# The Informational Effects of Firm-Funded Certification: Evidence from the Bond Rating Agencies *

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*Comments welcome.*

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**Abstract**

This study examines whether and how the information content of bond ratings changes as a result of the incentives provided by the issuer-pay business model (i.e., issuers paying for rating services). This model has commonly been criticized for creating an independence problem and less informative ratings. Alternatively, the resulting stronger business relation could actually provide issuers with an incentive to share more private information and lead to more informative ratings. Using the natural experiment of Moody's and Standard and Poor's separate initial adoptions of the issuer-pay model in the 1970s (which provide two separate difference-in-difference tests), I find that ratings become generally more informative using multiple measures of information content.



**Keywords:** bond rating agencies, issuer-pay model, conflicts of interest, information content

**JEL Classifications:** D82, D83, G24, G28

# 1 Introduction

Bond ratings agencies play a critical role in intermediating bond markets by providing information to prospective investors about the default risk of bond issues. A major concern regarding the ratings process is that the bond issuer generally pays the rating agency, which potentially compromises the information content of the rating by creating an independence problem.[1] In fact, legislators' concerns are significant enough that Congress has required the Securities and Exchange Commission (SEC) to study rating agency revenue models through the Dodd-Frank Act of 2010. Although the relation between the rating agency and the firm whose bond is being rated creates an independence problem, that problem could be mitigated by the rating agency's efforts to maintain a reputation in the marketplace.[2] Furthermore, the business relation itself may allow the rating agency to obtain additional information about the firm's prospects, which would potentially increase the information content of the rating.[3] A priori, then, it is unclear how the information content of the debt rating is influenced by the fact that a firm pays for its bond rating, which is referred to as the issuer-pay model ("issuer-pay"). In order to assess how issuer-pay influences the information content of ratings, I examine whether the adoption of issuer-pay by major ratings agencies is associated with alterations in the information conveyed by their ratings.

Bond rating agencies are but one example of information intermediaries which face an independence problem that could reduce how informative their opinions are. Audit firms receive fees in exchange for an opinion as to whether a company's financial statements are in accordance with Generally Accepted Accounting Principles.[4] In addition, equity analysts whose firms provide investment banking services to firms also face an independence problem when offering stock recommendations and earnings forecasts about investment banking clients (Clarke et al., 2004; Mehran and Stulz, 2007; Jacob et al., 2008). Finally, in the realm of consumer information, the Better Business Bureau's reliability ratings, the American Automobile Association's Diamond ratings for hospitality

[1] See Partnoy (1999), Partnoy (2001), Securities and Exchange Commission (2003), Partnoy (2006), Coffee (2008), Egan (2008), and Gellert (2009) for various allegations of underperformance by the rating agencies as a result of receiving fees from debt security issuers.

[2] Various studies have noted the importance of reputation to bond rating agencies including: Cantor and Packer (1994), Smith and Walter (2002), Covitz and Harrison (2003), and Securities and Exchange Commission (2003).

[3] Several academic studies have conjectured that rating agencies may benefit from the sharing of private information from bond issuers (Griffin and Sanvicente, 1982; Kliger and Sarig, 2000). Furthermore, the rating agencies themselves and industry observers have asserted that the move to the issuer-pay model led to greater access to information (McDaniel, 2009; Walker, 2010). I test these conjectures directly.

[4] See for example Simunic (1984), Reynolds and Francis (2000), Craswell et al. (2002), and DeFond et al. (2002).

providers, and Underwriters Laboratory's certification of product quality and safety all rely on fees paid by the company seeking the rating (Hathaway, 2010; Rhee and Ross, 2010; Lazarus, 2011). Yet in each of these examples, it is unclear the extent to which the independence problem reduces the information content of the provided opinion or whether the incentives arising from the business model are the only drivers of changes in information content.

I take advantage of a natural experiment—the initial adoption of issuer-pay by Moody's and S&P in the 1970s—to test whether the information content of bond ratings worsened or improved under issuer-pay relative to investor-pay. This setting allows me to hold constant other potential drivers of bond rating quality, such as the provision of consulting services, and focus only on how *charging issuers* for bond ratings affects ratings' information content. As shown in Figure 1, Moody's was the first major rating agency to charge corporate issuers on October 1, 1970 after many decades of earning revenue from the sale of its research to investors through its Moody's Industrial Manuals. S&P delayed changing to issuer-pay until July 1, 1974, after also originally using an investor-pay model.

The adoption of issuer-pay could, as critics suggest, result in the incentives of the major rating agencies becoming more aligned with those of their clients. This could lead the rating agencies to communicate only information that benefits their clients, resulting in less informative ratings under issuer-pay than investor-pay. However, the possibility for reduced communication is tempered by potential reputational consequences (Cantor and Packer, 1994; Covitz and Harrison, 2003).[5]

Alternatively, the adoption of issuer-pay could lead to more informative ratings because of the major rating agencies gaining greater access to private information and better resources. First, issuers potentially face a greater incentive to disclose their private information to the rating agencies following issuer-pay adoption. Issuers naturally have an incentive to lower their cost of debt through full disclosure of their private information to potential investors, but typically limit their disclosure because of important costs (e.g., proprietary or litigation costs). Issuers, however, can safely provide detailed private information to rating agencies in their role as information intermediaries, because disclosed information is only partially conveyed through credit ratings (Griffin and Sanvicente,

[5]Through the years, regulators have expressed concern that audit firms may not develop quality controls to adequately manage the effects of economic dependence on their judgment. Despite these concerns about auditor independence, prior research has failed to find that audit fee dependence affects independence (Craswell et al., 2002; Reynolds and Francis, 2000) though these studies were not able to observe audit firms which received no fees.

1982; Kliger and Sarig, 2000; Walker, 2010).[6] Under issuer-pay, the fiduciary responsibility of rating agencies not to reveal issuer's private information is potentially greater because of an implicit economic bond.[7] In this sense, issuer-pay should promote the sharing of value relevant information with rating agencies.

In addition, the rating agencies potentially gained greater access to issuers and their managers following issuer-pay adoption. Specifically, the increased economic bond between issuers and rating agencies under issuer pay should lead to more frequent repeat interactions and accordingly greater proximity to issuers (Petersen and Rajan, 2002; Liberti and Mian, 2009; Agarwal, 2010). Greater interaction should also increase rating agencies' ability to develop and exploit relationships with issuers' management (Petersen and Rajan, 1994; Berger and Udell, 1995; Doney and Cannon, 1997; Granovetter, 2005; Butler, 2008), and to observe the non-verbal cues of issuers' management and other employees (Houston et al., 1987; Walker and Trimboli, 1989).

Finally, the rating agencies' resources for analyzing credit risk likely increased following issuer-pay adoption. Under investor-pay, advances in reproductive technologies enabled investors to obtain rating research without paying the rating agencies (McDaniel, 2009). Such free riding reduced the resources available to rating agencies for information gathering. Adoption of issuer-pay allowed the rating agencies to increase the depth and quality of their analyses by ensuring the funding of costs incurred during the rating process (Cantor and Packer, 1994).

I find that after adoption of issuer-pay, bond ratings from Moody's and S&P become generally more informative using multiple measures of information content. The results in this study provide broad evidence consistent with issuer-pay leading to greater information sharing between bond issuers and rating agencies. Furthermore, the results suggest that evidence of higher average ratings provided by issuer-pay rating agencies (Jiang et al., 2010) may reflect non-public information inaccessible to investor-pay rating agencies.

Overall, this study highlights a potential benefit of issuer-pay: more informative ratings. The independence problem posed by issuer-pay may be, at least partially, offset by providing bond investors with more informative signals about default risk. With respect to recent calls for the

[6]Several empirical studies suggest that bond ratings do contain private information (Butler and Rodgers, 2003; Gan, 2004).

[7]In fact, rating agencies frequently sign confidentiality agreements with their issuer clients to cover all shared material non-public information (Langohr and Langohr, 2008).

prohibition of issuer-pay, the evidence in this study suggests that the business model of receiving fees from issuers does not solely lead to lower quality ratings. Thus, rating agencies' involvement with structuring asset-backed securities may explain ex-post optimistic ratings and slow downgrades as much as issuer-pay.

This study should be of interest to regulators, particularly the SEC, who are currently considering a prohibition of the issuer-pay business model by rating agencies designated as Nationally Recognized Statistical Rating Organizations (NRSROs) in accordance with the recently enacted Dodd-Frank Act. Given the results of this study in the corporate bond setting, where the structure of a firm and its debentures is more exogenous to the rating process, regulators may be interested in examining the effects of limiting rating agencies' involvement in advisory services rather than barring rating agencies from charging issuers for ratings. However, while my results suggest that ratings became more informative, on average, after the adoption of issuer-pay, it does not directly address the extent to which investors need time to understand the new mapping between ratings and information after the business model change because of cognitive biases and limitations. Thus, regulators may also wish to devote some attention to the particular issue of credit rating users' understanding of rating agency incentives.

The remainder of the paper is structured as follows. Section 2 provides some background about the history and economics of the bond rating industry and develops my empirical predictions related to rating informativeness. Section 3 describes the sample selection process and descriptive statistics. Section 4 presents my empirical analyses. Section 5 concludes the study.

## 2 Background and empirical predictions

In this section, I first provide some history of the credit rating agencies, which led to the adoption of issuer-pay and some of the changes that followed. Then, I develop my hypothesis on the changes in the informativeness of credit ratings after issuer-pay.

### 2.1 The history of rating agencies and the adoption of issuer-pay

Credit rating agencies have been a part of capital markets for well over a century. Although the industry began with many small firms, by the early 1970s, Moody's, S&P, and Fitch remained the only major players in the credit rating industry. To fund their credit analyses, rating agencies first sold publications to investors and other interested parties. *Moody's Bond Record* and *S&P Earnings and Bond Guide* are two examples of such publications. However, by the late 1960s, the advent of photocopiers had begun to render the so-called investor-pay model unprofitable. Accordingly, Moody's and Fitch began charging corporate bond issuers for ratings in 1970 while S&P followed in 1974. Issuer fees have become a significant source of revenue for the rating agencies, comprising more than 80 percent of S&P's annual revenue (Ederington and Yawitz, 1987).

Upon adoption of issuer-pay, Moody's implemented a fee schedule that charged issuers 0.01% of the principal amount issued ranging from a minimum of $600 to a maximum of $5,000 (WSJ Staff Reporter, 1970). Including fees for the ongoing monitoring of credit risk, the annual cost of maintaining a rating ranges from two to three basis points of the issue's face value (Cantor and Packer, 1994). Typically, fees have both a floor and a ceiling and different rates may apply to frequent issuers of debt instruments.

As a result of adopting issuer-pay, the major rating agencies implemented a rating process to complement new relationships developed with issuer clients. This process begins with a prospective issuer approaching a rating agency to inquire about obtaining a rating for the new debt issue. Following this initial contact from the issuer firm, the rating agency will request and receive a substantial amount of written information from the issuer client including but not limited to: (1) relevant industry and company positioning information, (2) descriptions of operations, products, and risk management, (3) a business plan, (4) audited annual financial statements for the previous five years, (5) interim financial statements for several recent sub-periods, and (6) a draft registration statement or offering memorandum for the new issue (Langohr and Langohr, 2008).

Rating agencies also conduct in-depth interviews with issuer management to gain a balanced understanding of the company and its prospects; most of these meetings occur on the premises of the issuer to allow rating analysts an opportunity to better understand the company. During the course of communication with issuers, rating agencies become privy to material non-public information about their clients. For example, rating agencies regularly receive detailed segment analyses and three- to five-year financial projections from clients and often incorporate budgets and forecasts, internal capital allocations, and contingent risks in their rating decisions (Langohr and Langohr, 2008; Securities and Exchange Commission, 2003). While rating agencies use material non-public information in their analyses, they do not disclose the specific information upon which they relied because of confidentiality agreements in place with clients.

## 2.2 Empirical predictions

While consumers rely on expert opinions for making decisions, the economic bond between firms and their clients may allow clients to influence these opinions. If clients' lobbying efforts are successful, expert opinions may reflect the biased perspective of the client. Likewise, opinion firms may engage in catering behavior to curry favor with clients for future services. Hence, the economic bond between opinion firms and their clients could lead to optimistically biased opinions. Various complaints against firms that charge fees for their professional opinions allege such biased behavior (Hathaway, 2010; Rhee and Ross, 2010; Lazarus, 2011). In the case of bond rating agencies, recent academic studies have provided evidence that corporate bond ratings are optimistic (Jiang et al., 2010; Kraft, 2010a,b; Xia, 2010). Even though the economic bond between opinion firms and their clients may lead to optimistic bias in opinions, bias is only one facet of informativeness. Moreover, since the informativeness of an opinion is a function of how much one can update his beliefs, bias may not even be a good reflection of an opinion's informativeness since rational users will attempt to remove expected bias prior to updating their beliefs.[8]

For issuer-pay to affect the informativeness of credit ratings, the incentives introduced by its adoption must influence what information rating agencies acquire and how they communicate with users of credit ratings. With respect to information acquisition, issuer-pay should have increased rating agencies' resources for analyzing credit risk and access to issuers' management. Walker (2010) argues that issuers share information with rating agencies under client-provider privilege and intend to provide greater clarity into firm strategy and performance. The rating agencies themselves have claimed that issuer-pay enabled an increase in the depth and quality of analysis and a reduction of the number of clients covered by a single analyst. Under issuer-pay, analysts were able to "increase the frequency of informational meetings with both issuers and investors" (McDaniel, 2009). Such information would create a more complete picture of a firm's credit risk. Managers may reveal internal accounting data and other budgets or forecasts about production, investment, and financing plans in their efforts to obtain favorable least-costly ratings (Griffin and Sanvicente,

[8] See for example Verrecchia (1986), Stein (1989), or Narayanan (1985).

1982). Thus, to the extent that information shared by firms with rating agencies is material and non-public, credit ratings become a vehicle for the communication of private knowledge to investors and creditors. Rating agencies have argued that issuer-pay gains them access to material non-public information not otherwise disseminated to the public (Standard & Poor's, 2010). Several empirical studies suggest that bond ratings do contain private information (Butler and Rodgers, 2003; Gan, 2004).

While better resources and access to information should increase the informativeness of credit ratings, the alignment of incentives with issuers may reduce the amount of information conveyed by rating agencies to users of ratings. Nonetheless, rating agencies face reputational consequences for their actions, which may counterbalance the incentives induced by issuer-pay. In this study, I analyze a broad set of attributes of credit ratings' informativeness including: (1) bond market pricing, (2) accuracy as measured by cumulative accuracy profiles and Type I/II error analysis, (3) timeliness, and (4) information asymmetry.

### 2.2.1 Initial bond yields

Prior research has found that corporate bond ratings are negatively related to initial yield spreads after controlling for firm and issue characteristics (Ederington et al., 1987; Liu and Thakor, 1984; West, 1973). If the adoption of issuer-pay leads only to bias in ratings, bond investors should charge more for split-rated bonds. Such pricing would reduce reliance on issuer-pay ratings when they include upward bias and increase reliance when they reflect a more precise negative signal of default risk. However, if the issuer-pay rating agency is able to glean private information from management and communicate the information to investors, bond investors should charge less when the issuer-pay rating agency rates a new bond higher than the other agency.

### 2.2.2 Rating accuracy

The major rating agencies have defined their credit ratings as relative measures of default risk (Hamilton et al., 2005; Standard & Poor's, 2010). Thus, a Aaa rating from Moody's should indicate a lower likelihood of default over a particular horizon than a Aa rating. As relative measures of default risk, these credit rating systems are more informative if the lowest rated bonds (i.e., C) capture a greater proportion of total defaults than the highest rated bonds (i.e., Aaa). If the adoption of issuer-pay induced an upward bias in bond ratings, a greater proportion of defaulting bonds would receive ratings in categories higher than C. In turn, the ability of the issuer-pay rating agency's ratings to discriminate between defaulting and non-defaulting bonds decreases. However, increased access to issuer management and private information should enhance an issuer-pay rating agency's ability to evaluate default risk. For instance, if management's internal projections of future profitability reduce the rating agency's assessment of default risk for a non-defaulting bond by enough to cross a rating category threshold, the bond will receive a higher rating under issuer-pay than otherwise, but it will increase the discriminatory power of the rating system.

### 2.2.3 Rating timeliness

While the ability of bond ratings to discriminate between defaulting and non-defaulting bonds (accuracy) is an important attribute, bond market investors are also concerned with the timeliness of ratings. Despite investors' demand for timely information about the creditworthiness of bonds, the major rating agencies seem to lag smaller, investor-pay rating agencies (Beaver et al., 2006). Cantor and Mann (2006) argue that the lack of timeliness in ratings is mostly related to regulatory and contracting forces that increase the demand for stable ratings. At the time of Moody's adoption of issuer-pay, though, there was no regulatory role for credit rating agencies.[9] In the early 1970s, Moody's and S&P played a role more akin to that of Egan-Jones Ratings in the Beaver et al. (2006) study of rating timeliness. Issuer firms' willingness to pay for ratings is consistent with their recognition of the need to independently certify the credit quality of bonds for the benefit of investors. Ultimately, investors make better-informed decisions with more timely information, which suggests that the adoption of issuer-pay would lead to greater rating timeliness. Nonetheless, the potential conflict of interest inherent to issuer-pay might result in catering through withheld downgrades—which reduces timeliness.

### 2.2.4 Information asymmetry

One of the perceived benefits of issuer-pay is rating agencies' access to private information from issuers. Both Ederington et al. (1987) and Griffin and Sanvicente (1982) suggest that ratings

[9]The SEC amended Rule 15c3-1 regarding the uniform net capital rule in 1975 to impose higher capital haircuts on broker/dealers' below-investment-grade bonds, where the rating status of the bonds would be determined by the ratings of Nationally Recognized Statistical Rating Organizations.

could provide a mechanism for communicating private information without divulging the details to firms' competitors. Consistent with this reasoning, Ederington and Yawitz (1987) assert that during the bond rating process, rating agencies gain access to forecasts of key financial figures (sometime 5 or more years into the future), capital spending plans, future financing plans, and copies of internal reports prepared for firms' boards of directors. If bond ratings convey some of the private information held by an issuer's management, there should be less informed trading in that company's bonds. Furthermore, since issuer-pay should facilitate *greater* information exchange between issuer and rating agency, there should be less informed trading after the adoption of issuer-pay.

# 3 Sample selection and descriptive statistics

## 3.1 Sample selection

To test my hypothesis regarding the effect of issuer-pay on the informativeness of corporate bond ratings, I collect information about initial ratings and rating changes for all U.S. corporate bonds from 1967 – 1978. I obtain such rating information directly from Moody's Rating Delivery Service and S&P RatingsXpress and supplement these ratings with information from *Moody's Bond Record* and *Standard & Poor's Bond Guide*. In addition, I gather corporate default information from both the *Commercial and Financial Chronicle* and *Moody's Bond Survey*. For bond bid-ask spreads, I search through the *Bank and Quotation Record* and collect monthly quotes for both exchange-traded and over-the-counter bonds. *Moody's Bond Record* and *Standard & Poor's Bond Guide* provide issue-level characteristics such as face amount issued, senior and secured status, and initial pricing. Finally, I gather information about firm fundamentals from Compustat and stock return data from CRSP.

Since some of my analysis requires the pairing of ratings made by Moody's and S&P regarding the same issue, I match rating information using CUSIP as the primary identifier. For analyses requiring fundamental and stock price data, I link issue-level CUSIP numbers to Compustat GVKEYs and CRSP PERMNOs using a manual review of issuer names and CUSIP numbers. Because many debt issues have an issuer-level CUSIP (six-digit) that differs from that of the parent company with accounting and stock price information, a simple matching of CUSIP numbers will result in the loss of a significant number of observations. This process yields an initial sample of 4,681 unique ratings on 3,243 new bond issues and 4,995 rating changes.

### 3.2 Descriptive statistics

Table 1 provides descriptive statistics for the main explanatory and control variables used in my empirical analyses. The firms in the sample have an interquartile range for total assets of approximately \$345 million – \$1.98 billion, representing larger firms during the 1967 – 1978 period. As shown in Table 1, firms' EBITDA covers approximately 59% of outstanding long-term debt, on average, while long-term debt makes up approximately 30% of sample firms' capital structures. Firms earn net income that is about 5% of total assets, on average, and appear to exhibit slightly less systematic equity risk than the market (average $\beta$=0.80). While many corporate bonds issued during the sample period have ratings from both S&P and Moody's at the time of issuance, there are a significant number of bonds with only a single rating—from either S&P or Moody's. Turning to characteristics of the new bonds issued during the sample period, about 54% of issues are senior claims with roughly 35% having secured collateral. The average issue amount for bonds in the sample is approximately \$53 million with the interquartile range being \$30 millon – \$100 million. Newly issued bonds have long maturities, averaging over 26 years.

Table 2 shows the distribution of ratings across rating categories during the three main sub-periods of the sample. It appears that the overwhelming majority of new corporate bonds during the 1967 – 1978 period were of higher credit quality, as evidenced by the significant number of ratings in the categories A, Aa/AA, and Aaa/AAA. Nearly 77% of bonds receive one of those ratings at the time of issuance. Looking across the three sample sub-periods, there appears to be a change in the distribution of ratings for both S&P and Moody's between 1967 – 1970 and 1971 – 1974. In particular, there is an increase in the percentage of bonds receiving A ratings and a corresponding decrease in the percentage receiving B ratings. For Moody's, A ratings increased from 76.2% of bonds issued to 83.2% while B ratings declined from 23.5% to 16.8%. For S&P, A ratings increased from 68.1% to 77.5% while B ratings decreased from 30.0% to 21.5%. Using a Kolmogorov-Smirnov test of distribution equality, I am able to reject the equality of both Moody's and S&P's rating distributions across the 1967 – 1970 and 1971 – 1974 time periods ($p$-values are 0.015 and 0.002 for Moody's and S&P respectively). In addition, S&P's distribution of ratings changes around its adoption of issuer-pay (Kolmogorov-Smirnov $p$-value=0.028).

For bonds rated by both rating agencies, there is generally no difference between the ratings given by S&P and Moody's. However, in some cases, Moody's rates one notch below or one notch above S&P. Table 3 shows the distribution of differences between Moody's and S&P for bonds with two ratings during the sub-periods of the sample related to each agency's adoption of the issuer-pay model. Consistent with Jiang et al. (2010), there appears to be an increase in the number of bonds rated higher by Moody's after Moody's adopts issuer-pay but before S&P adopts issuer-pay and a subsequent decrease after S&P adopts issuer-pay. However, a Kolmogorov-Smirnov test across sub-periods fails to reject the equality of the rating difference distributions ($p$-value=0.194 for the Moody's adoption and $p$-value=0.493 for the S&P adoption. Thus, for bonds with two ratings, there does not appear to be statistical evidence of higher ratings after the adoption of issuer-pay.

# 4 Empirical analyses

## 4.1 Initial bond yields

In my first test of how bond rating informativeness changes after the adoption of issuer-pay, I examine the determinants of initial yield spreads for the corporate bonds in my sample and follow the models used by those who have explored the information content of bond ratings (Ederington et al., 1987; Ziebart and Reiter, 1992). In these studies, determinants of corporate bond yields can be organized into two categories: (1) firm-specific financial information and (2) issue-specific characteristics. For the first category, I use cash flow before interest and taxes/total debt ($COV$), long-term debt/total assets ($LEV$), net income/total assets ($PROF$), the natural logarithm of total assets ($SIZE$). For the second category, I include the natural logarithm of the face value of the bond issue ($ISSUEAMT$), years until maturity ($MATUR$), an indicator for the secured status of the bond ($SECUR$), and an indicator for the seniority of the bond ($SENIOR$). In addition, I control for the level of the S&P rating by including the following binary variables, which are set equal to one if the bond possesses that rating and zero otherwise: $AAA$, $AA$, $A$, $BBB$, $BB$. I interact $POST$, a binary variable set equal to one if the bond was issued after 1970 (1974), with $ABOVE$, a binary variable set equal to one if Moody's (S&P) provides a higher initial rating and zero otherwise, and $BELOW$, a binary variable set equal to one if Moody's (S&P) provides a lower initial rating and zero otherwise, to yield the following model:

$$\begin{aligned} YSPREAD = {} & \beta_0 + \beta_1 POST + \beta_2 ABOVE + \beta_3 POST * ABOVE + \beta_4 BELOW \\ & + \beta_5 POST * BELOW + \beta_6 AAA + \beta_7 AA + \beta_8 A + \beta 9 BBB + \beta_{10} BB \\ & + \beta_{11} SIZE + \beta_{12} COV + \beta_{13} LEV + \beta_{14} PROF + \beta_{15} ISSUEAMT \\ & + \beta_{16} SENIOR + \beta_{17} SECUR + \beta_{18} MATUR + \epsilon \end{aligned} \tag{1}$$

Table 4 presents the regression tests of initial bond yields for both the S&P and Moody's adoption dates. In both regressions, the coefficients on the interactions $POST * ABOVE$ and $POST * BELOW$ are statistically significant in the negative and positive direction respectively. In the case of Moody's adoption of issuer-pay, when Moody's provides a higher rating than S&P on the same bond, yields spreads are nearly 37 basis points lower, on average, in the period after adoption. For the S&P adoption, this spread reduction is approximately 45 basis points, on average. When Moody's provides a lower rating than S&P, the spread is 49 basis points higher, on average, in the post-adoption period, while bonds experience a 38 basis point average increase in spread for cases in which S&P provides a lower rating after switching to the issuer-pay model.

On the whole, the evidence in Table 4 is consistent with ratings becoming more informative to bond market investors after the adoption of issuer-pay. For the rating agency adopting issuer-pay, providing a rating that differs from the other rating agency has a more pronounced effect on spreads after the adoption of the issuer-pay model. Thus, for example, when Moody's charges an issuer and provides a higher rating than S&P (who does not charge the issuer), bond investors demand less compensation than when Moody's issued a higher rating but did not charge the issuer.

## 4.2 Rating accuracy

Following Cheng and Neamtiu (2009), I test whether the adoption of issuer-pay led to more accurate bond ratings, consistent with assertions that issuer-pay increased access to management and its private information (McDaniel, 2009; Walker, 2010). To do so, I conduct two analyses: (1) a comparison of defaults by rating category using cumulative accuracy profiles and (2) an examination of misclassified bond ratings (i.e., Type I and Type II errors).

### 4.2.1 Cumulative accuracy profiles (ROC curves)

Rating agencies have always contended that the primary intent of bond ratings is to provide an "accurate and stable measure of *relative* default risk" (Cantor and Mann, 2003). For instance, Moody's and S&P do not grant a Aaa (AAA) rating under the premise that a bond being rated has an X% probability of default. Rather, when they assign a Aaa (AAA) rating, they believe that the bond being rated is less likely to default than a bond with a Aa (AA) rating. In this sense, with more accurate ratings, the lowest rating categories (i.e., CCC/Caa and below) should capture a significantly larger proportion of defaults than the highest categories (i.e., AA/Aa and above). Cantor and Mann (2003) suggest that a "key metric" used by Moody's to measure the relative accuracy of its ratings is the "cumulative accuracy profile" or receiver operating characteristic (ROC) curve. The ROC curve plots the cumulative percentage of bonds issued (starting with the lowest rating) on the horizontal axis and the cumulative percentage of defaults on the vertical axis. The area underneath the cumulative accuracy profile ranges from zero to one and may be used as a barometer of ratings' relative accuracy.

Thus, to gauge the changes in the accuracy of bond ratings around the adoption of issuer-pay in a manner consistent with the intent of the rating agencies, I calculate the cumulative accuracy of both Moody's and S&P during periods of time before and after each rating agency adopts issuer-pay. I then compare the area underneath each ROC curve to make inferences about the impact of issuer-pay on the relative accuracy of corporate bond ratings.[10] Figure 2 shows the cumulative accuracy profiles for Moody's and S&P during the 1967 – 1974 period around Moody's adoption of issuer-pay. Figure 3 shows the cumulative accuracy profiles during the 1971 – 1978 period around S&P's adoption of issuer-pay. Both figures show curves that are more bowed toward the upper-left corner of the graph after each firm adopts issuer-pay. This evidence is consistent with ratings becoming more accurate as relative measures of default risk after the start of issuer-pay.

Table 5 contains a statistical comparison of the area beneath the ROC curves for Moody's and S&P. Panel A tests the difference between the areas for each rating agency around Moody's adoption of the issuer-pay model in 1970, while Panel B tests the difference between the areas around S&P's adoption of the issuer-pay model in 1974. As shown in Panel A, Moody's exhibits a

[10] I conduct statistical comparisons of cumulative accuracy profiles consistent with methods developed in the receiver operating characteristic (ROC) curve literature (Bamber, 1975; Hanley and McNeil, 1982, 1983; Liu et al., 2005).

greater area under its ROC curve than S&P in both the pre- and post-1970 periods. Thus, Moody's ratings discriminate between defaulting and non-defaulting issues better than S&P at the one-year horizon. The change in the area under Moody's ROC curves from the pre- to post-adoption period exceeds the change in the area under S&P's ROC curves by 0.049, which is statistically significant at the 0.01 level. Turning to Panel B, S&P appears to improve its ratings' ability to discriminate between defaulting and non-defaulting bonds after adopting the issuer-pay model in 1974. The change in the area under the S&P ROC curve is 0.021 ($p$-value=0.025). Contrasting S&P's change with that of Moody's in Panel B reveals a difference in the ROC curve changes of 0.027, which is statistically significant at the 0.05 level. Taken together, Panels A and B of Table 5 provide evidence consistent with rating agencies improving their ability to discriminate between defaulting and non-defaulting bonds after they begin charging issuers for rating services. In this sense, ratings appear to become more informative after the rating agencies establish economic ties with bond issuers.

### 4.2.2 Bond rating misclassifications (Type I and II errors)

Another way to test whether bond rating accuracy improves around the adoption of the issuer-pay model is to analyze the frequency of misclassified bond ratings during the period before and after adoption. Bond rating misclassifications are of two types: (1) too favorable (Type I errors) and (2) too harsh (Type II errors). The definition of "too favorable" and "too harsh" requires a cutoff point on the rating scale, which for my empirical tests is the investment-grade threshold (i.e., BBB/Baa versus BB/Ba). Thus, a Type I (Type II) error is defined as an investment-grade (speculative) rating for a defaulting (non-defaulting) bonds. If the adoption of the issuer-pay model increases the cost of under-rating (Type II errors), I expect the frequency of Type II errors to decline after rating agencies begin charging issuers. Whether a decrease in the frequency of Type II errors is accompanied by fewer Type I errors depends on whether rating agencies receive more precise information about defaulting issues and communicate that via ratings in light of their compensation by issuers. I test whether the frequency of Type I and Type II errors change around the adoption of the issuer-pay model using the following model:

$$ERROR = \alpha_0 + \alpha_1 MOODYS + \alpha_2 POST + \alpha_3 POST * MOODYS + Controls + \xi \qquad (2)$$

$ERROR$ is a binary variable set equal to 1 if a bond is misclassified and zero otherwise. $MOODYS$ is a binary variable set equal to one if a rating comes from Moody's and zero otherwise. Control variables include: $SIZE$, $LEV$, $SENIOR$, $SECUR$, $ISSUEAMT$, and $MATUR$. If issuer-pay leads to a reduction (increase) in Type I or Type II errors, $\alpha_3$ should be less (greater) than zero.

Table 6 provides the results of logit regressions for Type I (too favorable ratings for defaulting issues) and Type II errors (too harsh ratings for non-defaulting issues). For interpretation of the results, I rely on the computation of average marginal effects to assess the incremental probability of committing either a Type I or Type II error around the rating agencies' adoption of the issuer-pay model. In Panel A, the marginal effect of interest is that related to the variable $POST * MOODYS$ for the Moody's model and $POST * SP$ for the S&P model. Consistent with ratings being more informative about default after adoption of the issuer-pay model, both Moody's and S&P exhibit a decreased likelihood of rating a defaulting bond above the investment-grade threshold after their respective adoptions of the issuer-pay model. Moody's is approximately 12% ($p$-value=0.047) less likely to commit such an error after 1970, while S&P is approximately 15% ($p$-value=0.066) less likely to do the same after 1974. These results appear to corroborate the findings of greater informativeness in the ROC curve analysis.

With respect to Type II errors, both rating agencies decrease their likelihood of assigning a below-investment-grade rating to a bond that will not default within the next year. Moody's is approximately 6% ($p$-value=0.001) less likely to commit a Type II error after 1970, while S&P is nearly 5% ($p$-value=0.004) likely to do so after 1974. Given that rating agencies receive remuneration from client issuers for rating services, the rating agencies should have an incentive to avoid under-rating bonds in the post-adoption period. The results in Panel B of Table 6 appear to document the effects of such an incentive.

## 4.3 Rating timeliness

### 4.3.1 Granger causality for rating changes

To assess the timeliness of rating upgrades and downgrades across Moody's and S&P, I follow Beaver et al. (2006) and employ Granger causality tests (Granger, 1969). These tests allow me to assess whether there is a temporal relationship between rating changes by each agency. I implement the Granger causality tests using logit regressions for both Moody's and S&P upgrades and downgrades during each of my major sample sub-periods: 1967 – 1970, 1971 – 1974, and 1975 – 1978. For the downgrade models, $MDG_t$ and $SDG_t$ are binary dependent variables set equal to one if there is a downgrade by Moody's and S&P, respectively, in month $t$ and zero otherwise. $MUG_t$ and $SUG_t$, the dependent variables for the upgrade models, are defined similarly for upgrade events. Each model contains lagged values of the dependent variable, along with lagged values of the other firm's variables, for six months prior to measurement month of the dependent variable, yielding the following specifications:

$$MDG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j MDG_{t-j} + \sum_{j=1}^{6} \delta_j SDG_{t-j} + \epsilon_t \tag{3}$$

$$SDG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j SDG_{t-j} + \sum_{j=1}^{6} \delta_j MDG_{t-j} + \epsilon_t \tag{4}$$

$$MUG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j MUG_{t-j} + \sum_{j=1}^{6} \delta_j SUG_{t-j} + \epsilon_t \tag{5}$$

$$SUG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j SUG_{t-j} + \sum_{j=1}^{6} \delta_j MUG_{t-j} + \epsilon_t \tag{6}$$

If Moody's bond rating changes are timelier than S&P rating changes, I expect that the $\delta$ coefficients in Equations (4) and (6) will be positive and statistically significant. On the other hand, if S&P rating changes are timelier than Moody's rating changes, I expect the $\delta$ coefficients in Equations (3) and (5) to be positive and statistically significant. Formally, the test of whether Moody's (S&P) rating changes *Granger cause* S&P (Moody's) rating changes requires that the $\delta$ coefficients are jointly statistically significant in Equations (4) and (6) ((3) and (5)). My timeliness test using Granger causality involves calculating a $\chi^2$-statistic based on comparing the explanatory power of downgrade and upgrade models which omit the lagged values from the other rating agency to that of the models which include the lagged values from the other rating agency.[11]

Table 7 shows the results of timeliness tests using Granger causality as a basis for assessing timeliness. In Panel A, I examine Granger causality with bond rating downgrades during the pre-Moody's issuer-pay period, the post-Moody's issuer-pay period, and the post-S&P issuer-pay period. Before Moody's adopts issuer-pay, S&P appears to lead Moody's with respect to downgrades. The Granger $\chi^2$-statistic is statistically significant at the 0.001 level and lead period is approximately two months. However, in the period after Moody's begins charging issuers, Moody's downgrades appear to lead S&P downgrades; the lead time is as much as five months and the Granger $\chi^2$-statistic is statistically significant at the 0.001 level. Once S&P adopts issuer-pay, Granger causality seems to run bi-directionally with both Granger $\chi^2$-statistics achieving statistical significance (at the 0.01 level for the Moody's regression and the 0.001 level for the S&P regression). Accordingly, when analyzing the timing of downgrades around the adoption of issuer-pay, the evidence is consistent with more timely downgrades from the agency with economic ties and greater potential access to information regarding changes in credit risk.

Turning to the Granger causality results for upgrades in Panel B of Table 7, there is no statistically significant evidence of a relationship between the adoption of issuer-pay and the relative timeliness of bond rating upgrades as measured by Granger causality. During both the period before and after Moody's adoption of issuer-pay, the results in Panel B show that S&P upgrades lead Moody's upgrades with Granger $\chi^2$-statistics statistically significant at the 0.001 level. After S&P adopts issuer-pay, the Granger causality becomes bi-directional. Thus, Panel B of Table 7 fails to provide statistical evidence of issuer-pay leading to changes in rating timeliness as measured by Granger causality.

#### 4.3.2 Short-window stock market reaction to rating changes

Short-window stock return tests provide another means to gauge the timeliness of rating agency actions.[12] I examine the short-window stock market reaction around both bond rating downgrades

[11] Consistent with Beaver et al. (2006) I also examine variations of my Granger causality models with up to 10 lags. The results of those specifications yield the same inferences as the model with six lags.

[12] There exists a fairly extensive literature documenting the information content of bond rating changes via the equity market. See Goh and Ederington (1993), Griffin and Sanvicente (1982), Hand et al. (1992), Holthausen and Leftwich (1986), Jorion et al. (2005), Kliger and Sarig (2000), and Pinches and Singleton (1978) for examples.

and upgrades. To the extent that the rating monitoring process leads managers to divulge material non-public information about firm performance to rating agencies and rating agencies incorporate this information into ratings in a timely fashion, changes in ratings can communicate this information to stock market investors. Thus, if these rating changes reveal new information to the stock market, firms' should exhibit abnormal stock returns around the announcement of such changes by rating agencies.

I compare the cumulative abnormal stock returns during the three days surrounding upgrades and downgrades announced by Moody's and S&P during the period before and after each rating agency adopts the issuer pay model. This comparison reveals changes in the timeliness (information content) of rating changes for firms that begin to receive remuneration for their rating and monitoring services. If firms convey more private information to rating agencies after they establish an economic relationship and rating agencies incorporate this information in a timely manner, Moody's upgrades (downgrades) should elicit a stronger positive (negative) stock market reaction relative to S&P upgrades and downgrades after Moody's adopts issuer-pay. Similarly, S&P upgrades and downgrades should not elicit a different stock market response from that of Moody's upgrades and downgrades after S&P's adoption of issuer-pay. On the other hand, if issuer-pay creates a conflict of interest which facilitates the delay of downgrades and the acceleration of upgrades by rating agencies, Moody's upgrades (downgrades) should elicit a stronger (weaker) positive (negative) stock market reaction relative to S&P upgrades (downgrades) after Moody's adopts issuer-pay. After S&P adopts issuer-pay, the stock market reaction to its upgrades and downgrades should not differ from the reaction to Moody's rating changes.

The results of the stock return analysis are shown in Table 8. In Panel A, the three-day cumulative abnormal returns around downgrades are negative and statistically significant during all time periods for both Moody's and S&P. Compared to the period before Moody's adopted issuer-pay, abnormal stock returns are more negative for both Moody's and S&P after Moody's adopted issuer-pay (-2.55% and -1.14% respectively). In addition, abnormal returns become relatively more negative for Moody's relative to S&P with an average difference-in-difference of approximately -1.41% ($p$-value=0.002). Moving into the period after S&P adopted the issuer-pay model, the difference-in-difference for abnormal stock returns around downgrade announcements is -1.38% ($p$-value=0.031) with S&P having the more negative change. Overall, the abnormal stock returns around downgrade announcements are consistent with issuer-pay facilitating greater timeliness for bond rating changes.

Turning to rating upgrades in Panel B of Table 8, abnormal stock returns are generally statistically insignificant prior to Moody's adoption of issuer-pay. Furthermore, abnormal returns around S&P upgrades are insignificantly different from zero prior to S&P's adoption of issuer-pay. However, after both Moody's and S&P adopted the issuer-pay model, the abnormal stock returns around upgrades became positive and statistically significant. Looking at the difference-in-difference for average abnormal stock returns between the pre- and post-issuer-pay periods for both Moody's and S&P indicates that abnormal returns became relatively more positive after each rating agency adopted the issuer-pay model. The difference-in-difference for the Moody's adoption is 1.59% ($p$-value=0.036) while for the S&P adoption is 0.71% ($p$-value=0.044). Hence, the abnormal stock returns around upgrade announcements are also consistent with issuer-pay facilitating greater timeliness for bond rating changes.

#### 4.3.3 Downgrade timing prior to default

Since rating agencies purport that their ratings capture the relative default risk of the securities or entities, timeliness should also relate to the actions taken by rating agencies in advance of default events. Downgrades are timelier if they provide an earlier indication of deterioration in credit quality. Thus, consistent with Cheng and Neamtiu (2009) I consider downgrades in advance of default to be timelier if they occur a greater number of days before the event of default. For example, Enron Corp. maintained an investment-grade credit rating (BBB-/Baa3) until four days before its Chapter 11 filing, which would be considered an extremely untimely downgrade under my measurement scheme. Using defaults from the period prior to Moody's adoption of issuer-pay through the period following S&P's adoption, I examine whether a rating agency downgrades defaulting bonds sooner or later after the adoption of issuer-pay relative to the other rating agency. To do so, I estimate the following regression model:

$$DAYSBEFORE = \theta_0 + \theta_1 MOODYS + \theta_2 POST + \theta_3 POST * MOODYS + Controls + \epsilon \quad (7)$$

where $DAYSBEFORE$ is the number of days between the bond downgrade date and the default date. Control variables include: $SIZE$, $COV$, $LEV$, $ISSUEAMT$, $MATUR$, $SENIOR$, and the rating one year prior to the default date ($RATING$).

To supplement the analysis of Equation (7), I also estimate a regression model with the average rating during the year leading to the default date for each bond ($AVGRATING$).[13] To the extent that rating actions are timelier, the average rating during the year prior to default should be lower.

Table 9 presents the results of regressions related to the timeliness of bond rating downgrades in advance of default. In Panel A, Moody's downgrades defaulting bonds approximately 119 days ($\approx$ 2 months) early after its adopts issuer-pay relative to S&P. When S&P adopts issuer-pay, it downgrades defaulting bonds approximately 276 days ($\approx$ 9 months) earlier relative to Moody's. Both of these economic magnitudes are quite significant considering that Cheng and Neamtiu (2009) find that regulatory pressure during the 2000s led to a 134 day increase in downgrade timeliness by Moody's, S&P, and Fitch. In Panel B, the Moody's defaulting bonds are rated nearly one notch lower in the year leading to default after it adopts issuer-pay, while S&P rates defaulting issues close to one-half of a notch lower after it adopts issuer-pay. Overall, Table 9 corroborates the evidence in the Granger causality and short-window stock market reaction tests that ratings appear to be timelier after the adoption of issuer-pay.

### 4.4 Information asymmetry

If issuer-paid bond ratings reveal material non-public information to the bond market, the likelihood of informed trading in these bonds should decline. As informed trading decreases in rated bonds, the bid-ask spread for these bonds should narrow to reflect reduced information asymmetry in the market (Bagehot, 1971; Copeland and Galai, 1983; Glosten and Milgrom, 1985).[14] I follow these antecedent papers and employ the bid-ask spread in my analysis of whether issuer-paid bond ratings reduce information asymmetry.

As noted by Wittenberg-Moerman (2008), prior studies information asymmetry in the equity

[13] I estimate $AVGRATING$ consistent with Cheng and Neamtiu (2009) where the weighted average rating is computed as the sum of all ratings outstanding during the one year prior to default multiplied by the number of days each rating has been effective.

[14] Numerous studies in accounting have relied on the bid-ask spread as a primary measure of information asymmetry (Armstrong et al., 2011; Coller and Yohn, 1997; Leuz and Verrecchia, 2000; Leuz, 2003; Wittenberg-Moerman, 2008; Yohn, 1998).

attempt to disentangle the adverse selection component of the bid-ask spread from the transitory component that captures inventory and order-processing costs of the market maker.[15] During the period covered by this study, however, actual transaction data are not available for corporate bonds traded in the secondary market. Accordingly, I use the full bid-ask spread for my analysis of information asymmetry in the corporate bond market. Nonetheless, I attempt to control for determinants of the transitory component as suggested by prior literature. Following Sarig and Warga (1989) and Hong and Warga (2000), I control for the bond rating ($RATE$) and the dollar volume of trade ($VOL$), $ISSUEAMT$, and $MATUR$. As in prior studies, $ISSUEAMT$, $MATUR$, and $VOL$ are proxies for liquidity (illiquidity in the case of $MATUR$); I expect $ISSUEAMT$ and $VOL$ to be negatively correlated with bond bid-ask spreads and $MATUR$ to be positively correlated with bond bid-ask spreads. Based on prior research, I expect that bond ratings will be negatively correlated with bid-ask spreads (Hong and Warga, 2000).

To test whether issuer-paid bond ratings reduce information asymmetry, I regress the average monthly bid-ask spread over the first two years after a bond's issuance ($BIDASK$) on $MOODYS$ ($SP$) and an interaction between $MOODYS$ ($SP$) and $POST$, along with the control variables discussed above. This model is shown below:

$$BIDASK = \phi_0 + \phi_1 MOODYS + \phi_2 POST + \phi_3 POST * MOODYS + Controls + \epsilon \qquad (8)$$

Table 10 presents the results of the bid-ask spread regressions. Based on the coefficient on $POST{*}MOODYS$ in the first estimation, corporate bonds have relatively narrower bid-ask spreads if they carry an initial rating from Moody's after Moody's adopts issuer-pay. Compared to bonds without a Moody's rating, Moody's rated bonds exhibit bid-ask spreads that narrow by approximately 0.7% of par value ($p$-value=0.005). Turning to the second estimation, S&P rated bonds experience a similar relative narrowing of bid-ask spreads after S&P adopts issuer-pay. Compared to bond without an S&P rating, S&P rated bonds exhibit bid-ask spreads that narrow by approximately 0.3% of par value ($p$-value=0.028). Taken together, the evidence from bond bid-ask spreads suggests that bond ratings reduce information asymmetry in the bond market to a greater extent after rating agencies adopt issuer-pay. Such a reduction in information asymmetry would be con-

[15] See Glosten and Harris (1988) for an example of a method for separating the adverse selection component of the bid-ask spread from the transitory component.

sistent with rating agencies gaining increased access to management of issuer clients and conveying information obtained via their ratings.

## 5 Conclusion

In this study, I examine a potential benefit of credit rating agencies' adoption of the issuer-pay business model: increased flow of information from issuer clients to rating agencies leading to ratings that are more informative to the bond market. While much of the debate regarding rating agencies and the issuer-pay model has centered around the potential conflict of interest which arises from issuers paying for ratings, there has been very little discussion about the information sharing aspect of issuer-pay. I find broad evidence consistent with bond ratings becoming more informative following the adoption of the issuer-pay by Moody's and S&P in the 1970s. Specifically, bond ratings appear to be more accurate measures of relative default risk and more timely indicators of changes in default risk. In addition, bond investors seem to price positive and negative rating differences between rating agencies to a greater extent after both Moody's and S&P adopt issuer-pay. Lastly, bid-ask spreads are narrower for bonds rated by an issuer-pay rating agency than for those not rated by an issuer-pay rating agency.

Although there is evidence that bond ratings were higher following rating agencies' adoptions of issuer-pay (see Jiang et al. (2010)), the evidence in the study suggests that higher ratings were not less informative about default risk. Thus, at least for corporate bonds, the introduction of the issuer-pay model alone does not appear reduce ratings informativeness. Recent criticism of the rating agencies has focused on the quality of ratings for structured finance. While the results of this study pertain to corporate bond ratings, they imply that the rating process rather than the source of revenue may have contributed to the poor performance of structured finance ratings. The Dodd-Frank Act of 2010 requires regulators to study the consequences of issuer-pay for debt market investors. The results of the study should inform that debate regarding information transmission via bond ratings. Finally, if issuer-pay leads to an incentive for inflated ratings, but also greater information sharing between rating agencies and their clients, the recent elimination of rating agencies' Regulation Fair Disclosure exemption related to material non-public information access may reduce the informativeness of bond ratings.

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Figure 1: Rating Agency Adoption of the Issuer-Pay Model

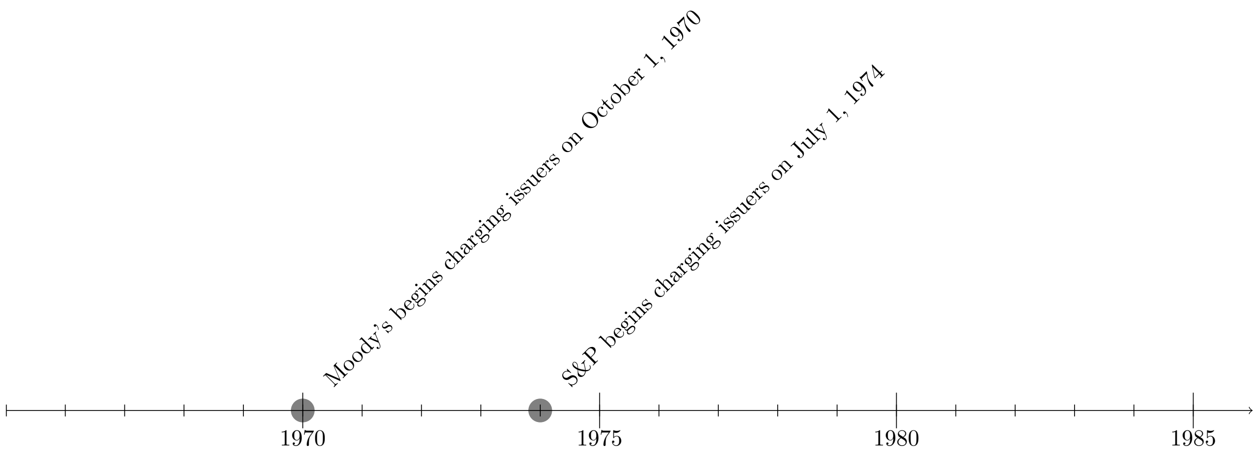

Figure 2: Cumulative accuracy profiles (ROC curves) during the 1967 – 1974 period

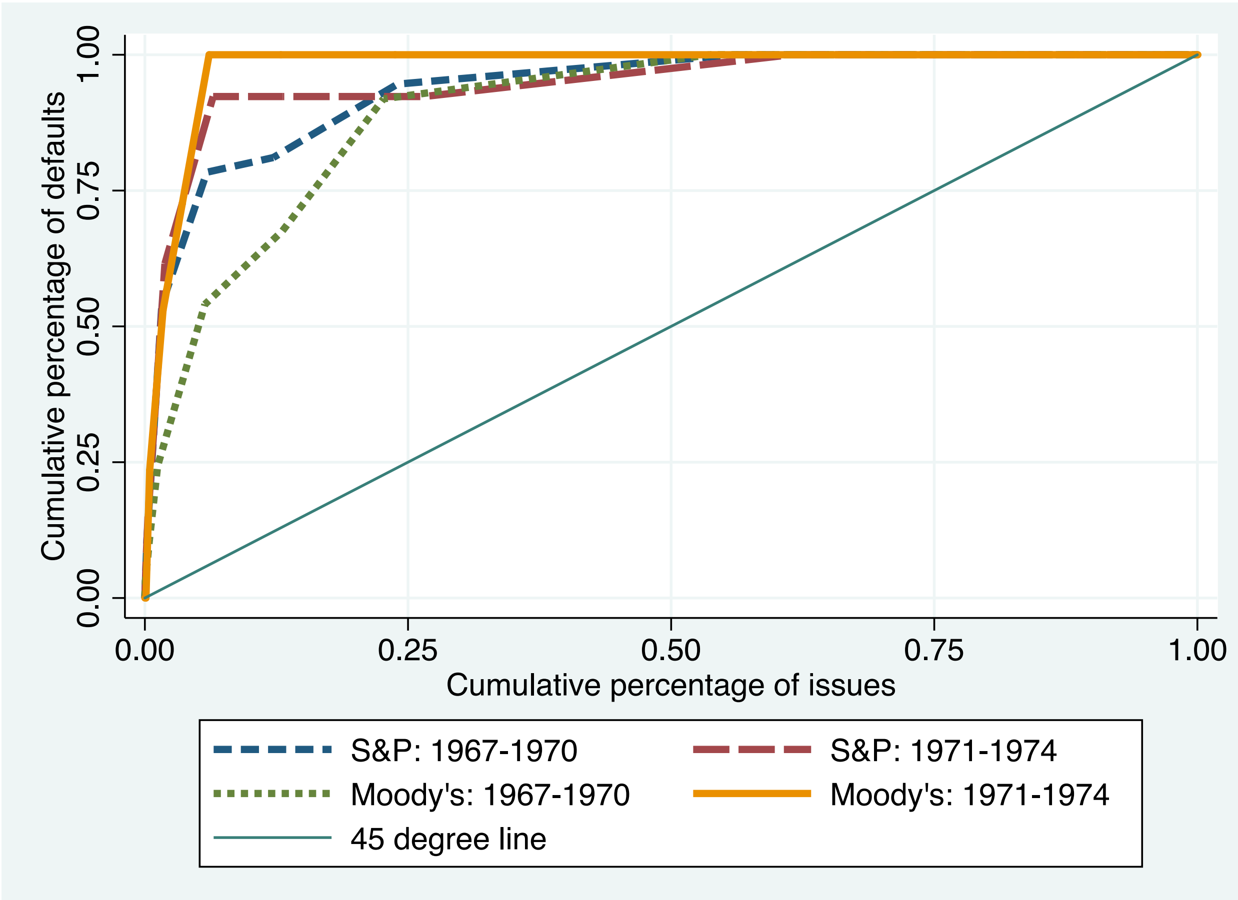

Figure 3: Cumulative accuracy profiles (ROC curves) during the 1971 – 1978 period

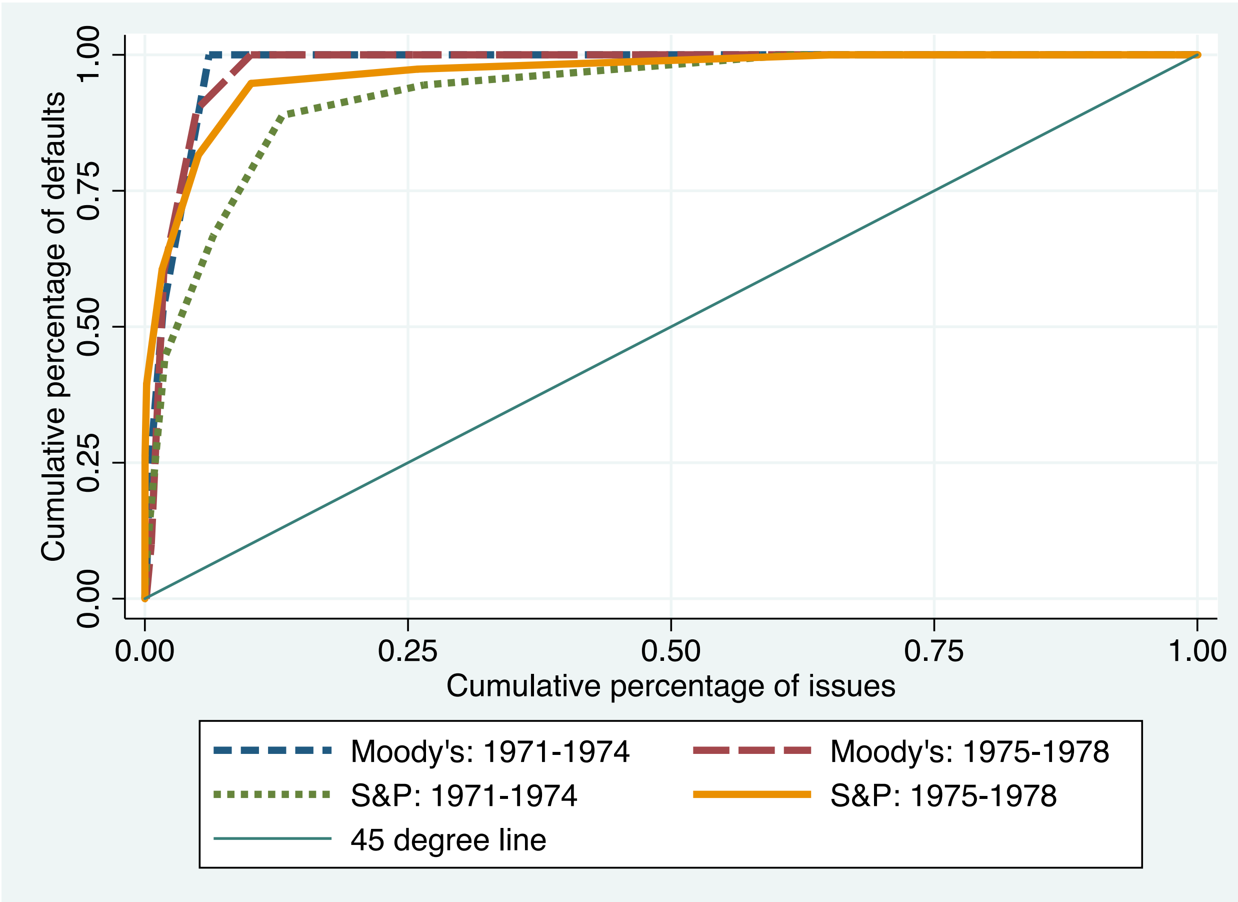

Table 1: Descriptive statistics

| Variable | Mean | Median | Std. Dev. | Q1 | Q3 |
|---|---|---|---|---|---|
| $SIZE$ | 20.595 | 20.568 | 1.359 | 19.659 | 21.404 |
| $COV$ | 0.591 | 0.330 | 0.955 | 0.216 | 0.658 |
| $LEV$ | 0.303 | 0.317 | 0.156 | 0.164 | 0.445 |
| $PROF$ | 0.050 | 0.044 | 0.026 | 0.034 | 0.061 |
| $BETA$ | 0.803 | 0.726 | 0.460 | 0.453 | 1.095 |
| $SENIOR$ | 0.536 | 1.000 | 0.499 | 0.000 | 1.000 |
| $SECURED$ | 0.346 | 0.000 | 0.476 | 0.000 | 1.000 |
| $ISSUEAMT$ | 17.777 | 17.728 | 0.824 | 17.217 | 18.421 |
| $MATUR$ | 26.406 | 25.033 | 4.369 | 24.992 | 30.011 |
| $YSPREAD$ | 3.404 | 3.426 | 1.465 | 2.549 | 4.215 |

This table presents descriptive statistics for the variables used in the empirical analyses. The sample consists of all bonds rated by either S&P or Moody's during the 1966 – 1978 period with issuers having Compustat and CRSP data. $SIZE$ is the natural logarithm of an issuer's total assets. $COV$ is an issuer's interest coverage ratio in the year prior to bond issuance and is defined as income before extraordinary items, interest, taxes, and depreciation divided by long-term debt. $LEV$ is an issuer's leverage ratio in the year prior to bond issuance and is defined as long-term debt divided by total assets. $PROF$ is the net income of an issuer in the year prior to bond issuance scaled by total assets. $BETA$ is an issuer's market model beta estimated during the year prior to bond issuance. $SENIOR$ is a binary variable set equal to one if a bond has seniority status and zero otherwise. $SECUR$ is a binary variable set equal to one if a bond is secured with collateral and zero otherwise. $ISSUEAMT$ is the natural logarithm of the face value of the bond issue. $MATUR$ is time until the maturity of the bond in years. $YSPREAD$ is the difference between a bond's initial yield-to-maturity and the yield on a U.S. Treasury bond with the closest maturity.

Table 2: Changes in the distribution of ratings on new bonds around issuer-pay adoptions

| Rating Agency | Period | Caa/CCC | B | Ba/BB | Baa/BBB | A | Aa/AA | Aaa/AAA |
|---|---|---|---|---|---|---|---|---|
| | 1967 – 1970 | 2 | 38 | 45 | 59 | 206 | 169 | 86 |
| Moody's | 1971 – 1974 | 0 | 15 | 31 | 88 | 324 | 226 | 115 |
| | 1975 – 1978 | 0 | 45 | 15 | 108 | 339 | 262 | 121 |
| Kolmogorov-Smirnov $p$-values: | | | | | | | | |
| 1967 – 1970 vs. 1971 – 1974 | 0.015 | | | | | | | |
| 1971 – 1974 vs. 1975 – 1978 | 0.770 | | | | | | | |
| | 1967 – 1970 | 10 | 50 | 49 | 59 | 157 | 149 | 53 |
| S&P | 1971 – 1974 | 8 | 30 | 39 | 93 | 300 | 211 | 73 |
| | 1975 – 1978 | 19 | 80 | 27 | 99 | 272 | 222 | 84 |
| Kolmogorov-Smirnov $p$-values: | | | | | | | | |
| 1967 – 1970 vs. 1971 – 1974 | 0.002 | | | | | | | |
| 1971 – 1974 vs. 1975 – 1978 | 0.028 | | | | | | | |

P

This table shows that the distribution of bond ratings changes for both rating agencies around Moody's adoption of issuer-pay while it changes only for S&P around S&P's adoption of issuer pay. The number of ratings in each category given to new bond issues during the 1967 – 1978 period are shown separately by rating agency. The three sub-periods divide the sample period relative to each rating agency's adoption of the issuer-pay model: 1967 – 1970 is the period before Moody's adopted issuer-pay, 1971 – 1974 is the period during which Moody's used issuer-pay and S&P used investor-pay, and 1975 – 1978 is the period during which both rating agencies used issuer-pay. Changes in ratings distributions are assessed using a Kolmogorov-Smirnov test for the equality of distributions. $p$-values are provided for tests of differences in distributions across time periods.

Table 3: Differences between the ratings of Moody's and S&P around issuer-pay adoptions

| Time Period | Diff=-1 | Diff=0 | Diff=1 | K-S $p$-value |
|---|---|---|---|---|
| 1967 – 1970 | 25 | 281 | 15 | |
| | | | | 0.194 |
| 1971 – 1974 | 23 | 425 | 62 | |
| | | | | 0.493 |
| 1975 – 1978 | 23 | 406 | 32 | |
| Entire Sample | 71 | 1,112 | 109 | |

This table finds no statistical evidence that the distribution of rating differences for bonds initially rated by both Moody's and S&P changes across each rating agency's adoption of issuer-pay. The number of bonds rated for each rating difference category are shown across the period during which Moody's and S&P both used investor-pay (1967 – 1970), the period during which Moody's used issuer-pay and S&P used investor-pay (1971 – 1974), and the period during which Moody's and S&P both used issuer-pay (1975 – 1978). *Diff* is defined as the numerical equivalent of Moody's rating (e.g., Aaa=9) minus the numerical equivalent of S&P's rating (e.g., AAA=9). Changes in rating difference distributions across sample sub-period are assessed using a Kolmogorov-Smirnov test for the equality of distributions. Kolmogorov-Smirnov $p$-values are provided in the last column.

Table 4: Initial bond yield spreads across the switch to the issuer-pay model

$$YSPREAD = \beta_0 + \beta_1 POST + \beta_2 ABOVE + \beta_3 POST * ABOVE$$
$$+\beta_4 BELOW + \beta_5 POST * BELOW + Controls + \epsilon$$

| | Moody's Change | | S&P Change | |
|---|---|---|---|---|
| Variable | Coefficient | $p$-value | Coefficient | $p$-value |
| $Intercept$ | 1.8008 | 0.000 | 5.4665 | 0.000 |
| $POST$ | 0.1789 | 0.003 | 1.2772 | 0.000 |
| $ABOVE$ | -0.5654 | 0.030 | 0.6922 | 0.059 |
| $POST * ABOVE$ | -0.3684 | 0.052 | -0.4506 | 0.013 |
| $BELOW$ | 0.1920 | 0.209 | -0.8713 | 0.025 |
| $POST * BELOW$ | 0.4947 | 0.044 | 0.3815 | 0.001 |
| $AAA$ | -1.3366 | 0.002 | -2.4041 | 0.000 |
| $AA$ | -1.1805 | 0.004 | -2.5327 | 0.000 |
| $A$ | -0.9003 | 0.018 | -2.1746 | 0.000 |
| $BAA$ | -0.5125 | 0.112 | -1.9872 | 0.000 |
| $BA$ | -0.9480 | 0.009 | -2.3055 | 0.000 |
| $SIZE$ | 0.0063 | 0.839 | 0.0090 | 0.680 |
| $COV$ | -0.0280 | 0.346 | -0.0778 | 0.280 |
| $LEV$ | 0.6983 | 0.032 | 0.1764 | 0.087 |
| $PROF$ | -7.5318 | 0.001 | -4.2935 | 0.003 |
| $ISSUEAMT$ | -0.1439 | 0.057 | -0.2360 | 0.039 |
| $SENIOR$ | -2.5374 | 0.000 | -0.6023 | 0.001 |
| $SECUR$ | -2.6428 | 0.000 | -0.7645 | 0.000 |
| $MATUR$ | 0.0094 | 0.184 | 0.0244 | 0.001 |
| Observations | 534 | | 1,022 | |
| Adjusted $R^2$ | 0.412 | | 0.517 | |

This table presents an OLS model that regresses initial bond yield spreads on differences in ratings between Moody's and S&P before and after each rating agency's adoption of issuer-pay along with other economic determinants of initial bond yield spreads. The Moody's Change specification uses new bond observations from the 1967 – 1974 period while the S&P Change specification uses new bond observations from the 1971 – 1978 period. The dependent variable, $YSPREAD$, is the difference between a bond's initial yield-to-maturity and the yield on a U.S. Treasury bond with the closest maturity. $POST$ is a binary variable set equal to one if a bond is issued after 1970 for the Moody's Change specification and after 1974 for the S&P Change specification and zero otherwise. $ABOVE$ is a binary variable set equal to one if the Moody's (S&P) rating is higher than the S&P (Moody's rating in the Moody's (S&P) Change specification and zero otherwise. $BELOW$ is a binary variable set equal to one if the Moody's (S&P) rating is lower than the S&P (Moody's rating in the Moody's (S&P) Change specification and zero otherwise. $AAA$ is a binary variable set equal to one if a bond is rated AAA (Aaa) by S&P (Moody's) in the Moody's (S&P) Change specification and zero otherwise. $AA$ is a binary variable set equal to one if a bond is rated AA (Aa) by S&P (Moody's) in the Moody's (S&P) Change specification and zero otherwise. $A$ is a binary variable set equal to one if a bond is rated AA by S&P (Moody's) in the Moody's (S&P) Change specification and zero otherwise. $BAA$ is a binary variable set equal to one if a bond is rated BBB (Baa) by S&P (Moody's) in the Moody's (S&P) Change specification and zero otherwise. $BA$ is a binary variable set equal to one if a bond is rated BB (Ba) by S&P (Moody's) in the Moody's (S&P) Change specification and zero otherwise. $SIZE$ is the natural logarithm of an issuer's total assets. $COV$ is an issuer's coverage ratio (earnings before interest and taxes divided by long-term debt) in the year prior to issuance. $LEV$ is an issuer's leverage ratio in the year prior to bond issuance and is defined as long-term debt divided by total assets. $PROF$ is an issuer's ratio of net income to total assets. $ISSUEAMT$ is the natural logarithm of the face value of the bond issue. $SENIOR$ is a binary variable set equal to one if a bond has seniority status and zero otherwise. $SECUR$ is a binary variable set equal to one if a bond is secured with collateral and zero otherwise. $MATUR$ is time until the maturity of the bond in years. Standard errors are corrected for general heteroskedasticity (White, 1980).

Table 5: Tests of changes in bond rating accuracy using cumulative accuracy profiles (ROC curves)

Panel A: Moody's adoption of issuer-pay

| | 1967 – 1970 | 1971 – 1974 | Difference |
|---|---|---|---|
| Moody's | 0.912 | 0.977 | 0.065 |
| | | | (0.000) |
| S&P | 0.932 | 0.948 | 0.016 |
| | | | (0.018) |
| ΔMoody's - ΔS&P | | | 0.049 |
| | | | (0.005) |

Panel B: S&P's adoption of issuer-pay

| | 1971 – 1974 | 1975 – 1978 | Difference |
|---|---|---|---|
| Moody's | 0.977 | 0.971 | -0.006 |
| | | | (0.353) |
| S&P | 0.948 | 0.968 | 0.021 |
| | | | (0.025) |
| ΔS&P - ΔMoody's | | | 0.027 |
| | | | (0.043) |

This table presents the area beneath cumulative accuracy profiles (ROC curves) for Moody's and S&P before and after their adoptions of issuer-pay. Panel A displays areas before and after the Moody's adoption of issuer-pay while Panel B displays areas before and after the S&P adoption of issuer-pay. Cumulative accuracy profiles plot the cumulative percentage of bond issues in each rating category on the horizontal axis against the cumulative percentage of defaults on the vertical axis. The areas shown in the table represent the area between the horizontal axis and the curve plotted using rating categories and defaults. A bond in a particular category is considered to be a default observation if it falls into a state of default within one year. Each point along the cumulative accuracy profile indicates the ability of a rating category to discriminate between defaulting and non-defaulting bonds in the population of bond issues. As the area under a cumulative accuracy profile approaches 1.0, a rating systems relative accuracy improves, as the percentage of defaults captured by the lowest rating category approaches 100%. The results in this table indicate that both Moody's and S&P experienced an improvement in the relative accuracy of their ratings after the adoption of issuer-pay. *P*-values for tests of differences between the areas under cumulative accuracy profiles are provided under the differences.

Table 6: Bond rating misclassifications: Type I and Type II errors

$$ERROR = \alpha_0 + \alpha_1 MOODYS + \alpha_2 POST + \alpha_3 POST * MOODYS + Controls + \xi$$

Panel A: Missed defaults (Type I errors)

| Variable | Average marginal effect | $p$-value | Variable | Average marginal effect | $p$-value |
|---|---|---|---|---|---|
| $MOODYS$ | -34.07% | 0.013 | $SP$ | 17.26% | 0.017 |
| $POST$ | 1.70% | 0.451 | $POST$ | 6.42% | 0.333 |
| $POST * MOODYS$ | -12.41% | 0.047 | $POST * SP$ | -15.05% | 0.066 |
| $SIZE$ | -0.81% | 0.315 | $SIZE$ | -0.96% | 0.451 |
| $LEV$ | -4.66% | 0.037 | $LEV$ | -7.02% | 0.004 |
| $SENIOR$ | 0.15% | 0.720 | $SENIOR$ | 0.09% | 0.684 |
| $SECUR$ | 0.54% | 0.509 | $SECUR$ | 0.34% | 0.677 |
| $ISSUEAMT$ | -1.28% | 0.083 | $ISSUEAMT$ | -0.95% | 0.112 |
| $MATUR$ | -3.69% | 0.022 | $MATUR$ | -4.21% | 0.016 |
| Observations | 116 | | Observations | 219 | |
| Pseudo $R^2$ | 0.204 | | Pseudo $R^2$ | 0.268 | |

Panel B: Missed non-defaults (Type II errors)

| Variable | Average marginal effect | p-value | Variable | Average marginal effect | p-value |
|---|---|---|---|---|---|
| $MOODYS$ | 0.08% | 0.151 | $SP$ | 5.41% | 0.001 |
| $POST$ | 0.46% | 0.786 | $POST$ | 1.61% | 0.003 |
| $POST * MOODYS$ | -5.95% | 0.001 | $POST * SP$ | -4.80% | 0.004 |
| $SIZE$ | 2.76% | 0.071 | $SIZE$ | 2.93% | 0.055 |
| $LEV$ | 1.33% | 0.063 | $LEV$ | 1.78% | 0.047 |
| $SENIOR$ | -0.88% | 0.341 | $SENIOR$ | -0.46% | 0.322 |
| $SECUR$ | -2.01% | 0.015 | $SECUR$ | -3.86% | 0.006 |
| $ISSUEAMT$ | 4.30% | 0.000 | $ISSUEAMT$ | 2.75% | 0.020 |
| $MATUR$ | -6.08% | 0.000 | $MATUR$ | -4.96% | 0.000 |
| Observations | 10,454 | | Observations | 12,688 | |
| Pseudo $R^2$ | 0.258 | | Pseudo $R^2$ | 0.316 | |

This table presents the results of logistic models that regress missed defaults (Type I errors) and missed non-defaults (Type II errors) on indicators for the source of the rating and whether the rating was in effect after the adoption of issuer-pay, an interaction between the two indicators, and other potential determinants of Type I and Type II errors. Panel A displays the results of the missed defaults estimation while Panel B displays the results of the missed non-defaults estimation. Missed defaults are defined as instances in which a bond maintains an investment-grade rating one year prior to default. Missed non-defaults are defined as instances in which a bond maintains a speculative-grade rating one-year prior to non-default. $MOODYS$ is a binary variable set equal to one if a bond is rated by Moody's and zero otherwise. $SP$ is a binary variable set equal to one if a bond is rated by S&P and zero otherwise. $POST$ is a binary variable set equal to one if a rating falls after Moody's (S&P's) adoption of the issuer-pay model. $SIZE$ is the natural logarithm of an issuer's total assets. $LEV$ is an issuer's leverage ratio in the year prior to bond issuance and is defined as long-term debt divided by total assets. $SENIOR$ is a binary variable set equal to one if a bond has seniority status and zero otherwise. $SECUR$ is a binary variable set equal to one if a bond is secured with collateral and zero otherwise. $ISSUEAMT$ is the natural logarithm of the face value of the bond issue. $MATUR$ is time until the maturity of the bond in years. Average marginal effects are shown for each variable and are estimated using the marginal effects for each observation in the sample. The results show a decline in the likelihood of both Type I and Type II errors following adoption of issuer-pay by Moody's and S&P. Standard errors are corrected for general heteroskedasticity (White, 1980).

Table 7: Granger causality logistic regression tests of rating timeliness between Moody's and S&P

Panel A: Downgrades

$$MDG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j MDG_{t-j} + \sum_{j=1}^{6} \delta_j SDG_{t-j} + \epsilon_t$$

$$SDG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j SDG_{t-j} + \sum_{j=1}^{6} \delta_j MDG_{t-j} + \epsilon_t$$

| | 1967 – 1970 (Pre-Moody's Issuer Pay) | | | |
|---|---|---|---|---|
| | $MDG_t$ | | $SDG_t$ | |
| | Marginal Effect | $p$-value | Marginal Effect | $p$-value |
| *Intercept* | 0.0018 | 0.000 | 0.0020 | 0.000 |
| $MDG_{t-1}$ | -0.0065 | 0.198 | 0.0097 | 0.064 |
| $MDG_{t-2}$ | -0.0041 | 0.420 | -0.0016 | 0.764 |
| $MDG_{t-3}$ | -0.0017 | 0.746 | -0.0014 | 0.796 |
| $MDG_{t-4}$ | -0.0017 | 0.744 | -0.0020 | 0.695 |
| $MDG_{t-5}$ | -0.0022 | 0.676 | -0.0015 | 0.783 |
| $MDG_{t-6}$ | -0.0043 | 0.432 | -0.0015 | 0.794 |
| $SDG_{t-1}$ | 0.0247 | 0.000 | 0.0093 | 0.071 |
| $SDG_{t-2}$ | 0.0115 | 0.020 | 0.0267 | 0.000 |
| $SDG_{t-3}$ | -0.0015 | 0.766 | -0.0021 | 0.688 |
| $SDG_{t-4}$ | -0.0014 | 0.779 | -0.0062 | 0.225 |
| $SDG_{t-5}$ | -0.0015 | 0.766 | -0.0023 | 0.661 |
| $SDG_{t-6}$ | 0.0116 | 0.020 | -0.0023 | 0.664 |
| Granger statistic | 30.62 | | 3.92 | |
| $p$-value | 0.000 | | 0.687 | |

| 1971 – 1974 (Post-Moody's Issuer Pay) | | | | |
|---|---|---|---|---|
| | $MDG_t$ | | $SDG_t$ | |
| | Marginal Effect | $p$-value | Marginal Effect | $p$-value |
| $Intercept$ | 0.0047 | 0.000 | 0.0061 | 0.000 |
| $MDG_{t-1}$ | -0.0047 | 0.185 | 0.1221 | 0.000 |
| $MDG_{t-2}$ | -0.0040 | 0.234 | 0.0733 | 0.000 |
| $MDG_{t-3}$ | -0.0088 | 0.111 | 0.0029 | 0.569 |
| $MDG_{t-4}$ | -0.0123 | 0.085 | 0.0036 | 0.484 |
| $MDG_{t-5}$ | 0.0851 | 0.008 | 0.0685 | 0.000 |
| $MDG_{t-6}$ | -0.0058 | 0.255 | -0.0070 | 0.223 |
| $SDG_{t-1}$ | -0.0028 | 0.000 | -0.0405 | 0.000 |
| $SDG_{t-2}$ | -0.0026 | 0.000 | -0.0235 | 0.000 |
| $SDG_{t-3}$ | 0.0135 | 0.192 | -0.0101 | 0.016 |
| $SDG_{t-4}$ | 0.0207 | 0.122 | -0.0106 | 0.015 |
| $SDG_{t-5}$ | 0.0242 | 0.329 | -0.0046 | 0.285 |
| $SDG_{t-6}$ | -0.0033 | 0.000 | -0.0085 | 0.053 |
| Granger statistic | 7.13 | | 48.39 | |
| $p$-value | 0.309 | | 0.000 | |

| 1975 – 1978 (Post-S&P Issuer Pay) | | | | |
|---|---|---|---|---|
| | $MDG_t$ | | $SDG_t$ | |
| | Marginal Effect | $p$-value | Marginal Effect | $p$-value |
| $Intercept$ | 0.0038 | 0.000 | 0.0022 | 0.000 |
| $MDG_{t-1}$ | -0.0046 | 0.209 | 0.1392 | 0.000 |
| $MDG_{t-2}$ | 0.0004 | 0.915 | 0.0336 | 0.000 |
| $MDG_{t-3}$ | -0.0059 | 0.091 | 0.0069 | 0.024 |
| $MDG_{t-4}$ | -0.0029 | 0.400 | 0.0238 | 0.000 |
| $MDG_{t-5}$ | 0.0145 | 0.000 | 0.0021 | 0.491 |
| $MDG_{t-6}$ | 0.0071 | 0.028 | 0.0372 | 0.000 |
| $SDG_{t-1}$ | 0.0058 | 0.183 | -0.0277 | 0.000 |
| $SDG_{t-2}$ | 0.0153 | 0.000 | -0.0118 | 0.002 |
| $SDG_{t-3}$ | -0.0028 | 0.491 | -0.0120 | 0.001 |
| $SDG_{t-4}$ | -0.0073 | 0.062 | -0.0085 | 0.013 |
| $SDG_{t-5}$ | -0.0005 | 0.893 | -0.0125 | 0.000 |
| $SDG_{t-6}$ | -0.0051 | 0.181 | -0.0159 | 0.000 |
| Granger statistic | 20.36 | | 88.96 | |
| $p$-value | 0.002 | | 0.000 | |

Panel B: Upgrades

$$MUG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j MUG_{t-j} + \sum_{j=1}^{6} \delta_j SUG_{t-j} + \epsilon_t$$

$$SUG_t = \gamma_0 + \sum_{j=1}^{6} \gamma_j SUG_{t-j} + \sum_{j=1}^{6} \delta_j MUG_{t-j} + \epsilon_t$$

1967 – 1970 (Pre-Moody's Issuer Pay)

| | $MUG_t$ | | $SUG_t$ | |
|---|---|---|---|---|
| | Marginal Effect | $p$-value | Marginal Effect | $p$-value |
| *Intercept* | 0.0006 | 0.000 | 0.0007 | 0.000 |
| $MUG_{t-1}$ | -0.0051 | 0.334 | -0.0006 | 0.913 |
| $MUG_{t-2}$ | -0.0005 | 0.917 | -0.0006 | 0.910 |
| $MUG_{t-3}$ | -0.0092 | 0.072 | -0.0006 | 0.904 |
| $MUG_{t-4}$ | -0.0036 | 0.486 | -0.0006 | 0.905 |
| $MUG_{t-5}$ | -0.0006 | 0.915 | -0.0006 | 0.904 |
| $MUG_{t-6}$ | -0.0006 | 0.913 | -0.0007 | 0.894 |
| $SUG_{t-1}$ | 0.1150 | 0.000 | -0.0007 | 0.895 |
| $SUG_{t-2}$ | 0.0000 | 0.997 | -0.0006 | 0.905 |
| $SUG_{t-3}$ | -0.0002 | 0.975 | -0.0006 | 0.906 |
| $SUG_{t-4}$ | 0.0775 | 0.000 | -0.0006 | 0.907 |
| $SUG_{t-5}$ | 0.0006 | 0.922 | -0.0005 | 0.936 |
| $SUG_{t-6}$ | -0.0004 | 0.950 | -0.0005 | 0.937 |
| Granger statistic | 51.46 | | 0.90 | |
| $p$-value | 0.000 | | 0.989 | |

1971 – 1974 (Post-Moody's Issuer Pay)

| | $MUG_t$ | | $SUG_t$ | |
|---|---|---|---|---|
| | Marginal Effect | $p$-value | Marginal Effect | $p$-value |
| *Intercept* | 0.0005 | 0.000 | 0.0008 | 0.000 |
| $MUG_{t-1}$ | -0.0241 | 0.000 | -0.0006 | 0.899 |
| $MUG_{t-2}$ | -0.0008 | 0.842 | -0.0006 | 0.897 |
| $MUG_{t-3}$ | -0.0004 | 0.908 | -0.0006 | 0.876 |
| $MUG_{t-4}$ | -0.0004 | 0.912 | -0.0006 | 0.880 |
| $MUG_{t-5}$ | -0.0004 | 0.909 | -0.0006 | 0.876 |
| $MUG_{t-6}$ | -0.0005 | 0.884 | -0.0008 | 0.842 |
| $SUG_{t-1}$ | 0.3201 | 0.000 | -0.0008 | 0.853 |
| $SUG_{t-2}$ | 0.0081 | 0.061 | -0.0006 | 0.902 |
| $SUG_{t-3}$ | -0.0002 | 0.959 | -0.0006 | 0.906 |
| $SUG_{t-4}$ | -0.0004 | 0.932 | -0.0005 | 0.907 |
| $SUG_{t-5}$ | -0.0004 | 0.932 | -0.0005 | 0.907 |
| $SUG_{t-6}$ | -0.0004 | 0.928 | -0.0006 | 0.901 |
| Granger statistic | 30.62 | | 1.44 | |
| $p$-value | 0.000 | | 0.963 | |

| 1975 – 1978 (Post-S&P Issuer Pay) | | | | |
|---|---|---|---|---|
| | $MUG_t$ | | $SUG_t$ | |
| | Marginal Effect | $p$-value | Marginal Effect | $p$-value |
| *Intercept* | 0.0020 | 0.000 | 0.0027 | 0.000 |
| $MUG_{t-1}$ | -0.0019 | 0.616 | 0.0194 | 0.000 |
| $MUG_{t-2}$ | -0.0049 | 0.208 | -0.0020 | 0.647 |
| $MUG_{t-3}$ | -0.0029 | 0.456 | 0.0054 | 0.230 |
| $MUG_{t-4}$ | -0.0038 | 0.357 | -0.0020 | 0.670 |
| $MUG_{t-5}$ | -0.0029 | 0.477 | 0.0061 | 0.192 |
| $MUG_{t-6}$ | -0.0018 | 0.667 | 0.0061 | 0.196 |
| $SUG_{t-1}$ | -0.0017 | 0.617 | -0.0053 | 0.177 |
| $SUG_{t-2}$ | 0.0148 | 0.000 | -0.0025 | 0.521 |
| $SUG_{t-3}$ | 0.0039 | 0.253 | -0.0037 | 0.341 |
| $SUG_{t-4}$ | 0.0096 | 0.005 | -0.0026 | 0.510 |
| $SUG_{t-5}$ | 0.0039 | 0.247 | -0.0038 | 0.332 |
| $SUG_{t-6}$ | -0.0016 | 0.631 | -0.0036 | 0.360 |
| Granger statistic | 30.06 | | 24.55 | |
| $p$-value | 0.000 | | 0.000 | |

This table presents the results of logit models that regress a time series of bond rating upgrade and downgrade indicators for each rating agency on six lags of the upgrade or downgrade time series and six lags of the other rating agency's upgrade or downgrade time series. Panel A displays downgrade estimations while Panel B displays upgrade estimations. Regressions show average marginal effects for each variable. $MDG_t$ is a binary variable set equal to one if Moody's downgrades a bond in month $t$ and zero otherwise. $SDG_t$ is a binary variable set equal to one if S&P downgrades a bond in month $t$ and zero otherwise. $MUG_t$ is a binary variable set equal to one if Moody's upgrades a bond in month $t$ and zero otherwise. $SUG_t$ is a binary variable set equal to one if S&P upgrades a bond in month $t$ and zero otherwise. Granger test statistics are shown below regression results and represent a $\chi^2$ statistic for the joint statistical significance of combined lagged indicators related to the rating agency not used for the dependent variable (i.e., for $MDG_t$ as the dependent variable, $SDG_{t-1}$ through $SDG_{t-6}$ are used for computation of the Granger statistic). Standard errors are corrected for general heteroskedasticity (White, 1980).

Table 8: Short-window stock market reaction to bond rating changes by Moody's and S&P

Panel A: Downgrades

| | N | 1967 – 1970 | N | 1971 – 1974 | Difference |
|---|---|---|---|---|---|
| Moody's | 164 | -1.89% | 208 | -4.45% | -2.55% |
| | | (0.004) | | (0.000) | (0.000) |
| S&P | 114 | -0.90% | 346 | -2.05% | -1.14% |
| | | (0.001) | | (0.000) | (0.000) |
| $\Delta$Moody's - $\Delta$S&P | | | | | -1.41% |
| | | | | | (0.002) |

| | N | 1971 – 1974 | N | 1975 – 1978 | Difference |
|---|---|---|---|---|---|
| Moody's | 208 | -4.45% | 545 | -3.98% | 0.47% |
| | | (0.000) | | (0.000) | (0.056) |
| S&P | 346 | -2.05% | 437 | -2.96% | -0.91% |
| | | (0.000) | | (0.000) | (0.014) |
| $\Delta$S&P - $\Delta$Moody's | | | | | -1.38% |
| | | | | | (0.031) |

Panel B: Upgrades

| | N | 1967 – 1970 | N | 1971 – 1974 | Difference |
|---|---|---|---|---|---|
| Moody's | 45 | -0.48% | 77 | 1.56% | 2.04% |
| | | (0.368) | | (0.000) | (0.003) |
| S&P | 71 | -0.10% | 98 | 0.35% | 0.45% |
| | | (0.806) | | (0.335) | (0.417) |
| ΔMoody's - ΔS&P | | | | | 1.59% |
| | | | | | (0.036) |

| | N | 1971 – 1974 | N | 1975 – 1978 | Difference |
|---|---|---|---|---|---|
| Moody's | 77 | 1.56% | 196 | 1.89% | 0.33% |
| | | (0.002) | | (0.018) | (0.288) |
| S&P | 98 | 0.35% | 332 | 1.39% | 1.04% |
| | | (0.532) | | (0.009) | (0.020) |
| ΔS&P - ΔMoody's | | | | | 0.71% |
| | | | | | (0.044) |

This table presents short-window abnormal stock market returns around bond rating downgrades and upgrades. Panel A shows abnormal returns for downgrades while Panel B shows abnormal returns for upgrades. Abnormal stock returns are calculated using residuals from a market model estimated over the (-255,-46) trading window and are accumulated over the three days surrounding the rating change announcement (-1,+1). *P*-values for statistical tests of differences are shown in parentheses.

Table 9: Regressions of rating timeliness in advance of defaults

Panel A: Number of days between downgrade date and default

$$DAYSBEFORE = \theta_0 + \theta_1 MOODYS + \theta_2 POST + \theta_3 POST * MOODYS + Controls + \epsilon$$

| Variable | Coefficient | $p$-value |
|---|---|---|
| *Intercept* | 271.44 | 0.022 |
| *MOODYS* | 320.95 | 0.017 |
| *POST* | -26.07 | 0.423 |
| *POST ∗ MOODYS* | 118.85 | 0.041 |
| *SIZE* | 30.16 | 0.012 |
| *COV* | 0.37 | 0.056 |
| *LEV* | 0.81 | 0.022 |
| *ISSUEAMT* | 13.72 | 0.216 |
| *MATUR* | -0.28 | 0.115 |
| *SENIOR* | -4.83 | 0.059 |
| *RATING* | -1.12 | 0.127 |
| Observations | 116 | |
| Adjusted $R^2$ | 0.277 | |

| Variable | Coefficient | $p$-value |
|---|---|---|
| *Intercept* | 537.19 | 0.000 |
| *SP* | -310.09 | 0.000 |
| *POST* | -86.76 | 0.000 |
| *POST ∗ SP* | 275.61 | 0.000 |
| *SIZE* | 46.23 | 0.019 |
| *COV* | 0.54 | 0.156 |
| *LEV* | 0.96 | 0.027 |
| *ISSUEAMT* | 23.49 | 0.097 |
| *MATUR* | -0.57 | 0.188 |
| *SENIOR* | -7.08 | 0.044 |
| *RATING* | -0.73 | 0.216 |
| Observations | 219 | |
| Adjusted $R^2$ | 0.448 | |

Panel B: Average rating during year prior to default

$$AVGRATING = \theta_0 + \theta_1 MOODYS + \theta_2 POST + \theta_3 POST * MOODYS + Controls + \epsilon$$

| Variable | Coefficient | $p$-value |
|---|---|---|
| *Intercept* | 3.8100 | 0.000 |
| *MOODYS* | 0.2414 | 0.074 |
| *POST* | 0.0656 | 0.907 |
| *POST ∗ MOODYS* | -0.9286 | 0.031 |
| *SIZE* | 0.2916 | 0.053 |
| *COV* | 0.1790 | 0.487 |
| *LEV* | -0.0962 | 0.681 |
| *ISSUEAMT* | 0.0046 | 0.772 |
| *MATUR* | -0.1184 | 0.030 |
| *SENIOR* | 0.8571 | 0.000 |
| Observations | 116 | |
| Adjusted $R^2$ | 0.158 | |

| Variable | Coefficient | $p$-value |
|---|---|---|
| *Intercept* | 3.6190 | 0.000 |
| *SP* | -0.3331 | 0.052 |
| *POST* | 0.0921 | 0.667 |
| *POST ∗ SP* | -0.4775 | 0.029 |
| *SIZE* | 0.5163 | 0.040 |
| *COV* | 0.3312 | 0.260 |
| *LEV* | -0.1533 | 0.499 |
| *ISSUEAMT* | 0.0108 | 0.556 |
| *MATUR* | -0.0867 | 0.073 |
| *SENIOR* | 0.6378 | 0.027 |
| Observations | 219 | |
| Adjusted $R^2$ | 0.193 | |

This table presents the results of OLS models that regress measures of rating timeliness on indicators for the source of the rating and whether the rating was in effect after the adoption of issuer-pay, an interaction between the two indicators, and other potential determinants of rating timeliness. The sample employed for the regression in this table is composed of defaulted bonds. Panel A displays results with the number of days between downgrade and default ($DAYSBEFORE$) as the dependent variable while Panel B displays results with the average rating during the year prior to default as the dependent variable ($AVGRATING$). $MOODYS$ and $SP$ are binary variables set equal to one if a rating comes from Moody's and S&P respectively and zero otherwise. $POST$ is a binary variable set equal to one if the rating was issued after Moody's and S&P adopted issuer-pay and zero otherwise. $SIZE$ is the natural logarithm of an issuer's total assets. $COV$ is an issuer's interest coverage ratio in the year prior to bond issuance and is defined as income before extraordinary items, interest, taxes, and depreciation divided by long-term debt. $LEV$ is an issuer's leverage ratio in the year prior to bond issuance and is defined as long-term debt divided by total assets. $ISSUEAMT$ is the natural logarithm of the face value of the bond issue. $MATUR$ is time until the maturity of the bond in years. $SENIOR$ is a binary variable set equal to one if a bond has seniority status and zero otherwise. $RATING$ is the bond rating one year prior to the default date. The results suggest that ratings became more timely after the adoption of issuer-pay, as evidenced by earlier downgrades and lower average ratings in the year prior to default. Standard errors are corrected for general heteroskedasticity (White, 1980).

Table 10: Bid-Ask Spreads in the Corporate Bond Market

$$BIDASK = \phi_0 + \phi_1 MOODYS + \phi_2 POST + \phi_3 POST * MOODYS + Controls + \epsilon$$

| | Moody's Change | | | S&P Change | |
|---|---|---|---|---|---|
| Variable | Coefficient | $p$-value | | Coefficient | $p$-value |
| $Intercept$ | 0.1080 | 0.000 | $Intercept$ | 0.0833 | 0.000 |
| $MOODYS$ | 0.0010 | 0.344 | $SP$ | -0.0001 | 0.468 |
| $POST$ | -0.0025 | 0.162 | $POST$ | 0.0004 | 0.210 |
| $POST * MOODYS$ | -0.0074 | 0.005 | $POST * SP$ | -0.0027 | 0.043 |
| $ISSUEAMT$ | -0.0003 | 0.000 | $ISSUEAMT$ | -0.0007 | 0.000 |
| $MATUR$ | 0.0008 | 0.013 | $MATUR$ | 0.0012 | 0.028 |
| $RATE$ | -0.0136 | 0.000 | $RATE$ | -0.0392 | 0.000 |
| $VOL$ | -0.0071 | 0.000 | $VOL$ | -0.0261 | 0.000 |
| Observations | 534 | | | 793 | |
| Adjusted $R^2$ | 0.382 | | | 0.466 | |

This table presents the results of OLS models that regress corporate bond bid-ask spreads on indicators for the source of the rating and whether the rating was in effect after the adoption of issuer-pay, an interaction between the two indicators, and other potential determinants of bid-ask spreads. The dependent variable, $BIDASK$, is the monthly difference between ask and bid quotes (stated as a percentage of par value) averaged over the first 24 months of a bond's secondary market trading. $MOODYS$ and $SP$ are binary variables set equal to one if a bond possess a rating from Moody's and S&P respectively and zero otherwise. $POST$ is a binary variable set equal to one if the bond was issued after Moody's and S&P adopted the issuer-pay model and zero otherwise. $ISSUEAMT$ is the natural logarithm of the face value of the bond issue. $MATUR$ is time until the maturity of the bond in years. $RATE$ is the initial rating received by the bond issue. $VOL$ is the average dollar volume of trade during the first 24 months of a bond's secondary market trading. Standard errors are corrected for general heteroskedasticity (White, 1980).