bps increase over 12 months. This is our preferred specification, in the sense that it achieves a good balance between parsimony and power. In column (4) we show that these results are quite similar even controlling for ten bond-level maturity group fixed effects interacted with time trends, suggesting that our estimated effects are unlikely to be an artifact of differential trends among bonds of differing maturities.

A potential concern regarding these estimates could be that the firms that received negative ratings surprises also differed along some other dimensions we may only imperfectly observe. If those firms happened to have differential exposure to some unanticipated economic event that coincided with the publication of the ratings, its impacts could potentially confound our estimated effects of ratings. Although we believe this is unlikely, we cannot dismiss that possibility completely. To help address this concern, we exploit variation in ratings surprises among bonds issued by the same firm.

We first recalculate the surprises without aggregating by firm. These bond-level surprises are more likely to be measured with error, due to the thinness of trading of many bonds; the noisy pre-ratings average yields of individual bonds taken from just a few observations distort the comparisons made to construct the surprises, and thus we interpret their effects with some caution.[35] Yet they vary within firms, since the bonds of a given railroad often differed in terms of their market yields

[35] This also results in the loss of a very small number of observations ($< 2\%$) with insufficient liquidity prior to ratings to estimate a surprise at all.

as well as the ratings they received. Thus, within the same firm some bonds may have received ratings that were worse than expected given their pre-rating yields, while other bonds did not. We use this source of variation in column (5), by re-estimating our preferred specification from column (3), but include instead an indicator for a negative surprise at the bond level, rather than the firm level. The results of this specification are very similar to the estimate reported in column (3), and help address concerns that our findings are influenced by the way we aggregate the data to estimate firm-level surprises.

In column (6), we investigate whether bonds that received negative surprise ratings saw differential changes in their yields after ratings were released, relative to other bonds of the same firm. In this specification we include firm fixed effects interacted with time trends, and therefore remove any potential time-varying confounds at the firm level. Again supporting a causal interpretation of our findings, the estimates indicate differential patterns in bond yields following rating surprises consistent with our prior estimates. In column (7) we show that results are essentially unchanged when we control for a major driver of bond-level yields, maturity, utilizing the same set of maturity controls from column (4).

The results thus far imply that the introduction of securities ratings did indeed change bond market yields. This is strong evidence that even in the absence of financial regulations based on ratings, and even in the presence of abundant information on bonds and bond issuers, letter-graded ratings can provide information about credit risk that has a meaningful impact on market prices. In Appendix Table A.2, we show that these results are robust to alternative specifications in which we control for the pre-rating yield quartiles (interacted with trends), rather than ratings (interacted with trends). That is, whereas our main specifications compare firms with similar ratings whose bonds had different yields, these alternative specifications compare firms whose bonds had the same yields, but received different ratings. Using this alternative source of variation, we obtain very similar results.[36]

Another more subtle concern could be that ratings predicted news events, and market yields responded to those news events rather than the ratings. We think this is unlikely since markets responded in just the first few weeks after ratings were released. In Appendix B we show a significant

[36] Our calculations of yields to maturity are somewhat imprecise, and in appendix Table A.2 we also show that when we re-estimate our regressions using perpetuity yields (coupons divided by prices), rather than yields to maturity, our results become much stronger.

impact of surprises on yields even when we restrict the analysis to the four or eight weeks after the publication of the manual. In addition, these effects are largely unchanged when we control flexibly for all news we could find about these firms during that period (or even removing firms with any news at all). See Appendix B for more details.

It also important to note that our findings are always in relative terms, since new information about some bonds may affect the willingness of market participants to transact in other bonds. While we cast our findings as evidence that bonds with negative surprises saw their yields rise relative to those that don't, it is equally valid to say that those that didn't receive a negative surprise (because theirs was positive or there was no surprise) saw their yields fall relative to those that did. In Appendix C we also show explicitly that the bonds of firms with positive surprises saw their yields fall (relative to those with negative surprises or no surprise at all). In general we fail to reject any difference in magnitude of effect size for positive versus negative surprises, except among large surprises, where we find some evidence consistent with negative bond-level surprise effects being more substantial. We discuss these results in detail in Appendix C.

Next, we further explore our main findings. Though the analysis of bond-level surprises in Table 4 helps address concerns that firm characteristics may be biasing our effects, one may still worry about these potential biases for our main analysis based on railroad-level surprises. To address this issue, we study the robustness of the effects of firm-level surprises to the inclusion of key railroad characteristics that were determinants of the ratings. To ease comparison, column (1) of Table 5 simply replicates column (3) of Table 4, our preferred specification based on weeks since. Column (2) controls in addition for our proxy for market based expectations for a bond's risk (the pre-rating yield) interacted with weeks since the ratings were released and obtains very similar results. This helps dispel concerns that surprises may be simply picking up differential trends in yields for railroads in the same yield quartile with different pre-rating yield levels.

Another possibility is that our measures of surprises are picking up other bond information that Moody's utilized to construct ratings. As we show in Table 2, of all the features that Moody's explicitly took into account in his ratings tables, factor of safety was the most important predictor of ratings. In column (3) of Table 5 we add factor of safety, interacted with weeks since the ratings release. As one would expect, we find that railroads with a higher average factor of safety saw less of an increase in yields in the post period. Importantly, the effect of negative surprises is virtually unchanged. In column (4) we show that the estimated coefficient on negative surprise is also robust to controlling for average income and interest per mile. It is also possible that bonds more or less sensitive to interest rate risk—a factor not explicitly taken into account by Moody—may have seen yields change differentially. Yet our results are robust to controlling for the average duration of the railroad's bonds (see column (5)). It is important to note that the variables we included thus far are on their own very strong predictors of the actual ratings assigned by Moody, which in turn are one of the two components we use to estimate surprises. In column (6) we control for both the bonds' pre-rating average yield, the other key piece of information we use to estimate surprises, and a predictor of ratings used by Moody. Remarkably, including this measure, as well as the average pre-rating bid-ask spread as a measure of liquidity, makes barely any dent on the effect of negative surprises. These results are important because they suggest that credit ratings may affect markets beyond the information that would be contained in linear assessments of a bond's risk, either those formed from relevant firm or bond characteristics, or from market expectations (i.e., yields).

These findings are also not the result of ratings simply conveying soft or insider information about specific firms. In column (7) we use the same set of pre-rating observable control variables × *Weeks since* from column (6) to instrument for *Weeks since* × *Negative surprise* in a two-stage least squares regression. Consistent with these data explaining variation in surprises, even after all fixed effects, the regression has a reasonably strong first-stage: the surprises are partly predictable using information that was publicly available and generally accessible. In addition, the instrumented surprises have a statistically significant effect on post-rating yields that is similar in magnitude to the OLS estimate reported in column (6). This suggests that factors other than observable financial data, such as soft or insider information, could not have been entirely responsible for the observed market effects of the ratings surprises.

Since firm-level surprises are largely predictable with public information, in which other way, then, can ratings convey information? One possibility is that the coarse nature of credit ratings, assigned to groups comprising substantial sets of securities, may be a more effective way to provide information to market participants, who would otherwise have to process complex information. In this sense, our results may be consistent with theoretical work that shows that in some contexts coarse signals can be more illuminating than precise ones, because they provide more clarity for interpreting the intended message sent (e.g., Martel et al., 2022), and with experimental work showing that simplifying complex information helps consumers make better financial decisions (e.g., Carpenter et al., 2021). Alternatively, the introduction of letter-graded ratings may have caused some investors to categorize particular bonds differently, and consider issues with the same rating, rather than issues that shared other attributes, as comparable (e.g., Ellis and Masatlioglu, 2022; Bordalo, Gennaoli and Shleifer, 2013). Although we cannot distinguish among these different potential mechanisms, our findings suggest that in the historical context of the first-ever ratings, what may have mattered was not only the level of information disclosure, but the manner in which this information was actually packaged, simplified, and presented to the market. Market participants were already familiar with ordinal ratings systems from experience with commercial credit reporting, which likely contributed to the influence of securities ratings (Carruthers, 2022:160-164).

5.2.2 Variation in the Impact of Ratings

The results presented in Tables 4 and 5 are remarkable for their consistency. Even when controlling for firm fixed effects, or for key determinants of the main components of the surprises themselves, the estimated effects of negative rating surprises are, while modest in magnitude, quite robust. They suggest that, even in an environment in which market participants have strong incentives to acquire information, ratings can still improve information provision. A natural question then arises: are there characteristics of firms where information provision via ratings is more or less impactful?

Negative surprises had an impact on yields when they updated market expectations downwards. This finding suggests, however, that those surprises may have had less of an impact on firms with strong reputations. We study this possibility by analyzing whether connections to prominent financiers served as a substitute for credit ratings. As shown by Frydman and Hilt (2017), in the early twentieth century, top underwriters utilized their positions on railroad boards to monitor those firms, thereby alleviating their financial constraints and helping them grow. These tight relationships with bankers were observable by market participants—firms often advertised their directors and, importantly, the lists of board members were also published in investor manuals. In column (1) of Table 6 we therefore allow the effect of negative ratings surprises to vary by whether the railroad had many connections to the top underwriting firms of the time through their board of directors—specifically, that they were among the top quartile in such connections, with at least three elite financiers among their directors. We find that the negative effect of surprises on yields was essentially undone for the most connected firms. Next, we compare the effects of negative surprises on the most connected railroads (in column (2)) with those on moderately connected railroads (in column (3)), and with those that had no connections to top underwriting firms (in column (4)). Firms with no connections saw a 30 bps annualized increase in yields following a negative surprise, while the effect was much smaller (0.3 bps annualized) and insignificant for those railroads with a high number of top underwriters on their boards.

These results suggest the role of ratings does appear to have been mediated by a firm's reputation, such as the signal imparted by the quality of a their underwriters. If this reputation-enhancing mechanism helped resolve problems related to asymmetric information, then the fact that ratings surprises only impacted firms without the mechanism in place suggests the effects of ratings were also related to asymmetric information. We explore this connection in more detail below.

5.3 Interpretation of Effects of Ratings on Yields

We interpret the estimated effects of ratings on yields (Table 4) as evidence that securities ratings can be an effective tool for information provision. By making complex data easier to evaluate, ratings refined investors' expectations regarding the likelihood of defaults, which was then reflected in changes in those bonds' yields.

An alternative explanation of these effects might be that the ratings were inaccurate, yet nonetheless induced changes in yields because investors simply believed them and sold off the bonds that received negative surprises. If this were the case, the ratings could have produced the observed impacts on yields without actually improving investors' understanding of the risks of securities; ratings may have served merely as a focal point that led to commonality in beliefs (e.g., Boot et al., 2006; Morris and Shin, 2007).

This interpretation would imply that ratings had powerful effects that increased the impact of the information being provided (i.e., it would still support our definition of information provision), although not through improving the equilibrium level of fundamental information in prices. Yet the lack of reversion in prices (Figure 2) suggests this is unlikely to be the most plausible explanation for the effects we observe. A full year after the release of ratings, which should have been a sufficiently long period for the inaccuracy of ratings to have been revealed, there was no indication of a weakening of the effects of negative surprises, much less a reversal.

Further evidence against this interpretation comes from the response to ratings from investment bankers. The acceptance of inaccurate ratings by investors should have created profitable trading opportunities for well-informed actors. Yet the best-informed and most sophisticated investors of the time, investment bankers, strongly opposed Moody's innovation of providing ratings (Stimpson and Mahoney, 2008). The response to the introduction of ratings was "in no circles...more hostile than among investment bankers," and their hostility was specifically attributed to the ratings' tendency to "narrow the price spread between trading points," and influence "the resale of bonds" as well as the "original sale of new issues" (Harold 1938: 16). By making ordinary investors better informed, ratings likely reduced the informational advantage of investment bankers and other sophisticated investors.[37] The bitterness with which investment bankers greeted the ratings is evidence supporting our preferred interpretation of their effects.

6 Ratings and the Functioning of Financial Markets

We next analyze the equilibrium response of the functioning of financial markets to the introduction of the ratings. If Moody's innovation did indeed help small investors to become better informed, or otherwise reduced the informational advantage of sophisticated investors, it may have resolved problems related to asymmetric information, and improved market liquidity. This effect would not have been produced by the particular ratings given to bonds, and whether they constituted surprises, but simply by the fact that bonds were given ratings. We therefore need a different empirical design than the one utilized above, focused on whether bonds were rated, rather than the specific ratings bonds received.

6.1 Empirical Method and Predictions

Moody's volume of ratings included the majority of large railroad systems and some smaller ones too, but it excluded a relatively small number of NYSE-listed railroad bonds. Though these unrated bonds constitute a natural control group for the analysis of the effect of the ratings on liquidity,

[37] When Moody discussed his books with traders he was informed by an "old Wall Street buccaneer...if you begin to flaunt too many facts, there won't be much inside knowledge left to work on; you will be spoiling our game" (Moody, 1933: pg. 91).

Moody's choices over which railroads to leave out were not random. For example, rated bonds tended to be substantially more liquid (e.g. smaller bid-ask spreads) than unrated bonds, though there was substantial overlap in the distribution of spreads across both groups (Appendix Table A.3). To evaluate the effect of the presence of ratings on market liquidity, we need to examine plausibly exogenous variation in Moody's propensity to rate particular railroads' bonds.

Moody's ratings included all of the railroads with liquid, high-quality (low-yield) bonds, which were of the greatest interest to investors. However, some of the railroads rated by Moody had some relatively lower-quality, less liquid issues outstanding—issues that were similar to the bonds that were not rated. Many of these small, riskier bond issues were originally the obligations of smaller railroads that had been acquired by a larger system, and were secured by collateral that was less valuable (per mile) than other bonds of the same system.

When Moody rated the bonds of a railroad, he rated all of its bonds, not merely the more liquid or safe issues.[38] This meant that lower-quality bonds of railroads that also had high-quality bonds outstanding received ratings simply because they were liabilities of a railroad with other high-quality bonds outstanding. By contrast, similar lower-quality bonds issued by railroads which had no high quality issues were less likely to be rated. We therefore use the average yields of the other outstanding bonds of the same issuer as an instrument for whether or not a bond was rated. If the average yield of the other bonds of the same issuer did indeed influence Moody's decision to rate a particular bond, but did not cause any changes to its bid-ask spread in the period after the ratings were introduced, then it represents a valid instrument for whether or not a bond was rated.

As with our analysis of the effects of ratings on yields, we account for any ongoing trends in the differences between rated and unrated bonds using a linear time trend. We estimate the following regression via two-stage least squares:

$$liquidity_{it} = \alpha_i + \gamma_t + \theta_1 rated_{it} \times \text{postRatings}_t + \theta_2 rated_{it} \times \text{trend}_t + \beta X_{it} + \epsilon_{it} \qquad (2)$$

where $liquidity_{it}$ is proxy for issue i's liquidity (such as bid-ask spread) in week t; α_i and γ_t are bond and week fixed effects; $rated_{it}$ takes a value of one for issues that were rated by Moody's

[38] As noted above, the analysis underpinning the ratings required Moody to create a seniority ranking of all outstanding bonds for the railroads he rated, and calculate the available income for each. It was therefore quite natural to rate all bonds and the marginal cost of doing so was likely low.

for the weeks after the ratings' release; postRatings_t is an indicator equal to one for all weeks following the introduction of Moody's ratings, which occurred on the 23rd of April 1909; trend_t is a time trend; and X_{it} includes various characteristics of issue i, such as its average yield and bid-ask spread during the period prior to the introduction of the ratings, interacted with a post-ratings indicator. Since $rated_{it}$ appears twice in (2), our specification contains two endogenous regressors. We therefore use two instruments: the average yield of the other outstanding issues of the same railroad as issue i interacted with the post-ratings period ($\bar{y}_{-i} \times \text{postRatings}_t$) and the average yield of other outstanding issues interacted with a trend ($\bar{y}_{-i} \times \text{trend}_t$). The main parameter of interest is θ_1. Our key identifying assumption is that comparing observationally equivalent bonds of different issuers, the bond belonging to an issuer with other bonds with lower yields is more likely to have been rated. We exploit that increase in likelihood of being rated to study whether receiving a rating has a causal impact on the bonds' market liquidity.

6.2 Effects of Getting Rated - IV Results

In Table 7 we present our estimates of the effects of being rated on bid-ask spreads. As a baseline in column (1) we present the results from an OLS regression of bid-ask spreads on a dummy variable equal to 1 if a bond was rated, after controlling for issue fixed effects, time fixed effects, the pre-rating mean bid-ask spread for that issue interacted with a post ratings dummy, and the pre-rating mean yield for that issue interacted with a post ratings dummy. We also allow for differential trends by rated status. The estimated value of the parameter θ_1 from equation (2) indicates that rated bonds saw their spreads fall by 54 bps in the weeks following the introduction of ratings. That said, it is important to reiterate the caveat that new information about some bonds may also affect market participants' views (and their trading) for other (in this case, not rated) bonds. Thus, it is possible that the market perceived a lack of ratings as information about relative asymmetric information, and so therefore one could equally interpret our results as indicating that the introduction of ratings caused a rise in bid-ask spreads for unrated bonds relative to rated ones.

While the OLS estimates are suggestive of an effect of ratings on liquidity, as we noted previously they are subject to selection concerns.Column (2) of Table 7 presents the same equation estimated via 2SLS, to alleviate bias caused by selection effects arising from Moody's choice of which bonds to rate, while the corresponding first stages (with matching column numbers) in their entirety are shown in Appendix Table A.4. Consistent with our expectations, the corresponding first stage regressions in column (2) of Appendix Table A.4 show that the estimated parameter on the instrument is large and negative, indicating that bonds issued by railroads whose other bonds had lower yields were much more likely to be rated. Specifically, we find that a one percentage point increase in the pre-ratings yields of the other bonds of a railroad reduced the likelihood that a bond was rated by about 11 percent, after controlling for the risk and liquidity of that bond prior to the ratings' release.

The parameters in column (2) Table 7 indicate that the 2SLS estimate of the effect of ratings on bid-ask spreads is considerably larger than OLS and large in absolute terms—298 bps. This is in fact larger than the mean value of the pre-ratings spread for rated bonds. It is important to note, however, that the local average treatment effect (LATE) is obtained from relatively illiquid bonds that were only rated because they were issued by railroads that had some high-quality issues. In fact, our first stage coefficients start to increase significantly once we restrict the sample to only those bonds that were highly illiquid (above the 60^{th} percentile in the bid-ask spreads distribution in the pre-rating period). This suggests that the instrument primarily operates through these highly illiquid bonds. While these estimated treatment effects are substantial, they are actually plausible within this subgroup.

To illustrate this point more clearly in columns (3) and (4) of Table 7 we re-estimate our regressions focusing on only those issues with bid-ask spreads above the 60^{th} and above the 80^{th} percentile of the pre-ratings distribution, respectively.[39] Despite having higher levels of initial spreads, we find very similar percentage point declines, implying much smaller percent declines than in column (2). In particular, these equate to about a 1.6 standard deviation decline in spreads among those more illiquid bonds. At the same time, the first stage F-stat rises substantially. This is because, just as we noted above, the LATE is the average treatment effect for compliers, and the compliers in our data are likely to be highly illiquid securities. Very liquid, frequently traded securities were rated no matter the characteristics of the other outstanding bonds of the railroad. By contrast, illiquid securities, with less market interest, would have been marginal bonds, and may

[39]In addition, restricting the sample to illiquid bonds helps us improve the comparability of rated and non-rated bonds, which are much fewer in our data, since Moody included the majority of railroads systems in his manual. In the bid-ask sample, only 7.3 percent of the bonds and 6 percent of the observations were not rated. When we focus on the bonds above the 60^{th} percentile of illiquidity, for example, those numbers are 12 and 11 percent, respectively.

have been rated or not, depending on whether the firm had other, more prominent securities.[40]

These results are consistent with work by Kelly and Ljungqvist (2012), who show in modern data that proxies for increases in information asymmetry driven by reduced equity analyst coverage widen bid-ask spreads. The effect of ratings in our sample was likely quite small for the high-quality issues that were the focus of Moody's volume and of investors' interest, which had very low bid-ask spreads before the introduction of the ratings. But for the less liquid, higher-yielding issues that were rated for somewhat arbitrary reasons and had initially very wide spreads, the effect of the ratings was quite substantial. In summary then, what this evidence suggests is that among those securities most likely to benefit from improved liquidity (i.e. highly illiquid securities), ratings were actually able to tighten their bid-ask spreads substantially. These findings also support the analysis in Section 5, since they suggest that incremental information made public through ratings disclosures narrowed bid-asks spreads, mitigating problems related to asymmetric information.

A potential source of concern regarding our IV estimates could be that they are driven by declining bid-ask spreads among the bonds of large railroad systems.[41] Since those systems were most likely to have a high-quality (low-yield) bonds outstanding, any change in their bonds' bid-ask spreads would be conflated with the effects of being rated in our framework. In Table 8, we show that this is unlikely to be responsible for our results. In the table we present the reduced-form estimates of our IV, with columns (1) through (3) displaying the estimates from the samples of columns (2) through (4) in Table 7. As expected, the estimates are positive and statistically significant—the lower the yields of the other bonds of the same railroad, the lower the bid-ask spread in the post-ratings period, which we ascribe to the greater likelihood of getting rated. Yet in columns (4) and (5), when we restrict the sample to the most liquid bonds, we find no effect. As can be seen clearly in the table, almost all very liquid bonds were rated (3 out of 60 in column (4) and 5 of our 195 in column (5)). For these bonds, whether other bonds in the same system were of interest to investors and had low yields was immaterial.[42] These falsification tests show that the

[40]We address concerns regarding test size distortions caused by weak instruments by including weak-instrument robust confidence intervals, based on Andrews (2018) and discussed in Andrews, Stock and Sun (2019). These exclude 0 for all IV specifications.

[41]An additional concern is that the differences in the distribution of liquidity prior to the introduction of between rated and unrated bonds may affect our estimates. Yet our 2SLS coefficients are robust to restricting the sample to only those bonds in the overlapping part of the spreads distributions. (Results not shown.)

[42]This finding is consistent with the lack of a valid first stage in these samples. However, it is essential for us to obtain our main IV results to include the most illiquid bonds in our sample, for which the first stage and reduced form estimates start to rise.

instrument does not predict declines in bid-ask spreads for liquid bonds, and suggest that our main findings are not simply an artifact of comparing bonds in prominent railroad systems with those of small railroad systems. Only the most illiquid bonds of the rated systems saw their bid-ask spreads decline, which is inconsistent with the notion that changes in the spreads of all the bonds of large systems are driving our results.

Bid-ask spreads are, of course, not the only measure associated with liquidity and a well-functioning financial market. In Table 9 we use the same IV approach to study the effects of ratings on the block size of trades (the number of shares traded when a bond trades.)[43] We find that even though being rated doesn't seem to change the probability that a bond will trade on a given day among our compliers (column 1), the number (column 2) and probability (column 3) of single-lot trades increased (conditional on any trades for that security occurring). As the par value of most bonds was $1,000, at a time when nominal GDP per capita was less than $500, even a single lot trade was an immense amount of money. To the extent that small investors participated in this market, it would likely have been reflected in single-lot trades. Single lot trades were the most common transaction type in our data (∼21%), and although not all of these trades were initiated by small investors, virtually all trades by small investors would have been in single lots. While not as strong or clear as our results on bid-ask spreads, these findings could suggest that ratings encouraged more trading in illiquid securities (our compliers) among retail investors. By contrast, we find no clear evidence of a such a rise among large (≥10) lot trades (column 4), again suggesting that if ratings attracted increased trading interest for these illiquid securities it was probably most concentrated among retail traders.[44] Taken together, these results support the notion that ratings narrowed bid-ask spreads in bond markets and may have also opened up the trading of more illiquid securities to small investors.

[43]This data was compiled from the NYSE's daily reporting of bond transactions, which lists the block size of every trade. We collect this data for all bond trades for every Wednesday over the same interval of time for which we collected bid-ask data. See Appendix Figure A.4 for a partial example of intraday transactions for a single day.

[44]During our time period, institutional investors may have traded with one another in the over-the-counter market, making an effect on large trades difficult to detect in our data.

7 Conclusion: Ratings, Bond Markets and Information

This paper investigates the effects of the introduction of the first-ever bond ratings on financial markets. In 1909, John Moody produced and sold to investors a volume containing letter-graded ratings of the majority of railroad bonds listed on the New York Stock Exchange. Utilizing a variety of newly collected data, our analysis shows that this financial innovation improved the liquidity of corporate bonds and, when the ratings conveyed negative information relative to investor expectations, caused a modest but appreciable increase in their yields relative to other bonds. In the years since 1909, bond markets and the institutions associated with them have evolved considerably. What insights do these results offer for credit ratings and bond markets generally?

First, our unique historical setting allows us to provide credible evidence that ratings can help transmit information on credit risk to bond markets. A vast empirical literature has generally cast any effects of ratings on prices and firms as evidence of information transmission. Yet because ratings are embedded into modern financial regulations and investment mandates, their effects may be completely unrelated to information. A rating that brings a security closer to or further away from the threshold of "investment grade," for example, will change expected demand for that security, and therefore its price. The fact that Moody's 1909 ratings had significant effects at a time when there were no regulations or mandates tied to ratings demonstrates that ratings can actually influence the functioning of capital markets through information provision.

Our findings also offer some suggestive evidence on the mechanisms through which ratings may transmit information. Like modern ratings, Moody's 1909 ratings were largely explainable with public information that was broadly accessible. Their effects suggest that simplifying complex and multidimensional information by partitioning securities into coarse letter-graded categories may in fact be effective means of information transmission, and that the form in which information is presented may matter. Our results on trade sizes suggest that the effects of ratings were driven in part by greater participation among small investors and institutions, for whom acquiring and processing information was likely costly.

Although our historical setting allows us to isolate the information effects of ratings, it is unclear whether the magnitudes we estimate from 1909 are relevant to modern financial markets. This leads to our third insight, which is that reliance on ratings may actually influence information production outside rating agencies. Before the introduction of credit ratings, sophisticated investors devoted considerable resources to analyzing the risks of bonds. Once ratings were introduced, investors began to rely on them quite heavily (Harold, 1938), and the incorporation of ratings into financial regulations only increased their influence. The centrality of modern credit ratings has reduced the incentives of sophisticated modern investors to analyze the creditworthiness of relatively safe securities, other than during financial crises (Dang et al., 2020; Johnston et al., 2009; Hanson and Sunderam, 2013). Modern financial institutions effectively delegate information production for relatively safe securities to ratings agencies. Despite tremendous technological advances that have improved the availability of data and the processing of information over the past century, the reliance on ratings has diminished the incentives of investors to use those technologies and analyze the risks of relatively safe securities. As a result, credit ratings today may in fact have significant information-based effects, as they did in 1909.

A fourth and closely related point is that our analysis documents the origins of the role of ratings in creating safe assets. Safe assets are vital for the functioning of the economy, and in modern financial markets, privately created Aaa-rated assets account for a large share of the supply (Gorton 2017; Gorton et al., 2012). Our results focusing on ratings surprises show that Moody's 1909 volume led to convergence in bond yields within ratings levels, as investors began to view bonds of similar ratings as having similar credit risks. Of particular significance was Moody's designation of some bonds as Aaa, his highest rating. Moody stated that those issues "are dependent for their prices on the current rates for money, rather than the fluctuations in earning power" (Moody, 1909: 193), a characterization that is consistent with modern definitions of information-insensitive securities (eg., Dang et al., 2020). Following the publication of Moody's volume, corporate bonds rated Aaa quickly became important in the investment decisions of commercial banks and other institutional investors.[45] Over the twentieth century, the composition of safe assets produced by the financial system changed in ways that made ratings particularly important.[46] Our results suggest that when they were first introduced, ratings immediately began to shape investors' assessments

[45]Harold (1938:20) describes a commercial banker known as "Triple-A James" who insisted on buying only Aaa bonds, noting that he was "typical of thousands in the banking profession." Harold also mentions the importance of highly rated bonds to other types of institutional investors such as insurance companies and trust companies.

[46]Especially after 1980, money-like debt instruments and mortgage-backed securities became increasingly important safe assets (Gorton et al., 2012); a rating of AAA/Aaa is crucial to their status as safe (Dang, Gorton, and Holmström, 2020).

of the riskiness of securities. Thus, third-party risk assessments that are credible to investors can help create safe assets, even when these assessments have no bearing on financial regulations that restrict the types of assets that institutions can hold.

Finally, in the wake of the 2008 financial crisis, serious concerns were raised about the quality of credit ratings (Benmelech and Dlugosz 2009, 2010). Our results show that when implemented in their original form—as an evaluation of securities sold to investors, with no role in regulations and no perverse incentives created by the modern issuer-pays business model—ratings increased participation and improved the functioning of financial markets. Credit ratings were an important financial innovation, one of many that over the past century have improved transparency and information access in financial markets, potentially improving the ability of firms to raise financing and the allocation of capital in the economy more broadly, and thereby contributing to long-run economic growth.

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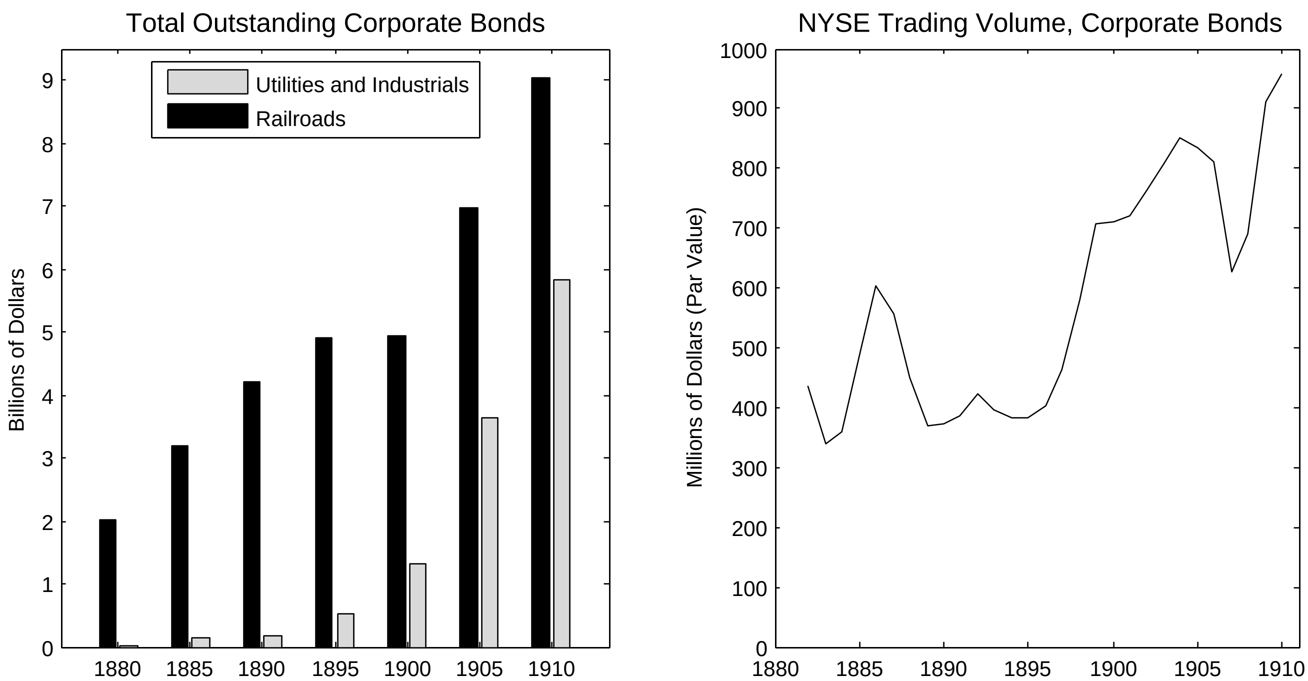

Figure 1:
Evolution of U.S. Corporate Bond Markets, 1880-1910

Note: The left panel presents the total value of outstanding corporate bonds, at five-year intervals, by sector. The right panel presents a 3-year trailing moving average of total NYSE bond transactions, expressed in millions of dollars of par value. *Sources:* Left panel: The data for utilities and industrials were compiled from the *Commercial Financial Chronicle*'s "Investors' Supplement," for years prior to 1900, and for later years, from Hickman (1952). The railroad data are from Hickman (1952). Right panel: for years after 1900, trading in "railroads and miscellaneous bonds" was recorded from the *New York Times* "Annual Financial Review." Data for earlier years was obtained from Stedman (1905).

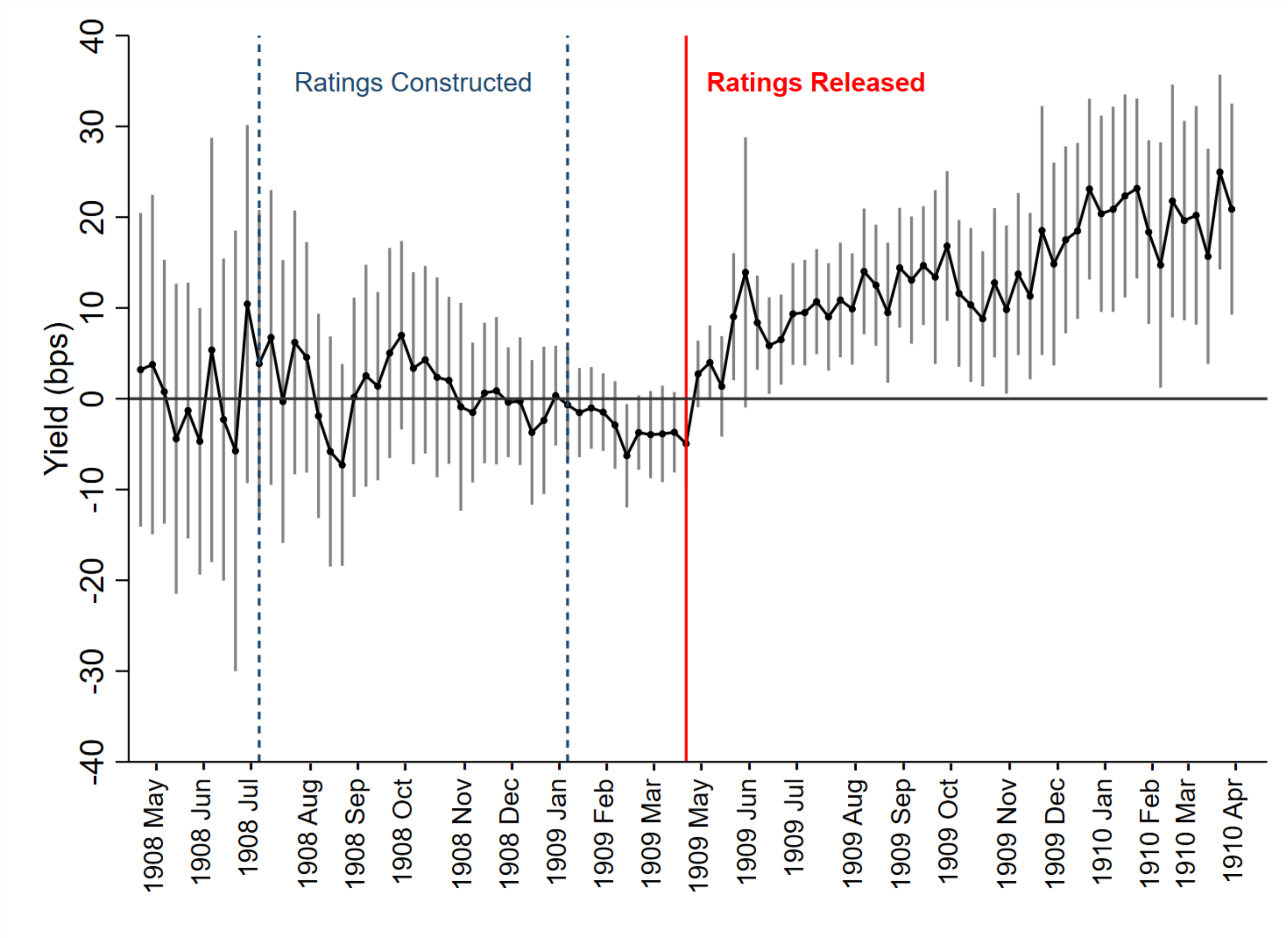

Figure 2:
Ratings Surprises and Bond Yields

Note: The figure presents the differences in yields between bonds whose ratings constituted a negative surprise and other rated bonds—those that either received a positive surprise, or no surprise. The differences plotted in the figure are estimated from regressions of yield-to-maturity on indicators for a negative surprise interacted with indicators for each week, with the week prior to the introduction of ratings excluded. The regressions also include bond fixed effects, as well as rating level fixed effects interacted with time trends (see text). The figure also includes lines representing 95 percent confidence intervals. The solid red vertical line indicates the release of ratings; the dashed blue lines denote the time period in which Moody constructed the ratings.

Table 1:
Moody's 1909 Ratings

		Mean			
Rating	Description	Factor of Safety (%)	Income Per Mile (000s)	Seniority Rank (1=highest)	Yield to Maturity (%)
Aaa	The highest class...their value is not affected by any normal changes in the earnings capacity of the railroad itself	81.25	5.79	6.79	4.08
Aa	While high-grade...slightly inferior to those having the first rating...in security or in salability	74.11	3.28	8.63	4.26
A	Although high-grade, ...affected, to a partial degree, by changing earning power	67.84	3.16	10.87	4.67
Baa	Generally good, but have a speculative tinge...good but second-grade issues	50.70	2.67	20.39	4.65
Ba	Make a moderately favorable showing and are regarded as well secured, but are affected by changing earning power	56.55	1.34	17.17	5.30
B	More susceptible to fluctuations, and are to be regarded as more speculative in position	43.90	1.38	13.22	5.31
Caa	Almost directly responsive to changes in earning power, and have not had the benefit of available income equal to more than double the interest	45.00	1.53	27.00	5.18
Ca	Approach more strongly to the field of speculative issues with but moderate security	31.04	0.97	16.80	7.92
C	Show but a slight margin in surplus above the amount required for their interest, and which are not well secured	20.00	1.17	16.58	6.88
D	Of doubtful character and almost purely speculative value				
E	Defaulted issues..awaiting the results of reorganizations				

Note: Authors' calculations from data presented in *Moody's Analyses of Railroads Investments*, 1909, and from weekly bond prices reported in the *New York Times*. Average (mean) statistics are computed for each bond-week observation used in the primary regression analysis shown in Table 4. *Factor of safety* is the percent of earnings available after interest on the issue (and other issues with equal seniority) has been paid. Income per mile is average earnings available for interest, per mile. Seniority rank is the ranking by Moody of the bond among all issues from the same railroad, with 1 being the most senior bond. The yield to maturity is the average value calculated from closing prices as reported in the *New York Times* over our sample.

Table 2:
Ratings: Pairwise correlations with firm characteristics

Correlations (firm-level)	Rating (Aaa=1)	Factor of Safety	Income per mile	Interest per mile	Duration	Bid-Ask Spread	Pre-Period YTM (mean)
Rating	1						
Factor of Safety	-0.85	1					
Income per Mile	-0.45	0.39	1				
Interest per mile	-0.07	-0.02	0.60	1			
Duration	0.05	-0.03	0.02	0.28	1		
Bid-Ask Spread	0.27	-0.17	-0.17	-0.12	0.08	1	
Pre-Period YTM	0.56	-0.55	-0.43	-0.24	-0.15	0.38	1

Note: This table presents pair-wise correlations between firm-level characteristics that may be correlated with Moody's 1909 securities ratings for railroad companies. *Rating* is a simple ordinal ranking of a bond's rating in 1909, with the lowest risk group (Aaa) denoted as 1, and values increasing in increments of 1 from there (e.g. Aa=2, A=3,...). We calculate the median over all bond-week observations in our sample per firm to obtain a firm-level measure. *Factor of safety* is the percent of earnings available after interest on the issue (and other issues with equal seniority) has been paid. *Avg. Income* is the average earnings available for interest, per mile. *Interest per mile* is the average interest owed per mile of railroad line. *Duration* is the bond's duration given it's coupon rate and maturity. *Bid-Ask spread* is the average difference in our sample pre-ratings period between the bid and ask prices from the same day at 11 AM, when the exchange printed and distributed quotations sheets that included all bid and ask quotations for listed bonds. *Pre-period YTM* is the average yield to maturity calculated from closing prices as reported in the *New York Times* during the months prior to the publication of the ratings volume. Unless otherwise stated, we map bond characteristics to firms by computing the mean value of that variable for the firm across all bond-week observations in our main sample used for our analysis in Table 4.

Table 3:
Railroad Bond Yield Quartiles

Pre-Rating Yield Quartile	Minimum Yield	Maximum Yield	Mean Yield	Percent Aaa	Percent Aa	Percent A	Percent Baa Or Lower	Mean Rating (1=Aaa)	Median Rating
1	0.036	0.041	0.039	0.841	0.028	0.000	0.131	1.421	Aaa
2	0.041	0.043	0.042	0.298	0.602	0.100	0.000	1.769	Aa
3	0.043	0.047	0.045	0.255	0.292	0.453	0.000	2.188	Aa
4	0.047	0.067	0.053	0.000	0.052	0.652	0.297	3.511	A

Note: This table presents the distribution of the average yields in the period prior to ratings of the bonds of different railroads, sorted into quartiles, and the median ratings those railroads' bonds received in each yield quartile. Railroads that received a rating below the median for their quartile are designated as having received a negative surprise. The presented mean yield, distribution of ratings, and mean rating within each yield quartile are computed based on bond-week observations that match the sample used in our prior regression analysis in Table 4.

Table 4:
Effect of Ratings Surprises on Yields

Yield (Basis Points)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Neg Surprise × Post	14.4***						
	(4.6)						
Neg Surprise × Trend (Wks) × Post		0.51***					
		(0.19)					
Neg Surprise × Trend (Wks)		-0.08					
		(0.15)					
Neg Surprise × Weeks Since			0.39***	0.45***	0.41***	0.30**	0.33**
			(0.11)	(0.12)	(0.11)	(0.15)	(0.13)
Implied 12-Month ATE	**14bps**	**26bps**	**20bps**	**23bps**	**22bps**	**16bps**	**17bps**
95% CI, bps	[5,23]	[7,46]	[9,32]	[11, 35]	[7,36]	[1,31]	[4,31]
Bond FE	Y	Y	Y	Y	Y	Y	Y
Rating FE × Trend	Y	Y	Y	Y	Y	Y	Y
Week FE	Y	Y	Y	Y	Y	Y	Y
Firm × Trend FE	-	-	-	-	Y	Y	
Maturity × Trend FE	-	-	-	Y	-	-	Y
Level of Surprise	Firm	Firm	Firm	Firm	Bond	Bond	Bond
Post-Period Duration, Weeks	26-52	52	52	52	52	52	52
R^2	0.890	0.886	0.886	0.890	0.887	0.900	0.904
Obs	11,423	15,478	15,478	15,478	15,220	15,220	15,220

Note: This table depicts the effects of "surprises" (i.e. deviations in ratings from the median for those in the same yield quartile based on their mean yield among all traded bonds prior to the introduction of ratings) on secondary market bond yields trading on the New York Stock Exchange. Column (1) presents a 'donut' specification; we regress yield to maturity in basis points on a dummy variable equal to one for a negative surprise (*Neg Surprise*) interacted with a dummy variable equal to one if the bond transaction occurs 26 weeks after Moody's securities ratings are released in April of 1909 (*Post*). This specification also includes bond and week fixed effects and rating fixed effects interacted with time trends. The pre-period includes the year prior to the release of ratings, while the post-period includes the period 6 months to 12 months following their disclosure. Implied 12-month average treatment effects for the primary coefficient of interest as well as 95% confidence intervals for those 12-month estimates are included below the specification. In column (2) we interact *Neg Surprise* with a time trend, and then also with a time trend interacted with an indicator variable for the post-ratings period. Unlike the 'donut' of column (1), it includes all 12 months following release of ratings in the post period. In column (3), *Neg Surprise*is interacted with a variable which equals 0 prior to ratings being released and then after is the weeks since they were released (*Weeks Since*). Column (4) is the same as column (3) but also includes ten bond-level maturity group fixed effects interacted with a time trend. Column (5) is the same as column (3), but the surprises are calculated at the bond level, rather than the firm level. Column (6) is the same as column (5), but also includes Firm × Trend fixed effects, so that only the within-firm variation is used to estimate the effect of the surprises. Column (7) is the same as column (6), but also includes ten bond-level maturity group fixed effects interacted with a time trend. Standard errors clustered at the bond level are in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Table 5:
Effect of Surprises, Controlling for Rating Predictors

Yield (Basis Points)	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	2SLS (7)
Weeks since ×							
Negative surprise	0.39***	0.39***	0.37***	0.37***	0.37***	0.34***	0.54**
	(0.11)	(0.11)	(0.12)	(0.11)	(0.11)	(0.13)	(0.22)
Pre-rating yield		-5.4				-12.6	
		(11.9)				(13.7)	
Factor of safety			-0.002	-0.002	-0.002	-0.004	
			(0.005)	(0.006)	(0.006)	(0.006)	
Average income				0.00001	0.00001	0.00001	
				(0.00002)	(0.00002)	(0.00002)	
Interest per mile				-0.00009	-0.00002	-0.00002	
				(0.00011)	(0.00011)	(0.00011)	
Duration					0.0023	0.0015	
					(0.0033)	(0.0034)	
Pre-rating bid-ask						7.3	
						(12.2)	
Implied 12-Month ATE	**20bps**	**20bps**	**19bps**	**19bps**	**19bps**	**18bps**	**28bps**
95% CI, bps	[9,32]	[9,32]	[6,32]	[6,32]	[6,32]	[4,31]	[5,51]
Bond FE	Y	Y	Y	Y	Y	Y	Y
Rating FE× trend	Y	Y	Y	Y	Y	Y	Y
Week FE	Y	Y	Y	Y	Y	Y	Y
Kleibergen-Paap F-Stat	-	-	-	-	-	-	14.7
R^2	0.886	0.886	0.886	0.886	0.886	0.886	0.011
Obs	15,478	15,478	15,478	15,478	15,478	15,478	15,478

Note: This table depicts the effects of "surprises" (i.e. deviations in ratings from the median for those in the same yield quartile based on their mean yield among all traded bonds prior to the introduction of ratings) on secondary market bond yields trading on the New York Stock Exchange after controlling for other potential observable confounds. Column (1) regresses yield to maturity in basis points on a dummy variable equal to one for a negative surprise (*Neg Surprise*) interacted with a variable which equals 0 prior to ratings being released and then after are the weeks since they were released (*Weeks Since*). This specification also includes bond fixed effects, week fixed effects, and rating fixed effects interacted with weeks since ratings were released. The pre-period includes the year prior to the release of ratings, while the post-period includes the 12-months following their disclosure. Column (2) is the same as column (1), but also interacts *Weeks Since* with pre-rating mean yield-to-maturity (*Pre-rating yield*). Column (3) is the same as column (1), but also interacts *Weeks Since* with a firm's average bonds' factor of safety (*Factor of safety*) as a control variable. Column (4) is the same as column (3), but also interacts *Weeks Since* with a firm's bonds' average earnings available to pay interest (*Average income*) and interest per mile (*Interest per mile*) as additional control variables. Column (5) is the same as column (4), but also interacts *Weeks Since* with a firm's average bonds' duration (*Duration*) as an additional control variable. Column (6) is the same as column (5), but also interacts *Weeks Since* with a firm's bonds' average pre-ratings release bid-ask spread percent (*Pre-rating bid-ask spread*) and yield-to-maturity (*Pre-rating yield*) as additional control variables. Column (7) uses all control variables in column (6) but instead as instrumental variables within a two-stage least squares regression where *Weeks since* x *Negative surprise* is the endogenous variable and yields are again the outcome variable of interest. In this case confidence intervals are weak instrument robust confidence sets based on the two-step identification robust 95% confidence sets proposed by Andrews (2018) based on linear combination tests, as implemented in the "twostepweakiv" package in Stata using 1,000 grid points. See also Andrews, Stock and Sun (2019). All characteristics are computed at the firm-level by taking the mean for each bond-week observation in our sample just as in Table 2. Standard errors clustered at the bond level are in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Table 6:
Heterogeneity in Effect of Ratings Surprises on Yields

Yield (Basis Points)	All (1)	Many Bankers On Board (2)	Some Bankers On Board (3)	No Bankers On Board (4)
Weeks since ×				
Neg Surprise	0.48***	0.006	0.44***	0.58***
	(0.12)	(0.29)	(0.17)	(0.14)
Neg Surprise × Many Top Underwriters on Board	-0.53***			
	(0.18)			
All interactions	Y	Y	Y	Y
Bond FE	Y	Y	Y	Y
Rating FE × Trend (Wks)	Y	Y	Y	Y
Week FE	Y	Y	Y	Y
Underwriter Measure (Top 10 Bankers on Board)	≥3	≥3	$[1, 2]$	0
R^2	0.887	0.918	0.845	0.915
Obs	15,478	3,745	7,748	3,985

Note: This table depicts heterogeneity in the effects of "surprises" (i.e. deviations in ratings from the median for those in the same yield quartile based on their mean yield among all traded bonds prior to the introduction of ratings) on secondary market bond yields trading on the New York Stock Exchange. Column (1) regresses yield to maturity in basis points on a dummy variable equal to one for a negative surprise (*Neg Surprise*) interacted with a variable which equals 0 prior to ratings being released and then after are the weeks since they were released (*Weeks Since*) and interacted with a dummy variable equal to one if the firm is in the top quartile of the distribution of connections to elite underwriters, with three on their board (*Many Top Underwriters on Board*). This specification also includes bond fixed effects, week fixed effects, and rating fixed effects interacted with weeks since ratings were released. The pre-period includes the year prior to the release of ratings, while the post-period includes the 12-months following their disclosure. Columns (2)-(4) estimate the effect of the interaction of *Neg Surprise* and *Weeks Since*, only among the subset of firms where either more than 2, 1 or 2, or no top underwriters are on the board, respectively. Standard errors clustered at the bond level are in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Table 7:
IV Results: Effect of Ratings on Bid-Ask Spreads

	OLS (1)	2SLS (2)	2SLS (3)	2SLS (4)
Post × Rated Issue	-0.0054*	-0.0298***	-0.0294***	-0.0314***
	(0.0031)	(0.0099)	(0.0099)	(0.0109)
Trend × Rated Issue	0.00003	0.0015	0.0016	0.00015
	(0.00041)	(0.0012)	(0.0013)	(0.0016)
Weak IV CI, Post × Rated	–	[-.056, -.012]	[-.053, -.014]	[-.048 ,-.014]
Bond FE	Y	Y	Y	Y
Week FE	Y	Y	Y	Y
Week FE × Pre-Rating Yield	Y	Y	Y	Y
Week FE × Pre-Rating Spread	Y	Y	Y	Y
Pre-period Iliquidity	-	-	$\geq$ 60%	$\geq$ 80%
Kleibergen-Paap F-Stat	-	17.5	20.7	47.0
Observations	5,085	5,085	2,076	1,042
% Obs not rated	6%	6%	11%	13%
# Bonds	381	381	191	104
# Bonds not rated	28	28	23	13

Note: The table presents estimates of the effect of ratings on bid-ask spreads, using OLS and the IV approach of Equation (2), estimated via 2SLS. The regressions are estimated using 12 weeks of data before and after the introduction of ratings, for a total of 24 weeks of data. The weak instrument robust confidence sets are two-step identification robust 95% confidence sets proposed by Andrews (2018) based on linear combination tests, as implemented in the "twostepweakiv" package in Stata using 1,000 grid points. See also Andrews, Stock and Sun (2019). The pre-rating yield and the pre-rating spread are calculated as the mean yield and spread for each issue using all the observations 12 weeks before treatment. Column (1) is an OLS regression of a bond's bid-ask spread on a dummy variable equal to 1 if an issue (bond) is rated interacted with a dummy variable equal to 1 after ratings are released. It also includes bond, week, week × pre-rating yield, and week × pre-rating spread fixed effects. Column (2) is the same as column (1), but uses the IV approach from equation (2). In particular, after controlling for an issue's yield prior to the release of ratings, we use the yields of other bonds that are part of that same firm in the same period, as an instrument for being rated (because of Moody's propensity to rate all bonds of a given firm). The same-issuer pre-rating yield is calculated using observations over the 12 weeks before the introduction of ratings. Column (3) is the same as column (2), but restricts the analysis to only those issues with a mean bid-ask spread at or above the 60^{th} percentile in the period prior to ratings being released. Column (4) is the same as column (3) but for those above the 80^{th} percentile. The corresponding first stages of the regressions in columns (2)-(4) are shown in appendix Table A4. Robust standard errors, clustered by bond, are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Table 8:
Reduced-Form Estimates

	RF (1)	RF (2)	RF (3)	Falsification (4)	Falsification (5)
Post × OtherBondsYields	0.346***	0.406***	0.458***	-0.053	0.184
	(0.114)	(0.119)	(0.140)	(0.189)	(0.245)
Trend × OtherBondsYields	-0.017	-0.023	-0.022	0.002	-0.002
	(0.015)	(0.019)	(0.024)	(0.013)	(0.008)
Bond FE	Y	Y	Y	Y	Y
Week FE	Y	Y	Y	Y	Y
Week FE × Pre-Rating Yield	Y	Y	Y	Y	Y
Week FE × Pre-Rating Spread	Y	Y	Y	Y	Y
Pre-period Iliquidity	-	$\geq$ 60%	$\geq$ 80%	$\leq$ 20%	$\leq$ 60%
Kleibergen-Paap F, First Stage	17.5	20.7	47.0	0.8	0.1
Observations	5,085	2,076	1,042	1,023	3,059
% Obs not rated	6%	11%	13%	3%	2%
# Bonds	381	191	104	60	195
# Bonds not rated	28	23	13	3	5

Note: The table presents estimates of the reduced-form relationship between the instrument used in estimating Equation (2), the yield on the other bonds of the same railroads, and bid-ask spreads. The regressions are estimated using 12 weeks of data before and after the introduction of ratings, for a total of 24 weeks of data. The pre-rating yield and the pre-rating spread are calculated as the mean yield and spread for each issue using all the observations 12 weeks before treatment. Column (1) is a regression of bid ask spreads on the instrument, interacted with a post-ratings indicator and with a time trend. It also includes bond, week, week × pre-rating yield, and week × pre-rating spread fixed effects. Column (2) is the same as column (1), but restricts the analysis to only those issues with a mean bid-ask spread at or above the 60^{th} percentile in the period prior to ratings being released. Column (3) is the same as column (2) but for those above the 80^{th} percentile instead of the 60^{th}. In column (4), we present the results of a falsification test in which we restrict the sample to the most *liquid* bonds—those in the 20^{th} percentile of pre-rating spreads or below. In column (5), we present another falsification test, withe the sample restricted to bonds in the 40^{th} percentile of spreads or below. Robust standard errors, clustered by bond, are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Table 9:
IV Results: Effect of Ratings on Block Size

	2SLS (1) Any Trans	2SLS (2) # 1 Lot Trades	2SLS (3) $\mathbb{1}_{1LotTrade}$	2SLS (4) #≥10 Lot Trades
Post 23rd April 1909 × Rated Issue	-0.0083	0.568**	0.391**	0.132
	(0.1153)	(0.274)	(0.194)	(0.743)
Trend × Rated Issue	0.0031	-0.035	-0.024	0.010
	(0.0085)	(0.025)	(0.017)	(0.091)
Weak IV Robust Confidence Set, Post × Rated	–	[0.120, 1.238]	[0.081, 0.859]	–
Bond FE	Y	Y	Y	Y
Week FE	Y	Y	Y	Y
Week FE × Pre-Rating Yield	Y	Y	Y	Y
Week FE × Pre-Rating Spread	Y	Y	Y	Y
Kleibergen-Paap F-Stat	18.7	11.6	11.6	11.6
Dep Var Mean	0.259	0.403	0.333	0.741
Observations	9,675	2,429	2,429	2,429
# Bonds	387	313	313	313
# Bonds not rated	72	60	60	60

Note: The table presents estimates of the effect of ratings on trade size, and in particular the number of lots (of $1,000 par-value bonds) per transaction. All regressions are versions of Equation (2) estimated via 2SLS, with different second-stage outcomes as shown in the column headings. We use the yields of other bonds that are part of that same firm in the same period as an instrumental variable for being rated (because of Moody's propensity to rate all bonds of a given firm). All regressions include bond, week, week × pre-rating yield, and week × pre-rating spread fixed effects. The pre-rating yield and the pre-rating spread are calculated as the mean yield and spread for each issue using all the observations 12 weeks before treatment. Similarly, the instrument, the same-issuer pre-rating yield, is calculated using observations over the 12 weeks before the introduction of ratings. The regressions are estimated using 12 weeks of data before and after the introduction of ratings, for a total of 24 weeks of data. The weak instrument robust confidence sets are two-step identification robust 95% confidence sets proposed by Andrews (2018) based on linear combination tests, as implemented in the "twostepweakiv" package in Stata using 1,000 grid points. See also Andrews, Stock and Sun (2019). Column (1) is a 2SLS regression of the probability of any transaction occurring that day for that bond on an instrumented endogenous dummy variable equal to 1 if an issue (bond) is rated interacted with a dummy variable equal to 1 after ratings are released. Column (2) is the same column (1), but the dependent variable is number of standard (single) lot trades in a day, conditional on at least one transaction occurring that day for that bond. Column (3) is the same column (1), but the dependent variable is a dummy variable equal to one if at least one standard (single) lot trade occurs in a day, conditional on at least one transaction occurring that day for that bond. Column (4) is the same column (1), but the dependent variable is number of ten or larger lot trades in a day, conditional on at least one transaction occurring that day for that bond. Robust standard errors, clustered by bond, are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Appendix

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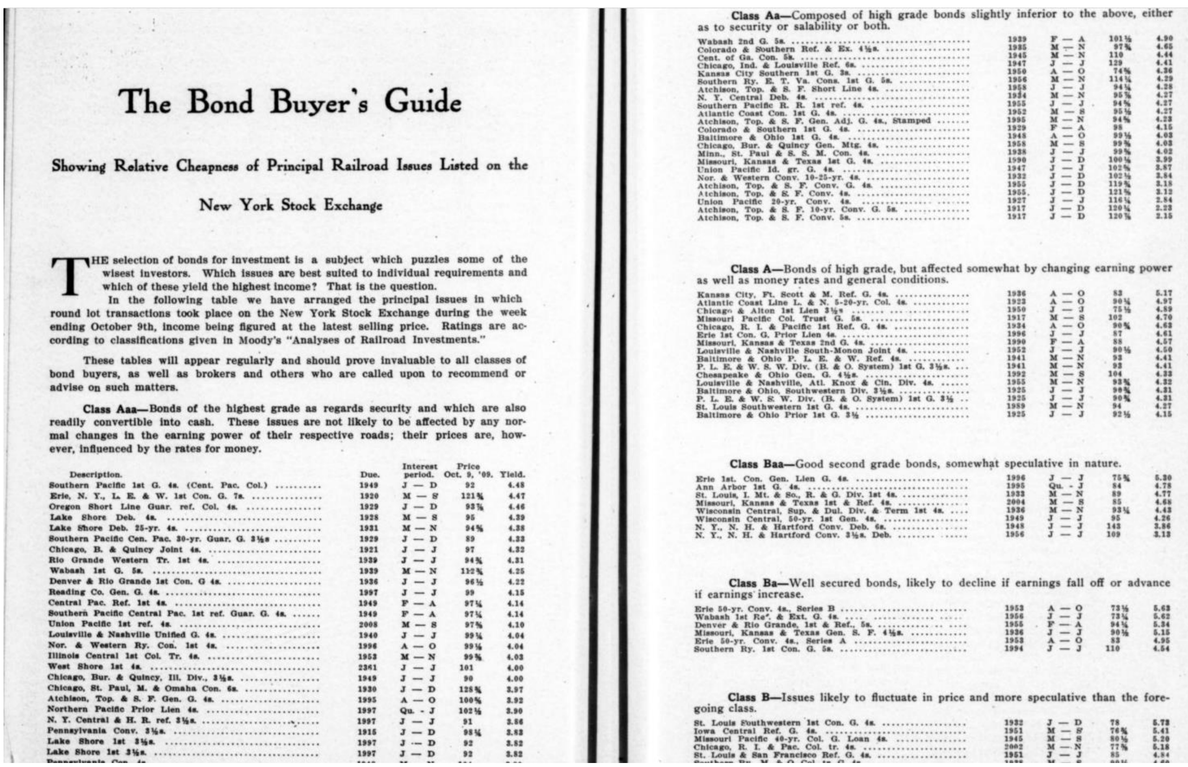
A Additional Tables and Figures



The Bond Buyer's Guide

Showing Relative Cheapness of Principal Railroad Issues Listed on the New York Stock Exchange

THE selection of bonds for investment is a subject which puzzles some of the wisest investors. Which issues are best suited to individual requirements and which of these yield the highest income? That is the question.

In the following table we have arranged the principal issues in which round lot transactions took place on the New York Stock Exchange during the week ending October 9th, income being figured at the latest selling price. Ratings are according to classifications given in Moody's "Analyses of Railroad Investments."

These tables will appear regularly and should prove invaluable to all classes of bond buyers, as well as brokers and others who are called upon to recommend or advise on such matters.

Class Aaa—Bonds of the highest grade as regards security and which are also readily convertible into cash. These issues are not likely to be affected by any normal changes in the earning power of their respective roads; their prices are, however, influenced by the rates for money.

Description.	Due.	Interest period.	Price Oct. 9, '09.	Yield.
Southern Pacific 1st G. 4s. (Cent. Pac. Col.)	1949	J — D	92	4.48
Erie, N. Y., L. E. & W. 1st Con. G. 7s.	1920	M — S	121¾	4.47
Oregon Short Line Guar. ref. Col. 4s.	1929	J — D	93⅞	4.46
Lake Shore Deb. 4s.	1928	M — S	95	4.39
Lake Shore Deb. 25-yr. 4s.	1931	M — N	94⅝	4.38
Southern Pacific Cen. Pac. 30-yr. Guar. G. 3½s	1929	J — D	89	4.33
Chicago, B. & Quincy Joint 4s.	1921	J — J	97	4.32
Rio Grande Western Tr. 1st 4s.	1939	J — J	94¾	4.31
Wabash 1st G. 5s.	1939	M — N	112¾	4.25
Denver & Rio Grande 1st Con. G 4s.	1936	J — J	96½	4.22
Reading Co. Gen. G. 4s.	1997	J — J	99	4.15
Central Pac. Ref. 1st 4s.	1949	F — A	97¼	4.14
Southern Pacific Central Pac. 1st ref. Guar. G. 4s.	1949	F — A	97¼	4.14
Union Pacific 1st ref. 4s.	2008	M — S	97⅝	4.10
Louisville & Nashville Unified G. 4s.	1940	J — J	99¼	4.04
Nor. & Western Ry. Con. 1st 4s.	1996	A — O	99⅛	4.04
Illinois Central 1st Col. Tr. 4s.	1953	M — N	99⅝	4.03
West Shore 1st 4s.	2361	J — J	101	4.00
Chicago, Bur. & Quincy, Ill. Div., 3½s.	1949	J — J	90	4.00
Chicago, St. Paul, M. & Omaha Con. 6s.	1930	J — D	128⅝	3.97
Atchison, Top. & S. F. Gen. G. 4s.	1995	A — O	100⅝	3.92
Northern Pacific Prior Lien 4s.	1997	Qu. - J	102⅛	3.90
N. Y. Central & H. R. ref. 3½s.	1997	J — J	91	3.86
Pennsylvania Conv. 3½s.	1915	J — D	98¼	3.83
Lake Shore 1st 3½s.	1997	J — D	92	3.82
Lake Shore 1st 3½s.	1997	J — D	92	3.82

Class Aa—Composed of high grade bonds slightly inferior to the above, either as to security or salability or both.

Wabash 2nd G. 5s.	1939	F — A	101½	4.90
Colorado & Southern Ref. & Ex. 4½s.	1935	M — N	97⅝	4.65
Cent. of Ga. Con. 5s.	1945	M — N	110	4.44
Chicago, Ind. & Louisville Ref. 6s.	1947	J — J	129	4.41
Kansas City Southern 1st G. 3s.	1950	A — O	74⅝	4.36
Southern Ry. E. T. Va. Cons. 1st G. 5s.	1956	M — N	114¼	4.29
Atchison, Top. & S. F. Short Line 4s.	1958	J — J	94¼	4.28
N. Y. Central Deb. 4s.	1934	M — N	95⅞	4.27
Southern Pacific R. R. 1st ref. 4s.	1955	J — J	94⅝	4.27
Atlantic Coast Con. 1st G. 4s.	1952	M — S	95½	4.27
Atchison, Top. & S. F. Gen. Adj. G. 4s., Stamped	1995	M — N	94⅝	4.23
Colorado & Southern 1st G. 4s.	1929	F — A	98	4.15
Baltimore & Ohio 1st G. 4s.	1948	A — O	99½	4.03
Chicago, Bur. & Quincy Gen. Mtg. 4s.	1958	M — S	99⅝	4.03
Minn., St. Paul & S. S. M. Con. 4s.	1938	J — J	99⅝	4.02
Missouri, Kansas & Texas 1st G. 4s.	1990	J — D	100⅛	3.99
Union Pacific Id. gr. G. 4s.	1947	J — J	102⅝	3.87
Nor. & Western Conv. 10-25-yr. 4s.	1932	J — D	102½	3.84
Atchison, Top. & S. F. Conv. G. 4s.	1955	J — D	119⅝	3.18
Atchison, Top. & S. F. Conv. 4s.	1955	J — D	121⅝	3.12
Union Pacific 20-yr. Conv. 4s.	1927	J — J	116¼	2.84
Atchison, Top. & S. F. 10-yr. Conv. G. 5s.	1917	J — D	120¼	2.23
Atchison, Top. & S. F. Conv. 5s.	1917	J — D	120⅞	2.15

Class A—Bonds of high grade, but affected somewhat by changing earning power as well as money rates and general conditions.

Kansas City, Ft. Scott & M. Ref. G. 4s.	1936	A — O	83	5.17
Atlantic Coast Line L. & N. 5-20-yr. Col. 4s.	1923	A — O	90¼	4.97
Chicago & Alton 1st Lien 3½s	1950	J — J	75½	4.89
Missouri Pacific Col. Trust G. 5s.	1917	M — S	102	4.70
Chicago, R. I. & Pacific 1st Ref. G. 4s.	1934	A — O	90⅝	4.63
Erie 1st Con. G. Prior Lien 4s.	1996	J — J	87	4.61
Missouri, Kansas & Texas 2nd G. 4s.	1990	F — A	88	4.57
Louisville & Nashville South-Monon Joint 4s.	1952	J — J	90½	4.50
Baltimore & Ohio P. L. E. & W. Ref. 4s.	1941	M — N	93	4.41
P. L. E. & W. S. W. Div. (B. & O. System) 1st G. 3½s.	1941	M — N	93	4.41
Chesapeake & Ohio Gen. G. 4½s.	1992	M — S	104	4.33
Louisville & Nashville, Atl. Knox & Cin. Div. 4s.	1955	M — N	93⅝	4.32
Baltimore & Ohio, Southwestern Div. 3½s.	1925	J — J	90⅝	4.31
P. L. E. & W. S. W. Div. (B. & O. System) 1st G. 3½	1925	J — J	90⅝	4.31
St. Louis Southwestern 1st G. 4s.	1989	M — N	94	4.27
Baltimore & Ohio Prior 1st G. 3½	1925	J — J	92½	4.15

Class Baa—Good second grade bonds, somewhat speculative in nature.

Erie 1st. Con. Gen. Lien G. 4s.	1996	J — J	75⅝	5.30
Ann Arbor 1st G. 4s.	1995	Qu. - J	84	4.78
St. Louis, I. Mt. & So., R. & G. Div. 1st 4s.	1933	M — N	89	4.77
Missouri, Kansas & Texas 1st & Ref. 4s.	2004	M — S	85	4.68
Wisconsin Central, Sup. & Dul. Div. & Term 1st 4s.	1936	M — N	93¼	4.43
Wisconsin Central, 50-yr. 1st Gen. 4s.	1949	J — J	95	4.26
N. Y., N. H. & Hartford Conv. Deb. 6s.	1948	J — J	143	3.86
N. Y., N. H. & Hartford Conv. 3½s. Deb.	1956	J — J	109	3.13

Class Ba—Well secured bonds, likely to decline if earnings fall off or advance if earnings increase.

Erie 50-yr. Conv. 4s., Series B	1953	A — O	73½	5.63
Wabash 1st Ref. & Ext. G. 4s.	1956	J — J	73¼	5.62
Denver & Rio Grande, 1st & Ref., 5s.	1955	F — A	94¼	5.34
Missouri, Kansas & Texas Gen. S. F. 4½s.	1936	J — J	90½	5.15
Erie 50-yr. Conv. 4s., Series A	1953	A — O	83	4.95
Southern Ry. 1st Con. G. 5s.	1994	J — J	110	4.54

Class B—Issues likely to fluctuate in price and more speculative than the foregoing class.

St. Louis Southwestern 1st Con. G. 4s.	1932	J — D	78	5.73
Iowa Central Ref. G. 4s.	1951	M — S	76⅝	5.41
Missouri Pacific 40-yr. Col. G. Loan 4s.	1945	M — S	80½	5.20
Chicago, R. I. & Pac. Col. tr. 4s.	2002	M — N	77⅝	5.18
St. Louis & San Francisco Ref. G. 4s.	1951	J — J	85	4.84

Figure A.1:
***The Ticker's* Bond Buyer's Guide**

Note: This figure provides an example (from November, 1909) of the tables printed in the popular finance magazine *The Ticker* beginning in November 1909. Bonds that had recently traded were grouped by the rating assigned by Moody, and then within each ratings class, were sorted by the yield to maturity implied by their price. The magazine frames the table as a guide to the "relative cheapness" of bonds, implying that bonds with high yields within their ratings class were cheap, and bonds with low yields compared to other bonds of the same rating were expensive. The magazine thus encouraged investors to trade on the basis of the surprises contained in Moody's ratings relative to market yields.

Complete Bond Transactions.

Total Week End. Mar. 13, $17,013,000	First.	High.	Low.	Last.	Sales.
Adams Express 4s	92⅞	93½	92⅞	93½	9
Albany & Susquehanna 3½s	97	97	97	97	16
Allis-Chalmers 5s	81¾	82	81½	82	75
American Agricult. Chem. conv. 5s, rcts.	99⅝	100	99⅝	99⅞	25
American Ice Securities 6s	71½	73	71½	73	36
American Cotton Oil 4½s	97⅛	97⅛	97⅛	97⅛	3
American Hide & Leather 6s	99	99	98	98	9
American Tel. & Tel. conv. 4s	94⅞	95½	94⅞	95½	924
American Tel. & Tel. col. tr. 4s	94	94½	94	94½	15
American Tobacco 4s	75⅝	78	75⅝	78	258
American Tobacco 6s	106⅝	107¾	106⅝	107¾	123
American Tobaco 6s, reg.	106¾	106¾	106¾	106¾	4
Ann Arbor 4s	86⅝	87¾	86⅝	87¾	12
Atch., Top. & Santa Fé gen. 4s	101	101	100¾	101	167
Atch., Top. & Santa Fé adj. 4s	94¼	94½	94¼	94½	9½
Atch., Top. & Santa Fé adj. 4s, stamped	94¾	94¾	94¾	94¾	16
Atch., Top. & Santa Fé conv. 5s	107½	107⅝	107	107¼	297
Atch., Top. & Santa Fé, East Okla. 4s	97⅞	97⅞	97⅞	97⅞	2
Atch., Top. & Santa Fé, Trans. Sh. 4s	95½	95½	95½	95½	44
Atch., Top. & Santa Fé conv. 4s	105⅞	105⅞	105⅛	105⅛	677
Atlantic Coast Line 4s	97½	97½	97	97¼	54
Atlantic Coast Line, L. & N. col. 4s	90	90¼	90	90	25
Baltimore & Ohio prior lien 3½s	93¾	93¾	93½	93¾	27
Baltimore & Ohio prior lien 3½s, reg.	92	92	92	92	8
Baltimore & Ohio gold 4s	100⅞	101	100¾	100¾	75
Balt. & Ohio, P., L. E. & W. Va. 4s	94⅝	94⅝	94⅛	94⅛	21
Bethlehem Steel 5s	80	80	79½	79½	68
Brooklyn Rapid Transit gold 5s	104¼	104¼	104¼	104¼	2
Brooklyn Rapid Transit ref. 4s	84	84	83½	83½	91
Brooklyn Union Elevated 1st 5s	102⅜	102½	102	102½	12
Brooklyn Union Gas 1st 5s	106½	106⅝	106½	106⅝	2
Canada Southern 1st ext. 6s	106¼	106¾	106¼	106¾	25
Canada Southern 2d 5s	102½	102½	102¼	102¼	5
Central of Georgia consol. 5s	110	110	110	110	1
Central of Georgia 2d inc. 5s, stamped	62	62	62	62	5
Central of Georgia 2d inc. 5s, Cent. Tr. cfs	63	63	63	63	27
Central of New Jersey gen. 5s, reg.	127⅜	127⅜	127⅜	127⅜	1
Central Leather 5s	97	97½	97	97½	46
Central Pacific gtd. 4s	98	98	97¾	98	191
Central Pacific 3½s	90½	90½	90½	90½	12
Central Pacific, Through Short Line 4s	94	94	94	94	5
Central Vermont 4s	83	83	83	83	3
Chesapeake & Ohio gen. 4½s	105⅜	105½	105	105	26
Chesapeake & Ohio con. 5s	115⅞	116	115⅞	116	256
Ches. & Ohio, Big Sandy 4s	90½	90½	90½	90½	1
Ches. & Ohio, tr. rcts. for gen. f. & i. 5s.	102⅛	102⅜	101⅞	101⅞	290
Chicago & Alton 3s	78½	78½	78½	78½	25
Chicago & Alton 3½s	74⅞	74⅞	74	74	4
Chi., Bur. & Q., N. P.-Gt. N. jt. 4s	98⅜	98⅜	98⅛	98⅜	508
Chi., Bur. & Q., N. P.-Gt. N. jt. 4s, reg.	98	98⅜	98	98⅜	7
Chi., Bur. & Q., Illinois Div. 3½s	92¼	92¼	91¾	91¾	3
Chi., Bur. & Q., Illinois Div. 4s	102¼	102¼	101¾	101¾	28
Chi., Bur. & Q., gen. 4s	100½	100½	100¼	100¼	185
Chi., Bur. & Q., Nebraska Ext. 4s	102	102	102	102	6
Chi., Bur. & Q., Southwest Div. 4s	99½	99½	99½	99½	1
Chicago & Eastern Illinois gen. 5s	115⅜	115⅜	115⅛	115¼	13
Chicago & Eastern Illinois ref. & imp. 4s.	88⅛	88⅛	88	88	86
Chicago & Erie 1st 5s	116¾	116¾	116½	116½	7
Chi., Mil. & St. P. gen. 3½s, Series B	91¾	91⅞	91¾	91⅞	11
Chi., Mil. & St. P. gen. 4s, Series A	102¾	103½	102¾	103½	11
Chi., Mil. & St. P., Hast. & Dak. 7s	102⅝	102⅝	102⅝	102⅝	17
Chi., Mil. & St. P., Mineral Point Div. 5s.	101¾	101¾	101¾	101¾	1
Chi., Mil. & St. P., Dak. & Gt. So. 5s	105⅞	105⅞	105⅞	105⅞	1
Chi., Mil. & St. P., Chi. & Mo. River 5s.	112⅞	112⅞	112⅞	112⅞	2
Chi., Mil. & St. P., So. Minn. Div. 5s	101¾	101¾	101¾	101¾	10
Chi., Mil. & St. P., Chi., Pac. & West. 5s.	110¼	110¼	110⅛	110⅛	4
Chicago & Northwestern ext. 4s reg.	100¼	100¼	100¼	100¼	5
Chicago & Northwestern gen. 3½s	92⅞	93	92⅞	93	36
Chicago, Rock Island & Pacific ref. 4s	93	93	92⅜	92½	314
Chicago, Rock Island & Pacific col. 4s	79	79	78¼	78¼	211
Chicago, Rock Island & Pacific col. 5s	90⅛	90⅛	89¼	89¼	43
Chicago, Rock Island & Pacific gen. 4s	100¾	100¾	100½	100½	83

	First.	High.	Low.	Last.	Sales.
Norwolk & Western gen. 6s	127½	127½	127½	127½	1
Norfolk & Western conv. 4s	96¼	96½	96	96	104
Norfolk & Western div'l 4s	93¾	93¾	93½	93½	25
Norfolk & Western consol. 4s	98⅝	98⅝	98⅝	98⅝	1
Norfolk & West. Pocahontas C. & C. 4s	92	92	92	92	8
Northern Pacific prior lien 4s	103¼	103⅜	103¼	103⅜	61
Northern Pacific 3s	74¾	74¾	74⅝	74¾	31½
Oregon Railroad & Navigation 4s	99	99	99	99	17
Oregon Short Line gtd. ref. 4s	94¾	95	94¾	95	73
Oregon Short Line consol. 5s	117	117	117	117	5
Pacific of Missouri 1st 4s	99¾	100	99¾	100	7
Pennsylvania con. 4s, 1948	104⅝	104⅝	104¼	104⅝	154
Pennsylvania conv. 3½s, 1912	97⅞	98	97⅞	97⅞	105
Pennsylvania conv. 3½s, 1915	95¾	95¾	95½	95½	448
Pennsylvania gtd. 3½s, tr. rects	96¾	96¾	96¾	96¾	11
Pennsylvania gtd. 3½s, Series B	90¼	90¼	90¼	90¼	5
Pennsylvania gtd. 4s	99	99	99	99	1
Pennsylvania gtd. 4½s	106	106	106	106	1
Peoria & Eastern inc. 4s	41⅛	41¼	41⅛	41¼	6
Peoria & Eastern 1st 4s	94¾	94¾	94¾	94¾	4
People's Gas of Chicago consol. 6s	121	121	120¼	120¼	3
Philippine Railway 4s	94	94	94	94	10
Reading gen. 4s	100	100⅛	99⅞	99⅞	152
Reading, Jersey Central col. 4s	97	97	97	97	1
Republic Iron & Steel 5s	99	99	99	99	10
Rochester & Pittsburg consol. 6s	121½	121½	121½	121½	3
Rio Grande Western coll. 4s	83	83	83	83	2
Rio Grande Western 1st 4s	98	98	98	98	4
St. Joseph & Grand Island 4s	95	95	95	95	2
St. Louis, Iron Mt. & So., R. & G. 4s	91	91	90⅞	91	12
St. Louis, Iron Mt. & So. unif. & ref. 4s	89	90⅝	89	90⅝	82
St. Louis, Iron Mt. & Southern gen. 5s	111½	111½	111¼	111½	12
St. Louis & San Francisco gen. 5s	111	111	111	111	4
St. Louis & San Francisco ref. 4s	86	86¼	85	85	94
St. Louis & San Francisco gen. 5s, tr. r.	89⅝	89⅝	89	89	34
St. Louis Southwestern consol. 4s	78¾	78¾	78¾	78¾	1
St. Louis Southwestern 1st 4s	94	94	94	94	14
St. Paul, Minn. & Man. consol. 6s	132⅝	132⅝	132⅝	132⅝	1
St. Paul, Minn. & Man. consol. 4½s	109¼	109½	109¼	109½	15
St. Paul, Minn. & Man. Montana Ext. 4s	99¼	99¾	99¼	99¾	5
St. Paul, Minn. & Man., Mont. Central 5s.	116½	116½	116½	116½	1
St. Paul & Northern Pacific 6s	121	121	121	121	1
San Antonio & Aransas Pass 4s	90¼	90¼	90	90	16
Seaboard Air Line 4s	65¼	65¼	65⅛	65⅛	18
Scioto Valley & New England 4s	97	97	97	97	1
Southern Railway 1st 5s	111¼	111¼	111	111	34
Southern Railway dev. & gen. 4s	78¾	78⅞	78½	78¾	801
Southern Railway, Mob. & Ohio col. 4s	89½	89½	89	89½	8
Southern Pacific 1st 4s	92	92	91¾	91¾	21
Southern Pacific ref. 4s	95¼	95¼	95⅛	95⅛	138
Terminal Assn. of St. Louis ref. 4s	97¾	97¾	97½	97½	17
Texas Pacific 1st 5s	118	118	118	118	2
Texas & Pacific 2d inc.	70	70	70	70	1
Third Ave. con. 4s, Cent. Tr. ctfs., st'p'd.	67½	68⅛	67	67¼	53
Toledo, Peoria & Western 4s	92½	94	92½	94	10
Ulster & Delaware con. 5s	108¾	108¾	108¾	108¾	2
Underground Rys. of London income 6s	28	28	28	28	3
Underground Rys. of London 4½s	79¼	79¼	79¼	79¼	10
Union Pacific 1st & ref. 4s	98¾	98⅞	98⅝	98⅝	322
Union Pacific 1st 4s	103¼	103½	103	103	38
Union Pacific conv. 4s	103⅛	103¾	102⅞	103¼	816
United Railways of San Francisco 4s	74	74	73	73	31
U. S. Reduction & Refining 6s	91	91	91	91	5
U. S. Rubber s. f. 6s, ctfs	102½	103	102½	102¾	45
U. S. Leather 6s	106½	106½	106	106	23
U. S. Realty & Improvement 5s	87¾	89½	87¾	89	63
U. S. Steel Corp. 2d mtge. s. f. 5s	103	103¼	103	103	601
U. S. Steel Corp. 2d mtge. s. f. 5s reg.	103	103	103	103	1½

Figure A.2:
New York Stock Exchange Weekly Bond Prices

Note: This figure provides an example (from March 13th, 1909) of weekly closing prices for all bonds traded on the New York Stock Exchange reported in the Monday edition of the *New York Times*. Data was collected for the two years surrounding the introduction of securities ratings in April of 1909.

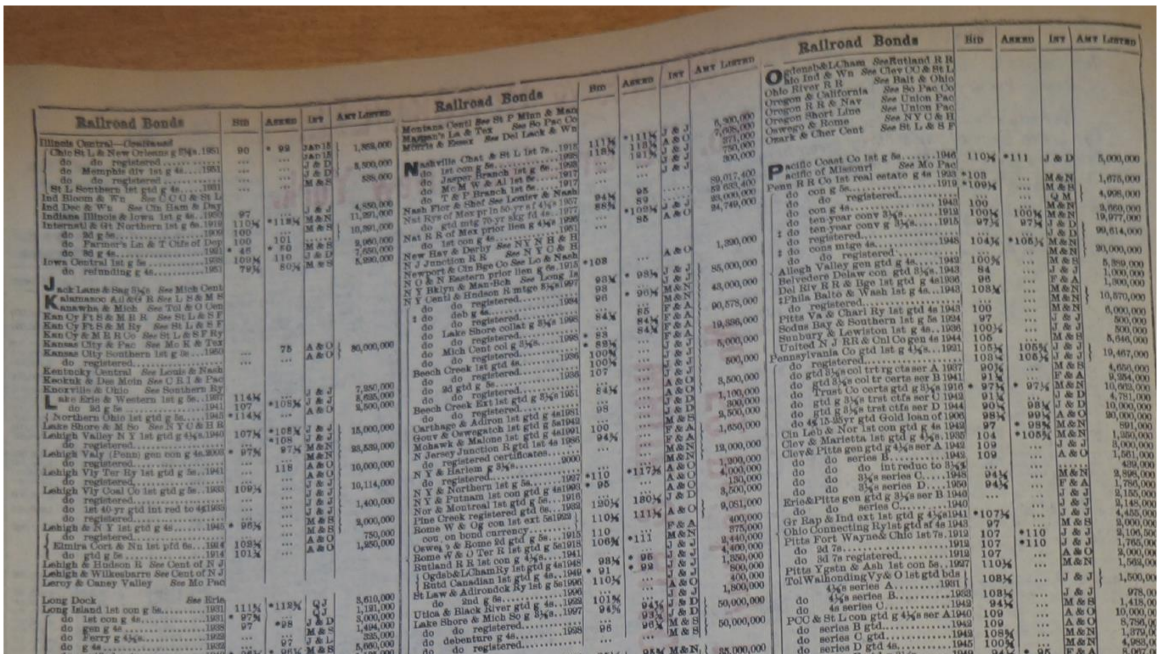


Figure A.3:
New York Stock Exchange Bond Bid and Ask Quotations

Note: The figure provides a partial example (from April 7, 1909) of New York Stock Exchange printed and distributed quotation sheets that include all bid-ask spreads from 11am accessed and digitized from the archives at the New York Stock Exchange. Data were collected at a weekly frequency for the 12 weeks surrounding the introduction of securities ratings in April of 1909.

BONDS ON STOCK EXCHANGE.

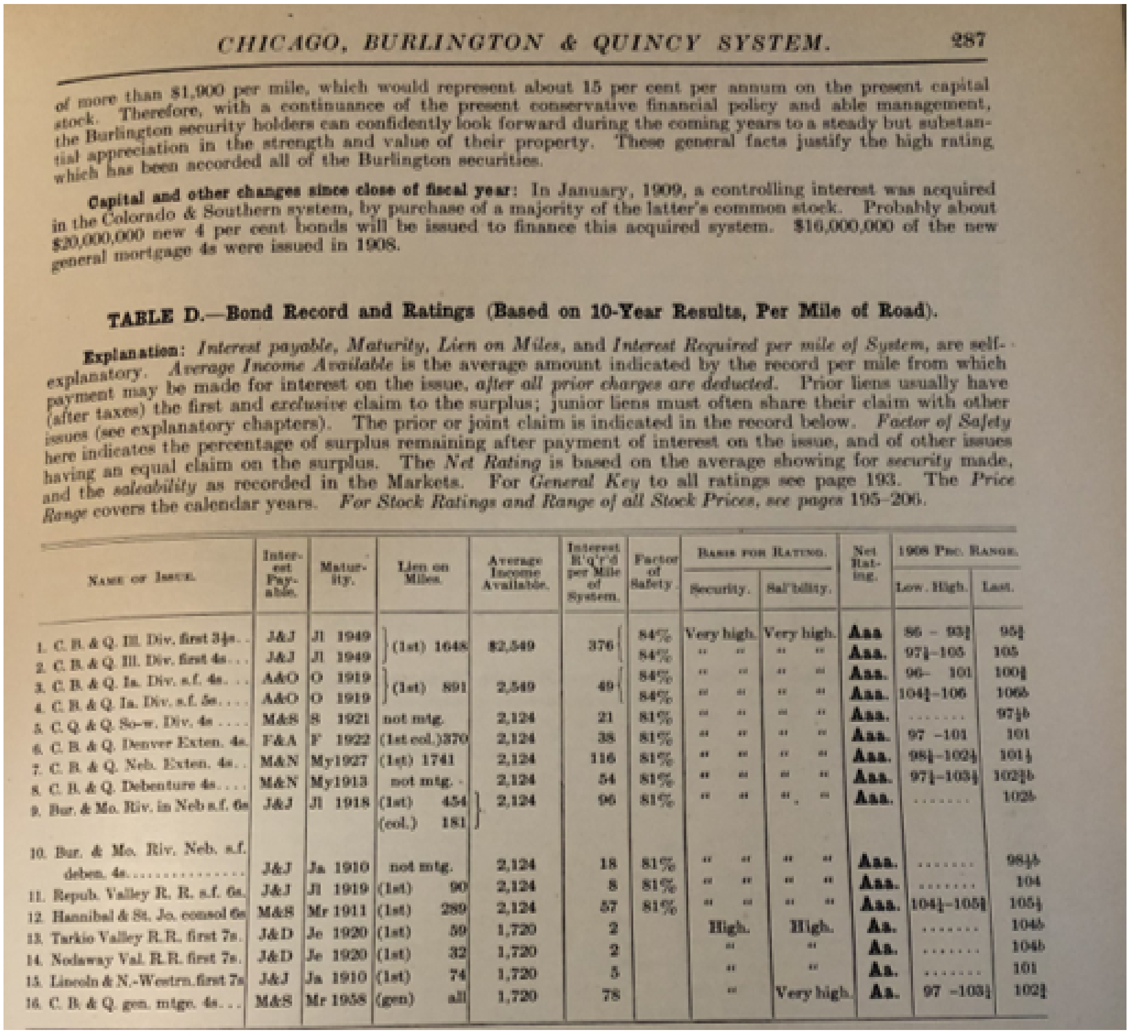
Wednesday.

Imprl Jap Gov 4½s sterl loan
1,000 3........ 92⅝
2d series
5,000s6f........ 91⅝
San Paulo 5s, trust rects
12,000.......... 92¾
80,000.......... 93
14,000.......... 93¼
2,000.......... 93⅜
2,000.......... 93⅝
U S of Mexico 4s
1,000.......... 93
U S of Mexico 5s
1,000.......... 98½
N Y City 4½s, 1957
1,000..........111½
new
11,000..........111½
35,000..........111⅝
1917
7,000..........104½
N Y City 4s, 1958, when issued
10,000..........101¾

Adams Express 4s
2,000.......... 93¾
Allis-Chalmers 5s
7,000.......... 81⅞
Am Ag Ch conv 5s
21,000..........100
Am Ice Secur 6s
1,000.......... 73½
Am Tel & T conv 4s
30,000.......... 95⅝
4,000s10f....... 95¼
134,000.......... 95½
87,000.......... 95⅝
48,000.......... 95¾
10,000.......... 95⅞
Inter-Metro 4½s
10,000.......... 78⅝
3,000.......... 78½
1,000.......... 78⅜
2,000.......... 78¼
11,000.......... 78⅜
46,000.......... 78½
Interb R T conv 6s
30,000..........103¼
14,000..........103⅜
Int & Gt N 2d 5s, Tr ctfs of dep
10,000.......... 86½
Int Stm Pump 6s
4,000..........102
Iowa Cent ref 4s
4,000.......... 78¾
4,000.......... 79
K C, Ft S & M 4s
3,000.......... 83¾
Kan City So 3s
1,000.......... 75
Kentucky Cent 4s
7,000.......... 98½
Kings Co Elev 4s, stamped gtd
9,000.......... 87¼
L E & Wn 1st 5s
10,000..........114
L S & Mich So 4s
3,000.......... 95½
L S & M So 4s, 1931
30,000.......... 95½
1,000.......... 95⅞
Leh Val Term 5s
2,000..........118¾
Lex Av & P F 1st
5,000..........101½
Lo & N unified 4s
3,000..........101
Mer Mar col tr 4½s
5,000.......... 71⅞

Figure A.4:
New York Stock Exchange Intraday Bond Transactions

Note: This figure provides an example (from March 17th, 1909) of daily bond intraday transactions for all bonds traded on the New York Stock Exchange as reported in the *New York Times.* Data was collected every Wednesday for 12 weeks surrounding the introduction of securities ratings in April of 1909.



of more than $1,900 per mile, which would represent about 15 per cent per annum on the present capital stock. Therefore, with a continuance of the present conservative financial policy and able management, the Burlington security holders can confidently look forward during the coming years to a steady but substantial appreciation in the strength and value of their property. These general facts justify the high rating which has been accorded all of the Burlington securities.

Capital and other changes since close of fiscal year: In January, 1909, a controlling interest was acquired in the Colorado & Southern system, by purchase of a majority of the latter's common stock. Probably about $20,000,000 new 4 per cent bonds will be issued to finance this acquired system. $16,000,000 of the new general mortgage 4s were issued in 1908.

TABLE D.—Bond Record and Ratings (Based on 10-Year Results, Per Mile of Road).

Explanation: *Interest payable, Maturity, Lien on Miles,* and *Interest Required per mile of System,* are self-explanatory. *Average Income Available* is the average amount indicated by the record per mile from which payment may be made for interest on the issue, *after all prior charges are deducted.* Prior liens usually have (after taxes) the first and *exclusive* claim to the surplus; junior liens must often share their claim with other issues (see explanatory chapters). The prior or joint claim is indicated in the record below. *Factor of Safety* here indicates the percentage of surplus remaining after payment of interest on the issue, and of other issues having an equal claim on the surplus. The *Net Rating* is based on the average showing for *security* made, and the *saleability* as recorded in the Markets. For *General Key* to all ratings see page 193. The *Price Range* covers the calendar years. *For Stock Ratings and Range of all Stock Prices, see pages 195–206.*

Name of Issue.	Interest Payable.	Maturity.	Lien on Miles.	Average Income Available.	Interest R'q'r'd per Mile of System.	Factor of Safety.	Basis for Rating.		Net Rating.	1908 Pr. Range.	
							Security.	Sal'bility.		Low. High.	Last.
1. C. B. & Q. Ill. Div. first 3½s. .	J&J	Jl 1949	(1st) 1648	$2,549	376	84%	Very high.	Very high.	Aaa	86 – 93¾	95¾
2. C. B. & Q. Ill. Div. first 4s. . .	J&J	Jl 1949				84%	" "	" "	Aaa.	97½–105	105
3. C. B. & Q. Ia. Div. s.f. 4s. . .	A&O	O 1919	(1st) 891	2,549	49	84%	" "	" "	Aaa.	96– 101	100⅞
4. C. B. & Q. Ia. Div. s.f. 5s. . . .	A&O	O 1919				84%	" "	" "	Aaa.	104½–106	106b
5. C. Q. & Q. So-w. Div. 4s	M&S	S 1921	not mtg.	2,124	21	81%	" "	" "	Aaa.	. . . .	97½b
6. C. B. & Q. Denver Exten. 4s.	F&A	F 1922	(1st col.)370	2,124	38	81%	" "	" "	Aaa.	97 –101	101
7. C. B. & Q. Neb. Exten. 4s. .	M&N	My1927	(1st) 1741	2,124	116	81%	" "	" "	Aaa.	98½–102¼	101½
8. C. B. & Q. Debenture 4s. . . .	M&N	My1913	not mtg.	2,124	54	81%	" "	" "	Aaa.	97¼–103¼	102½b
9. Bur. & Mo. Riv. in Neb s.f. 6s	J&J	Jl 1918	(1st) 454 (col.) 181	2,124	96	81%	" "	" "	Aaa.	. . . .	102b
10. Bur. & Mo. Riv. Neb. s.f. deben. 4s.	J&J	Ja 1910	not mtg.	2,124	18	81%	" "	" "	Aaa.	. . . .	98½b
11. Repub. Valley R. R. s.f. 6s.	J&J	Jl 1919	(1st) 90	2,124	8	81%	" "	" "	Aaa.	. . . .	104
12. Hannibal & St. Jo. consol 6s	M&S	Mr 1911	(1st) 289	2,124	57	81%	" "	" "	Aaa.	104½–105¾	105¼
13. Tarkio Valley R.R. first 7s.	J&D	Je 1920	(1st) 59	1,720	2		High.	High.	Aa.	. . . .	104b
14. Nodaway Val. R.R. first 7s.	J&D	Je 1920	(1st) 32	1,720	2		"	"	Aa.	. . . .	104b
15. Lincoln & N.-Westrn. first 7s	J&J	Ja 1910	(1st) 74	1,720	5		"	"	Aa.	. . . .	101
16. C. B. & Q. gen. mtge. 4s. . .	M&S	Mr 1958	(gen) all	1,720	78		"	Very high.	Aa.	97 –103¼	102¾

Figure A.5:

Note: The figure provides an example of a Ratings Table presented in Moody's Manuals when they are released in 1909.

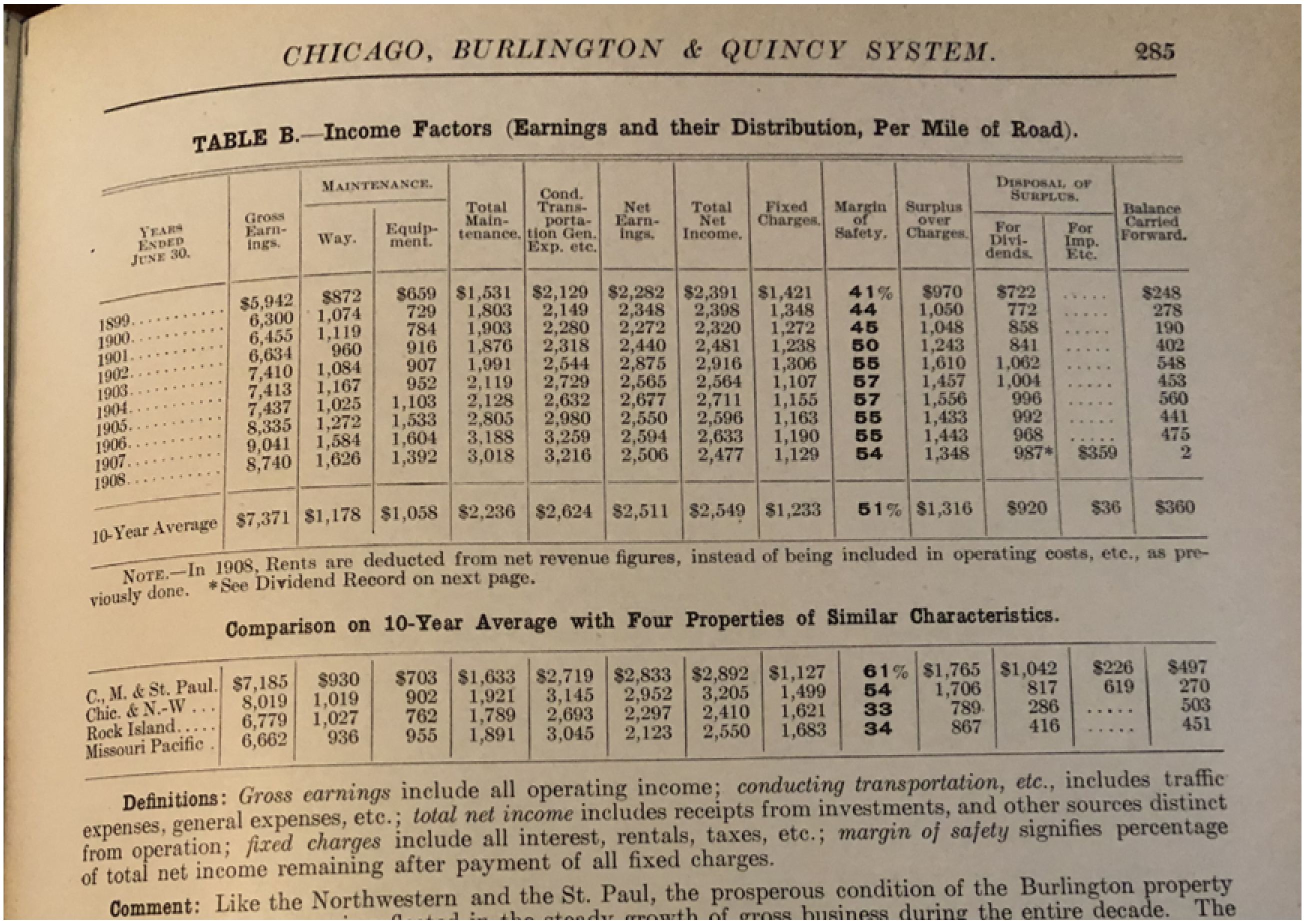


TABLE B.—Income Factors (Earnings and their Distribution, Per Mile of Road).

Years Ended June 30.	Gross Earnings.	Maintenance. Way.	Maintenance. Equipment.	Total Maintenance.	Cond. Transportation Gen. Exp. etc.	Net Earnings.	Total Net Income.	Fixed Charges.	Margin of Safety.	Surplus over Charges.	Disposal of Surplus. For Dividends.	Disposal of Surplus. For Imp. Etc.	Balance Carried Forward.
1899	$5,942	$872	$659	$1,531	$2,129	$2,282	$2,391	$1,421	**41%**	$970	$722	.....	$248
1900	6,300	1,074	729	1,803	2,149	2,348	2,398	1,348	**44**	1,050	772	.....	278
1901	6,455	1,119	784	1,903	2,280	2,272	2,320	1,272	**45**	1,048	858	.....	190
1902	6,634	960	916	1,876	2,318	2,440	2,481	1,238	**50**	1,243	841	.....	402
1903	7,410	1,084	907	1,991	2,544	2,875	2,916	1,306	**55**	1,610	1,062	.....	548
1904	7,413	1,167	952	2,119	2,729	2,565	2,564	1,107	**57**	1,457	1,004	.....	453
1905	7,437	1,025	1,103	2,128	2,632	2,677	2,711	1,155	**57**	1,556	996	.....	560
1906	8,335	1,272	1,533	2,805	2,980	2,550	2,596	1,163	**55**	1,433	992	.....	441
1907	9,041	1,584	1,604	3,188	3,259	2,594	2,633	1,190	**55**	1,443	968	.....	475
1908	8,740	1,626	1,392	3,018	3,216	2,506	2,477	1,129	**54**	1,348	987*	$359	2
10-Year Average	$7,371	$1,178	$1,058	$2,236	$2,624	$2,511	$2,549	$1,233	**51%**	$1,316	$920	$36	$360

Note.—In 1908, Rents are deducted from net revenue figures, instead of being included in operating costs, etc., as previously done. *See Dividend Record on next page.

Comparison on 10-Year Average with Four Properties of Similar Characteristics.

C., M. & St. Paul.	$7,185	$930	$703	$1,633	$2,719	$2,833	$2,892	$1,127	**61%**	$1,765	$1,042	$226	$497
Chic. & N.-W.	8,019	1,019	902	1,921	3,145	2,952	3,205	1,499	**54**	1,706	817	619	270
Rock Island	6,779	1,027	762	1,789	2,693	2,297	2,410	1,621	**33**	789	286	.....	503
Missouri Pacific	6,662	936	955	1,891	3,045	2,123	2,550	1,683	**34**	867	416	.....	451

Definitions: *Gross earnings* include all operating income; *conducting transportation, etc.*, includes traffic expenses, general expenses, etc.; *total net income* includes receipts from investments, and other sources distinct from operation; *fixed charges* include all interest, rentals, taxes, etc.; *margin of safety* signifies percentage of total net income remaining after payment of all fixed charges.

Comment: Like the Northwestern and the St. Paul, the prosperous condition of the Burlington property ... growth of gross business during the entire decade. The

Figure A.6:
Basis of Ratings

Note: The figure provides an example of the kind of information presented in Moody's Manuals when they are released in 1909.

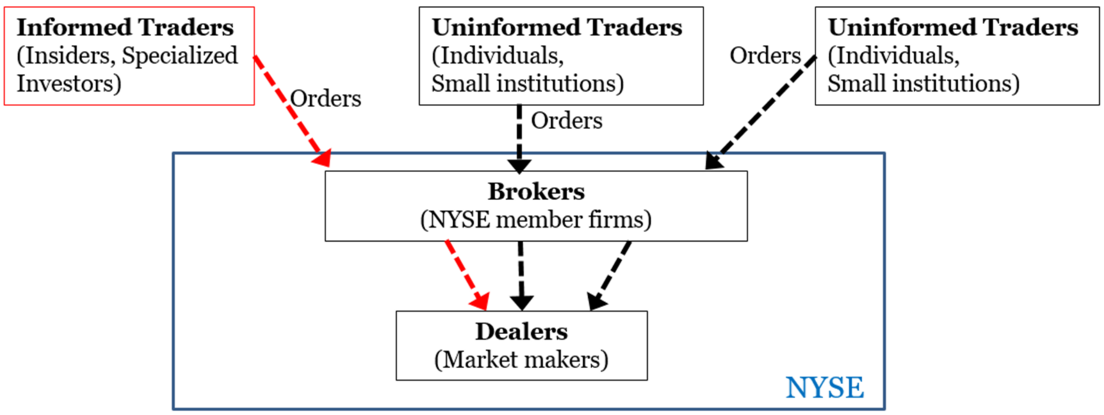


Figure A.7:
Structure of Bond Trading on the NYSE

Note: The figure provides a visual demonstration of the structure of bond trading on the New York Stock Exchange in the early 20th century. Typically, orders were telephoned to brokers on the floor, who transacted with dealers, who were known as specialists. In some cases a broker receiving an order might transact directly with one of the other brokers who typically gathered near the specialists, but more often the dealer would buy or sell the bond out of their inventory.

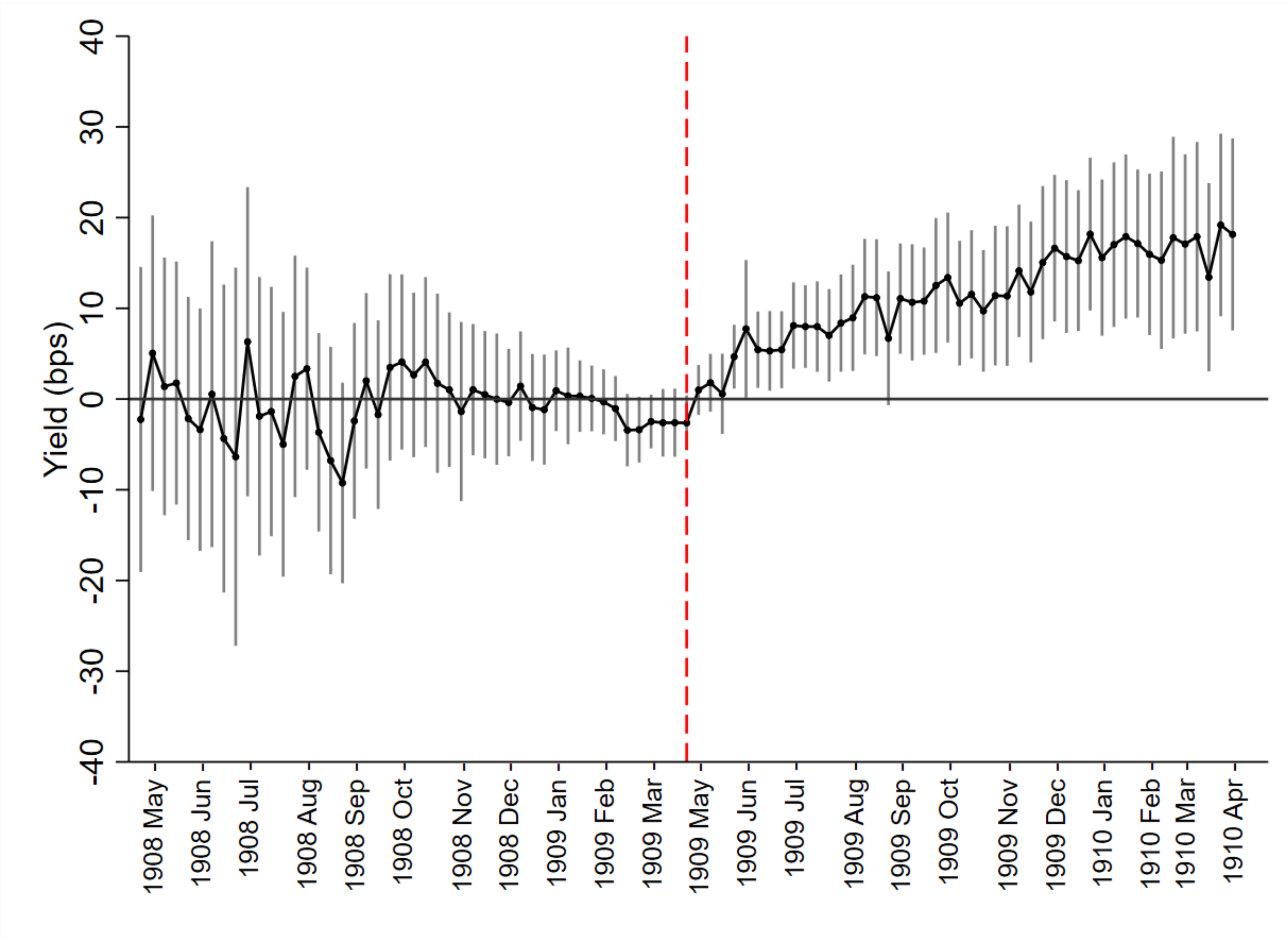


Figure A.8:
Ratings Surprises and Bond Yields (Robustness to yield measure)

Note: The figure presents the differences in yields between bonds whose ratings constituted a negative surprise and other rated bonds—those that either received a positive surprise, or no surprise. The differences plotted in the figure are estimated from regressions of "perpetuity yield" (PY = coupon/price) on indicators for a negative surprise interacted with indicators for each week, with the week prior to the introduction of ratings excluded. The regressions also include bond fixed effects, as well as rating level fixed effects interacted with time trends (see text). The figure also includes lines representing 95 percent confidence intervals.

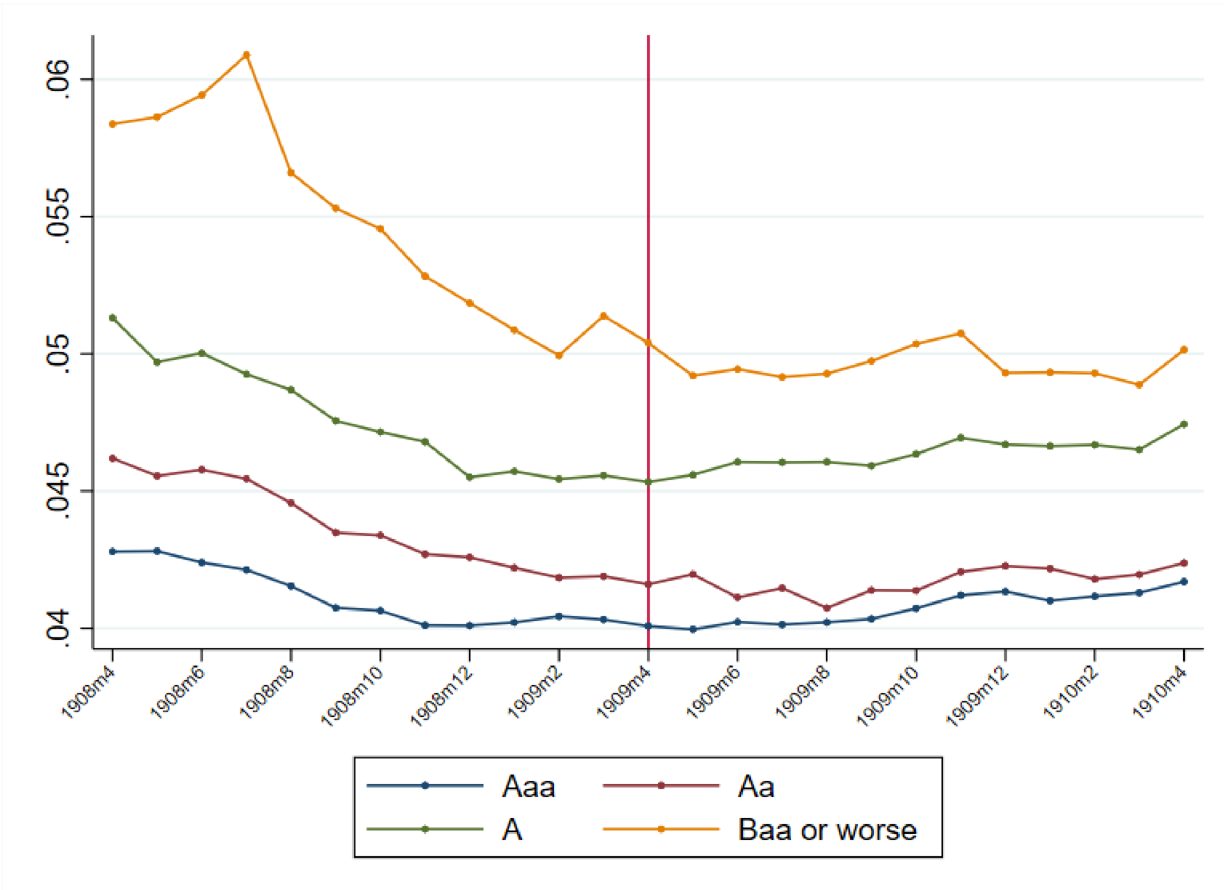


Figure A.9:
Railroad Bond Yields, by Rating Level

Note: The figure presents the mean yield-to-maturity for railroad bonds both before and after the introduction of ratings, by the level of their ratings, from April 1908 to April 1910, as computed from closing prices reported in the *New York Times*.

Table A.1:
Summary Statistics: Transactions Data, Railroad Bonds

Statistic	*N*	Mean	St. Dev.	25th pct	50th pct	75th pct
Coupon	17,720	4.37	0.756	4	4	5
Yield	17,720	0.050	0.028	0.041	0.043	0.048
Last Price	17,720	94.76	17.30	87.88	97.25	103.9
Maturity (year)	17,720	1953	51	1931	1945	1955
Rated Issue	17,720	0.902				

Note: This table presents summary statistics for all railroad issues (rated and non-rated) in the transactions data collected from the *New York Times* for our analysis of the effect of ratings on bond yields. The data were collected weekly from 11th of April 1908 to the 23rd of April 1910. The observations for issues that do not have at least one observed last price before and after the 23rd of April 1909 are dropped. The yield is the yield to maturity using the last price and is winsorized at the top and bottom 1%. Rated issue is an indicator that is equal to 1 if the issue was rated by Moody.

Table A.2:
Effect of Ratings Surprises on Yields: Robustness Checks

Yield (Basis Points)	(1)	(2)	(3)	(4)	(5)
Neg Surprise × Weeks Since	0.39***	0.31**	0.24**		0.43***
	(0.11)	(0.13)	(0.11)		(0.10)
Neg Surprise × Trend (Wks) × Post				0.48***	
				(0.18)	
Neg Surprise × Trend (Wks)				-0.11	
				(0.14)	
All interactions	Y	Y	Y	Y	Y
Bond FE	Y	Y	Y	Y	Y
Rating FE × Trend	Y	-	-	-	Y
Week FE	Y	Y	Y	Y	Y
PreYieldFEs x Trend	-	Y	Y	Y	-
# Yield Groups	-	4	10	4	-
Yield	YTM	YTM	YTM	YTM	PY
R^2	0.886	0.888	0.882	0.887	0.936
Obs	15,478	15,478	15,478	15,478	15,525

Note: This table depicts the effects of "surprises" (i.e. deviations in ratings from the median for those in the same yield quartile based on their mean yield among all traded bonds prior to the introduction of ratings) on secondary market bond yields trading on the New York Stock Exchange, using alternative specifications. Column (1) replicates our preferred specification (column (3) from Table 4), in which we regress the yield to maturity in basis points on a dummy variable equal to one for a negative surprise (*Neg Surprise*) interacted with a variable recording weeks since the release of the ratings (*Weeks Since*). This specification also includes bond and week fixed effects and rating fixed effects interacted with weeks since ratings were released. The pre-period includes the year prior to the release of ratings, while the post-period includes the 12 months following their disclosure. In column (2) we modify the specification by replacing the rating fixed effects interacted with trends with yield level fixed effects interacted with trends. Column (3) is the same as column (2), but the original four yield level groups are replaced with 10 yield level groups. In column (4) we interact our negative surprise variable with a trend, and then also with a post ratings indicator. In column (5), we revert to our baseline specification, but replace our yield to maturity variable, which is measured imprecisely, with perpetuity yield (coupon rate/price). Standard errors clustered at the bond level are in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Table A.3: Summary Statistics: Bid-Ask Data, Railroad Bonds

Panel A: Aggregate Statistics, Full Sample

Statistic	N	Mean	St. Dev.	25th pct	50th pct	75th pct
Coupon	5,085	4.55	0.87	4.00	4.00	5.00
Bid Price	5,085	100.32	13.62	93.25	100.38	110.00
Ask Price	5,085	101.22	14.33	94.00	101.00	111.00
Bid-Ask Spread	5,085	0.0116	0.0157	0.0033	0.0061	0.0123
Yield	5,085	0.044	0.009	0.040	0.042	0.046
Maturity (year)	5,085	1946	36	1927	1939	1952
Rated Issue	5,085	0.944				

Note: The table presents summary statistics for all the railroad issues in the bid-ask data for the 12 weeks surrounding the introduction of ratings and for the sample used in the primary regression analysis on bid-ask spreads. Observations for issues that do not have at least one observed bid price before and after the 23rd of April 1909 are dropped. Additionally, observations for issuers that do not have at least two issues with at least one observed bid price before and after the 23rd of April 1909 are also excluded. When there are multiple coupons listed for a single issue, we use the maximum. The yield is the yield to maturity using the bid price and is winsorized at the top and bottom 1%. The bid-ask spread is presented as a percentage and is calculated as $\frac{(ask-bid)\times 2}{(ask+bid)}$. The bid-ask spread is also winsorized at the top and bottom 1%.

Panel B: Pre-Ratings Distribution of Bid-Ask Spreads for Rated vs Unrated Bonds

(bps)	Min	1st	5th	10th	25th	50th	75th	90th	95th	99th	Max
Rated	12	23	29	35	48	73	148	240	342	712	993
Not Rated	23	23	41	69	102	165	510	564	564	993	993

Note: The table presents the distribution of average bid-ask spreads (in basis points) in the period prior to the release of ratings for bonds and rated and not rated in 1909. Distribution matches the regression sample and so is based on bond-week observations.

Table A.4:
IV Results: Effect of Ratings on Bid-Ask Spreads (First Stage)

	OLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
	Post × Rated Issue (First Stage)			
Post 23rd April 1909 × OtherBondsYields	NA	-11.35***	-13.73***	-14.83***
		(2.05)	(2.22)	(1.57)
Trend × OtherBondsYields	NA	-0.048	-0.094	-0.045
		(0.080)	(0.086)	(0.082)
	Trend × Rated Issue (First Stage)			
Post 23rd April 1909 × OtherBondsYields	NA	-4.88	1.62	-5.01
		(7.25)	(8.28)	(7.21)
Trend × OtherBondsYields	NA	-12.56***	-15.49***	-15.22***
		(1.96)	(2.00)	(1.57)
Bond FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Time FE × Pre-Rating Yield	Y	Y	Y	Y
Time FE × Pre-Rating Spread	Y	Y	Y	Y
Pre-Rating Spread >th-tile	-	-	60	80
Kleibergen-Paap F-Stat	-	17.5	20.7	47.0
Observations	5,085	5,085	2,076	1,042

Note: These are the corresponding first stages from the regressions in columns (1)-(4) of Table 7. See Table 7 description for more details. Robust standard errors, clustered by bond, are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Table A.5:
Summary Statistics: Intraday Trading Data

	Mean	SD	1st	5th	10th	25th	50th	75th	90th	95th	99th
Block size per trade	9.71	12.13	1	1	1	2	5.5	12	22.5	31.5	59
Log block size per trade	1.53	1.01	0	0	0	0.69	1.61	2.30	2.82	3.22	3.91
# of trades/day (cond. on trading)	2.58	3.50	1	1	1	1	1	3	5	9	18
# of trades of block size = 1 (cond. on trading)	0.41	0.64	0	0	0	0	0	1	1	2	3
% of trades in a day block size = 1	0.22										
% trades in a day block size$\leq$5	0.59										
% Trades in a day block size $\geq$15	0.18										

Note: These data are compiled from the NYSE's daily reporting of bond transactions, which lists the block size of every trade, and is reported in the *New York Times.* We collect this data for all bond trades for every Wednesday over the same interval of time for which we collected bid-ask data. See Appendix Figure A.4 for a partial example of intraday transactions for a single day.

B Surprises and Near-term News

This appendix addresses the possibility that rather than ratings causing market prices to respond, ratings could have just predicted news events, and markets could have responded to those news events instead of to the ratings. We think this is unlikely since the ratings are driven in large part by stale information that is years old. In addition, and there is no movement in yields in the weeks or months prior to their release, but then a relatively quick and steady rise in yields occurs among the bonds of firms receiving a negative surprise (relative to no surprise or a positive surprise) just after ratings are released. In fact, in Table B.1 columns (1) and (2) in this appendix section we show a statistically significant rise in yields in the first 4 weeks after ratings are released with most of the yield response we observe being evidenced within 8 weeks. This is important because the yield response then cannot be simply a reaction to the realization of news 6-12 months down the road. Instead, for this alternative interpretation of our effects it would need to be the case that ratings are predictive of news that happens in the first month or two following the publication the volume.

We think that is compelling evidence that most of the effect is likely to be driven by the ratings rather than ratings being predictive of future news. Yet we also tried to directly assess whether the ratings predict news that was released after the publication of the ratings manual by collecting data on news events. For this exercise we focused on a short period after April 1909, since the approach described above shows that the effects materialize relatively quickly. We took two approaches to identifying important news events related to the rated railroads that could affect the yields on their bonds.

First, we collected monthly estimated earnings, as reported in various editions of the *Commercial and Financial Chronicle* (CFC), a well-known business newspaper of the era. That newspaper published early estimates of earnings for just under half of the rated railroads (47%) for the month that had just ended, and for the same month in the previous year. We obtained data for the period May-July 1909, and May-July 1908. This information allows us to construct a measure of negative earnings shocks, which ought to influence investors' expectations regarding the credit risks of firms. To create this measure, we calculated the growth rate of earnings per mile, relative to the same month in the previous year. We then created an indicator for a negative earnings shock, which was equal to 1 for railroads in the bottom decile of the distribution of earnings growth for the month. Figure B.1 in this appendix compares the rates of negative earnings shocks between the railroads whose ratings were a negative surprise, and those whose ratings were not, over the three months immediately following April 1909. The figure confirms that railroads receiving negative surprises in their ratings were not more likely to experience negative earnings shocks in the months following the publication of the ratings; if anything, they have fewer negative earnings surprises but the difference is not statistically significant (p = 0.74).

Second, we carefully read through every issue of the *Wall Street Journal* from May through July of 1909 and searched for news articles on the rated railroads. We found a total of 114 news articles over those months that focused on one or more railroads rated by Moody, and coded each article as "negative" if it conveyed bad news, "neutral" if it seemed to discuss something already known, or "positive" if it conveyed good news. An example of good news was the announcement of a favorable supreme court decision in an antitrust case affecting several railroads ("Supreme Court Decision in the Commodities Case Favors Roads," 4 May), and an example of bad news was a forecast for bad earnings for the year for two railroads ("1909 A Lean Year for Edwin Hawley's Northwestern Roads," 29 June). Using these codings, we constructed a measure of net bad news for each railroad. We assigned a 1 to articles containing bad news, 0 to neutral articles, and -1 to articles containing good news, and summed them up for each railroad for all the articles over the period. The average value of this measure was negative. That is, on net the content of the *Wall Street Journal* articles was good news on average. If we compare railroads receiving negative surprises to those that did not, this was slightly less positive for negative surprise railroads (-0.72) compared to railroads not receiving negative surprises (-1.38), but the difference was not statistically significant (p = 0.24). Thus, these data do not suggest there was a substantial difference in the type of news announcements between the railroads receiving negative surprises, and those that did not.

Perhaps not surprisingly then, we can also show that our evidence on near-term yield responses in Table B.1 is robust to flexibly controlling for these news articles. In Table B.1 columns (3) and (4) we find similar effects on yields in the first 8 weeks after the publication of the ratings volume when controlling flexibly for indicators for the count of net bad news articles (bad minus good) interacted with week fixed effects (column 3) and for indicators of good and bad news article counts separately, each interacted with week fixed effects (column 4). In other words, the yield responses in the first 2 months don't seem to be explained by the bad/good news reported on for these firms over the first 3 months after ratings are released. In column (5) we even restrict the sample to only those firms for which no news was reported at all over that 3-month period and again find similar effects of negative surprises on yields.

Combining all of these results suggests to us strong evidence in favor of ratings themselves (rather than news released in the near-term correlated with ratings) as the driving force behind the yield response we observe in our analysis.

Table B.1:
Effect of Ratings Surprises on Yields: Robustness to Near-Term News

Post-Period (Wks)	4wks	8wks	8wks	8wks	8wks
Yield (Basis Points)	(1)	(2)	(3)	(4)	(5)
Neg Surprise × Post	8.2***	11.6**	14.5***	13.6***	19.6**
	(3.1)	(3.3)	(3.5)	(3.8)	(8.0)
Bond FE	Y	Y	Y	Y	Y
Rating FE × Trend	Y	Y	Y	Y	Y
Week FE	Y	Y	Y	Y	Y
Net # Bad News x Week FE	-	-	Y	-	-
# Good/Bad News x Week FE	-	-	-	Y	-
No News Sample	-	-	-	-	Y
R^2	0.925	0.919	0.928	0.929	0.890
Obs	8,012	8,685	8,683	8,685	1,450

Note: This table provides evidence that the effects of "surprises" (i.e. deviations in ratings from the median for those in the same yield quartile based on their mean yield among all traded bonds prior to the introduction of ratings) directly move secondary market bond yields trading on the New York Stock Exchange, rather than just predict news events that markets then respond to. In column (1) we regress yield to maturity in basis points on a dummy variable equal to one for a negative surprise (*Neg Surprise*) interacted with a dummy variable equal to one if the bond transaction occurs after Moody's securities ratings are released in April of 1909 (*Post*). This specification also includes bond and week fixed effects and rating fixed effects interacted with time trends. The pre-period includes the year prior to the release of ratings, while the post-period includes only the first 4 weeks following their disclosure. Column (2) is the same as column (1) but includes the first 8 weeks following the disclosure of ratings. Column (3) is the same as column (2) but includes week fixed effects interacted with fixed effects for the net number of bad news articles (number of bad news articles - number of good news articles) for each firm in the *Wall Street Journal* from May to July 1909. Column (4) is the same as column (3) but instead of net bad news articles we interact week fixed effects with the number of bad news articles and then also separately interact week fixed effects with the number of good news articles and well as with a dummy variable equal to one if we find any negative earnings news about a company over that period in the *Commercial and Financial Chronicle*. Column (5) is the same as column (2), but instead it restricts the sample to only those firms who have no news articles (good or bad) and no bad earnings news. Standard errors clustered at the bond level are in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively.

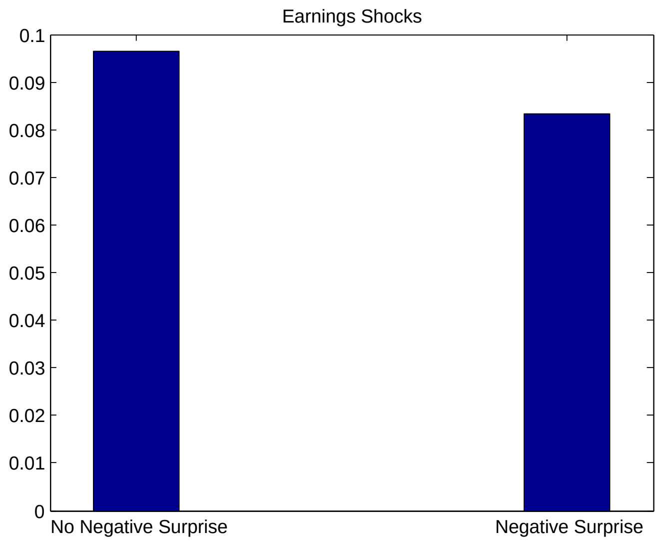


Figure B.1:
Firms with Negative Earnings News by Ratings Surprise

Note: Firms with negative earnings news in the *Commercial and Financial Chronicle* among those with monthly earnings estimates (47% of our sample) from May to July 1909. From the monthly earnings and mileage data reported, we construct a measure of the growth in earnings per mile, relative to the same month in the previous year. We designate an earnings report as negative earnings news if it is in the bottom decile of the distribution of earnings growth for the month.

C Effects of Suprises: Positive, Negative, Large and Small

Our main empirical specifications analyzing the surprise content of ratings focus on comparisons between bonds receiving a negative surprise and a control group of bonds receiving no surprise or a positive surprise. As we highlight in the text, there are reasons to believe that in our sample, which is primarily composed of relatively safe bonds, negative surprises may have conveyed relatively more information than positive surprises, but this is ultimately an empirical question. In this appendix, we separately study the effects of positive and negative surprises, and test whether their impacts are statistically significantly different. We also test the effects of large surprises, defined as those at least two ratings notches different from the expected level given pre-rating yields. For large surprises, we evaluate whether their effects on yields are greater than for small surprises, and also whether their effects are asymmetric, with negative large surprises having larger effects than positive surprises.

Column (1) of Table C.1 reproduces column 3 of Table 4, in which we test for the effects of a negative firm surprise (relative to no surprise and positive surprises), for comparison. Column (2) then estimates the effect of a positive firm surprise (relative to no surprise and negative surprises). Relative to their respective control groups, bonds with negative surprises saw their yields rise, while for positive surprises they fell, although the point estimate for the latter is smaller in absolute magnitude. Positive ratings surprises were indeed interpreted as favorable news regarding the risks of bonds.

In column (3), we test whether the estimated effects of the negative and positive surprises are statistically significantly different in magnitude. To do this, we compare the magnitude of the yield response of any surprise (with negative surprises coded as 1, positive surprises coded as -1 to elicit the same sign, and no surprises as 0) to having a positive surprise. The point estimate is smaller for positive surprises, but it is not statistically significant. So, for the average "surprise" we see no evidence of dramatic differences in the size of the yield responses we have power to identify.

One might expect the effects of smaller surprises to be symmetric, whereas for large surprises convexity in the sensitivity of yields to risk could predict an asymmetric response, with larger movements for negative surprises. To analyze this empirically, we need to use bond-level surprises, rather than firm-level surprises. There are too few large surprises among firm-level ratings, and all of them are negative, which limits our ability to conduct an analysis based on the size of the surprise. But we find more variation for bond-level surprises.

In column (4) of Table C.1, we reproduce the regressions of column (3) using the bond-level surprises. The results are generally similar to the results with the firm-level surprises, with no statistically significantly different impact for positive surprises.

In column (5), we explore the effects of large surprises, which again we define as ≥ 2 rating notches away from the expected level given pre-ratings yields. With large surprises coded in the same way as the any surprise variable (-1 for positive surprises and 1 for negative surprises), we find that they do indeed have statistically significantly larger effects. In column (6) this evidence holds and is even stronger, after comparing bonds within the same firm, by including firm fixed effects interacted with trends.

Focusing then only on bonds with either no surprise or large surprises in columns (7) and (8), we show that in this sample it is indeed the case that positive surprises have statistically significantly smaller (in absolute magnitude) yield responses than negative surprises. In other words, positive news has diminishing marginal effects on yields, whereas negative news can have effects that grow with the magnitude of the shock.

Table C.1:
Effect of Ratings Surprises: Positive, Negative, Large and Small

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weeks Since ×								
Negative Surprise	0.39***							
	(0.11)							
Positive Surprise		-0.23**						
		(0.14)						
Any Surprise [Positive = -1]			0.34***	0.37***	0.32***	0.18*	1.09***	1.07***
			(0.12)	(0.14)	(0.09)	(0.09)	(0.33)	(0.32)
Positive Surprise [Positive = -1]			-0.20	-0.08			-0.91***	-0.77**
			(0.18)	(0.17)			(0.35)	(0.36)
Large Surprise [$\geq$ 2 Rating Dif]					0.39*	0.51**		
					(0.21)	(0.23)		
All interactions	Y	Y	Y	Y	Y	Y	Y	Y
Bond FE	Y	Y	Y	Y	Y	Y	Y	Y
Rating FE × Trend	Y	Y	Y	Y	Y	Y	Y	Y
Week FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm × Trend	-	-	-	-	-	Y	-	Y
Surprises	All	All	All	All	All	All	Large	Large
Level of Surprise	Firm	Firm	Firm	Bond	Bond	Bond	Bond	Bond
R^2	0.886	0.885	0.886	0.887	0.888	0.901	0.898	0.911
Obs	15,478	15,478	15,478	15,220	15,220	15,220	10,210	10,210

Note: This table depicts the effects of positive and negative ratings "surprises," along with large and small surprises, on secondary market bond yields trading on the New York Stock Exchange after controlling for other potential observable confounds. Column (1) replicates column (3) of Table 4, and regresses yield to maturity in basis points on a dummy variable equal to one for a negative surprise, interacted with a variable which equals 0 prior to ratings being released and then after are the weeks since they were released (*Weeks Since*). This specification also includes bond fixed effects, week fixed effects, and rating fixed effects interacted with weeks since ratings were released. The pre-period includes the year prior to the release of ratings, while the post-period includes the 12-months following their disclosure. Column (2) estimates the same regression but with an indicator for a positive surprise. Column (3) tests whether the magnitudes of the effects of positive and negative surprises are different, by including a variable for any surprise (with a negative surprise coded as 1 and a positive surprise coded as -1 to elicit the same sign), along with an indicator for a positive surprise (also coded as -1).. In column (4) we estimate the same regression, but using surprises constructed at the bond level, rather than the firm level, since the regressions in the remaining columns must use the bond-level surprises. Column (5) tests whether "large" surprises, defined as a rating that was at least 2 notches above or below the median rating in the yield quartile, had larger effects by including an indicator for a large surprise (also coded as 1 for a negative large surprise and -1 for a positive large surprise) along with the indicator for any surprise. Column (6) is the same as column (5), but includes firm fixed effects interacted with trends, to capture the within-firm variation in the effects of the surprises. In column (7) we restrict the sample to large surprises, and test whether negative large surprises have distinct effects by including an indicator for a negative surprise alongside an indicator for a large surprise. Column (8) is the same as column (7), except we include firm fixed effects interacted with trends to capture the within-firm variation in the response to surprises. Standard errors clustered at the bond level are in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively.