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THE EFFECT OF BOND RATING CHANGES ON COMMON STOCK PRICES*

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The evidence in this paper suggests that downgrades by both Moody's and Standard and Poor's are associated with negative abnormal stock returns in the two-day window beginning the day of the press release by the rating agency. Significant negative abnormal performance can still be detected after eliminating observations containing obvious concurrent (potentially contaminating) news releases. There is little evidence of abnormal performance on announcement of an upgrade. Significant abnormal returns are associated with announcements of additions to the Standard and Poor's Credit Watch List, if either a potential downgrade or a potential upgrade is indicated.

1. Introduction

This paper uses daily data surrounding press release dates to examine abnormal returns of the common stock of companies experiencing bond rating changes. The evidence suggests that downgradings by both Moody's and Standard and Poor's result in negative abnormal returns at the time of the press release by the rating agency. The evidence is consistent with the argument that Moody's and Standard and Poor's provide information to the capital markets through a downgrade, or that a downgrade imposes costs on the affected firm. There is little evidence of abnormal performance on announcement of an upgrade. The paper also tests for abnormal performance at the time Standard and Poor's adds a company to the Credit Watch List. Negative abnormal performance is detected if the potential action is a downgrade, and some positive abnormal performance is observed if the potential action is an upgrade.

The negative abnormal performance associated with downgrades could be explained by the release of other information concurrently with the rating

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change. This alternative explanation is impossible to refute without an exhaustive listing of all information reaching the market on a given day, but we investigate this issue by classifying observations as either 'contaminated' or 'non-contaminated'. To control for obvious contemporaneous announcements, we classify observations as contaminated if the *Wall Street Journal* story about the rating change contains information from a source other than the rating agency, or if any other firm-specific information appears in the *Wall Street Journal* during the four trading days, day -1 to day $+2$, where day 0 is the date of the press release by the rating agency. The results for the non-contaminated sample are similar to those discussed above; that is, downgrades by Moody's and Standard and Poor's result in negative abnormal returns, although the magnitude is not as large. Indicated downgrades and upgrades in the Credit Watch sample have a significant effect on stock prices, even if contaminated observations are excluded. It is clear our procedures do not eliminate all concurrent information releases. However, at least some of the concurrent announcements are triggered by the rating change, so the results could underestimate the information effects of a rating change.

Our study of the effect of rating changes differs from previous studies in four respects:

(i) We use daily stock price data, as opposed to monthly data, to examine the stock price effect of rating agency announcements. The use of daily data has two advantages. First, it provides more powerful tests, assuming the exact event date can be identified. Press release dates were obtained from Moody's Investors Service and Standard and Poor's. Second, the use of daily data and a narrow announcement 'window' of two days reduces the likelihood that the effect of other disclosures is included in the measured announcement effects.

(ii) We eliminate observations if there are concurrent disclosures in the period surrounding the press release date. Some of the previous studies do not find a price impact associated with a rating change, so the elimination of observations with contaminating announcements is not an issue. In those studies that find a significant price response, no control for confounding events is implemented, although the problem is recognized.

(iii) We investigate potential determinants of the cross-sectional variation in the price impact for rating changes, such as, the magnitude of the rating change, whether the rating change affects a bond's investment grade status, whether the rating change closely follows a similar change by the other agency, and, whether the rating change is a resolution of Credit Watch.

(iv) We examine the effects on stock prices of Standard and Poor's Credit Watch additions and resolutions.

Our primary emphasis is on the two-day announcement period, although we report measures of abnormal performance for various subperiods between day −300 and day +60. Thus, our paper is primarily motivated by the question, do rating agencies provide information to the capital markets? Some previous research argues that security price performance in the period preceding the rating change is evidence of slow reaction by rating agencies to information already incorporated in security prices. We contend that it is difficult to draw inferences from the behavior of security returns prior to a rating change. Without knowledge of the rating agency's loss function, we cannot identify the optimal time to change a rating. Bond ratings attempt to measure the probability of default, a continuous variable that changes as new information arrives. Rating categories are discrete. Thus, we expect to observe some abnormal security price behavior prior to a rating change, but we cannot determine whether that prior abnormal performance is 'too much' or 'too little', i.e., whether the agency acts 'too early' or 'too late'. Instead, we argue that a price response on the *announcement* of a rating change is evidence that agencies provide some information not already incorporated in security price.

A security price response at the time of a rating change is generally inconsistent with evidence in Pinches and Singleton (1978) (monthly stock returns), Wakeman (1978) (monthly stock and weekly bond returns), and Weinstein (1977) (monthly bond returns), who find no evidence of a price response to rating changes. Our results are consistent with Griffin and Sanvicente (1982) who find a significant negative price response for downgrades using monthly stock return data. In addition, our results are generally consistent with those reported in Katz (1974) (monthly changes in bond yields), Grier and Katz (1976) (average monthly bond prices), Ingram, Brooks and Copeland (1983) (monthly changes in bond yields), and Stickel (1985) (daily preferred stock returns).

Several factors could explain the differences between our results and those in other studies. First, our tests may be more powerful. We are able to use daily data because we have precise announcement dates (press release dates). Moreover, as we discuss below, the signal to noise ratio may be more favorable for stock than bond data. Further, non-trading of bonds may eliminate some observations associated with price effects in bond price studies. Finally, our sample is drawn from a later time period, and the rating agencies may have improved their performance. Standard and Poor's introduced Credit Watch in an attempt to provide more timely information, and we do detect stronger results for the second half of our sample period.

Outline of the paper

Section 2 of the paper provides some institutional background on rating agencies. The data collection procedures for the rating change sample are

described in section 3. The methodology and empirical results concerning the mean effect of rating changes on common stock returns are reported in section 4. An analysis of cross-sectional variation in abnormal performance associated with rating changes is included in section 5. Section 6 describes the data, methodology, and empirical results for the Credit Watch sample. Conclusions are contained in section 7. An appendix describes the methodology for the stock return tests in more detail.

2. The bond rating process

The major bond rating agencies in the United States are Moody's Investors Service, Standard and Poor's Corporation, and Fitch Investors Service. Moody's began rating bonds in 1909, and the other services started in the early 1920's. Duff and Phelps is a more recent entrant in the bond rating business, and they have published their ratings since 1980. Standard and Poor's started a new service in November 1981, the Credit Watch List, which warns of probable future bond rating changes by Standard and Poor's.

Rating agencies cover a variety of publicly traded securities including: corporate bonds, preferred stock, commercial paper, and municipal bonds. The rating codes vary from service to service. Moody's uses codes from Aaa down to C, while Standard and Poor's rates bonds from AAA down to D. Both Moody's and Standard and Poor's assign three gradations within the five classes from AA(Aa) to B. (For example, Standard and Poor's AA class consists of AA +, AA, and AA −.) Standard and Poor's have disclosed the gradations within classes for some time, but Moody's did not publish gradations before April 1982.

Bond ratings are designed to measure default risk only, not the risk of interest rate changes due, for example, to shifts in expectations of inflation. There are at least two alternative views of how rating agencies obtain information about default risk. One view is that the rating agencies have access to only publicly available information, and the agencies generally lag the market in processing that information. According to this view, announcements of bond rating changes should not affect security prices, if capital markets are efficient in the semi-strong form. Proponents of this view argue that the agencies do not monitor the firms closely, and that many rating changes occur only when an agency reviews its rating of a company pursuant to a new debt issue. Zonana and Hertzberg (1981) estimate that only 2,000 of 18,000 outstanding ratings are reviewed each year. Weinstein (1977) indicates that over 50% of rating changes result from reviews accompanying new debt issues. The ability of simple discriminant models based on accounting and other publicly available data to closely mimic the ratings of bond rating agencies [e.g., Kaplan and

Urwitz (1979)] further supports the claim that rating agencies react to information which is already publicly available.[1]

An alternative view is that rating agencies are information specialists who obtain information that is not in the public domain, i.e., information acquisition is costly and rating agencies are the lowest cost providers of some information. Consequently, rating changes affect security prices and assigned ratings affect the yields on new issues.[2] Officials of corporations, municipalities and states often argue that 'faulty' (low) ratings cost stockholders, consumers, or taxpayers millions of dollars. (See, for example, 'When a City's Debt Ratings Fall, Its Costs Go Up, Officials Get Mad', *Wall Street Journal*, October 14, 1985, p. 15.)

Rating agencies claim that they have access to information that is probably not publicly available. For example, both Moody's and Standard and Poor's indicate that the rating review process usually includes discussions with management, visits to company premises, and forecasts of income statement and balance sheet data provided by management:

> 'Over 90% of industrial companies with debt ratings in investment grade categories regularly supply S&P with financial forecasts, as do a majority of companies with lower-rated debt. The typical package consists of three- to five-year projections of income statements, balance sheets, and source and use of fund statements. As appropriate, consolidated reports are supplemented with consolidating statements or with detailed data by business segment.' (*Standard and Poor's Credit Week*, August 22, 1983, p. 1099)

Further, *Standard and Poor's Credit Overview* (1982, p. 9) describes an elaborate review process in which management is warned of forthcoming rating changes, given a chance to present counter-arguments, and even an opportunity to appeal the proposed rating:

> 'Once the rating is determined, the issuer is notified of the rating and the major considerations supporting it. It is S&P policy, as part of the rating process, to allow the issuer to respond to the rating prior to the pub-

[1] The economic survival of rating agencies requires explanation if they do not provide timely information. 'Prudent investor rules' may create a demand from fiduciaries for a certification service. For example, an investment grade rating provides evidence of a prudent *ex ante* decision to purchase a bond that defaults *ex post*.

[2] Unexpected rating change announcements could affect security prices if markets were segmented, even if the rating agencies have access to only publicly available information. For example, many fiduciaries must hold securities of at least investment grade quality, and investment grade is generally defined as a rating of at least BBB(Baa).

lication through the presentation of new or additional data. This process is conducted as expeditiously as possible when a rating change is likely. The committee will then reconvene to consider the new information. After that, the rating will be disseminated, except for those types of ratings where the issuer has the publication rights to the rating (e.g., a new commercial paper request or private placement).'

3. Data – Moody's and Standard and Poor's bond rating changes

The sample consists of 1,014 rating changes by Moody's and Standard and Poor's over the 1977–82 period. The identity of the firm and the approximate date of the rating change for Moody's were obtained from the weekly *Moody's Bond Survey* in the section entitled 'Taxable Corporate Securities – Ratings Reviewed and Revised'. Standard and Poor's rating changes were assembled from a chronological listing entitled 'Standard and Poor's Corp. Corporate Finance Rating Changes' supplied by officials of the Standard and Poor's Corporation. Press release dates for the rating changes were provided by officials of the agencies.[3] We restricted the sample to rating changes for straight debt (i.e., changes exclusively for convertible debt and/or floating rate notes are excluded) and for corporations with common stock listed on the New York or American Stock Exchange.[4] A firm is included in the sample even if only one of its outstanding straight-debt issues experienced a rating change. This procedure probably reduces the power of subsequent tests. Efforts to determine whether a rerated bond was senior debt or non-senior debt were unsuccessful because we did not have sufficient information to determine the priority of individual bond issues.

Each rating change for a company results in one sample observation, regardless of the number of bonds affected. If a firm has two or more bond issues which are rated differently, we select the old and new rating according to the most common rating of the bonds with revised ratings. Table 1 provides descriptive evidence of rating changes by year for downgrades and upgrades for Moody's and Standard and Poor's separately and combined. We categorized rating changes according to whether they are within or across rating

[3]The Standard and Poor's sample contains ratings on industrial non-taxable bonds, such as Industrial Revenue Development Bonds. The Moody's sample does not, because Moody's provided us with press release dates for taxable bond rating changes only. The non-taxable bonds in the Standard and Poor's sample are bonds of the issuing corporation, with no recourse to the government body involved in the issue.

[4]We eliminated all rating changes announced by Moody's on April 20, 1982. Moody's changed its system of classifications to include three gradations of bonds for each rating class from Aa to B on April 20, and announced a large number of rating changes to place bonds in the new gradations.

Table 1

Summary of rating changes by calendar year, rating agency, and within and across classes.[a] Sample of 1014 rating changes of corporate debt of New York and American Stock Exchange listed firms announced by Moody's and Standard and Poor's, 1977–1982 (number and percentage of observations).

Calendar year	Moody's				Standard & Poor's				Total			
	Across classes		Within class		Across classes		Within class		Across classes		Within class	
	#	%	#	%	#	%	#	%	#	%	#	%
					Downgrades							
1977	16	7.8	0	0.0	19	7.6	15	10.3	35	7.7	15	8.2
1978	6	2.9	0	0.0	15	6.0	12	8.3	21	4.6	12	6.6
1979	22	10.7	0	0.0	18	7.2	19	13.1	40	8.8	19	10.4
1980	34	16.6	0	0.0	43	17.1	20	13.8	77	16.9	20	10.9
1981	38	18.6	0	0.0	61	24.3	26	17.9	99	21.7	26	14.2
1982	89	43.4	38	100.0	95	37.8	53	36.6	184	40.3	91	48.7
Total	205	100.0	38	100.0	251	100.0	145	100.0	456	100.0	183	100.0
					Upgrades							
1977	15	17.6	0	0.0	21	13.3	14	12.0	36	14.8	14	10.6
1978	13	15.3	0	0.0	19	12.0	20	17.1	32	13.2	20	15.2
1979	9	10.6	0	0.0	23	14.5	20	17.1	32	13.2	20	15.2
1980	8	9.4	0	0.0	45	28.5	16	13.6	53	21.8	16	12.1
1981	22	25.9	0	0.0	29	18.4	27	23.1	51	21.0	27	20.4
1982	18	21.2	15	100.0	21	13.3	20	17.1	39	16.0	35	26.5
Total	85	100.0	15	100.0	158	100.0	117	100.0	243	100.0	132	100.0

[a]Across classes or within class indicates whether the rating change takes place within gradations of a major class (e.g., AA + to AA −) or whether the rating change crosses classes (e.g., AA − to A +). Moody's did not designate gradations within classes until 1982.

Table 2

Transition matrix of rating changes. Sample of 1014 rating changes of corporate debt of New York and American Stock Exchange listed firms announced by Moody's and Standard and Poor's, 1977–1982 (number and percentage of observations).

Prior rating[a]	Revised rating[a]										Total	% down within class[b]
	AAA	AA	A	BBB	BB	B	CCC	CC	C	D		
AAA	0	35									35	0
AA	12	51	94	1	1						159	66.7
A	8	79	153	156	1			1			398	50.3
BBB	3	1	76	71	61					1	213	69.0
BB		1		26	17	41	2	1		2	90	58.8
B	1			2	20	23	43	1		4	94	56.5
CCC					1	10	0	4	1	5	21	0
CC							0	0	0	1	1	0
C							1	0	0	0	1	0
D							2		0	0	2	0
Total	24	167	323	256	101	74	48	7	1	13	1014	

[a] Ratings are described in terms of Standard and Poor's classification scheme.

[b] The main diagonal represents all of the 315 within-class rating changes. The '% down within class' column indicates the percentage of within-class changes that are downgrades. Across classes or within class indicates whether the rating change takes place within gradations of a major class (e.g., AA + to AA −) or whether the rating change crosses classes (e.g., AA − to A +). Moody's did not designate gradations within classes until 1982.

classes.[5] As indicated in table 1, the sample contains 456 downgrades across classes and 183 downgrades within a class. There are 243 upgrades across classes and 132 within a class. The downgrades and upgrades cluster in particular calendar years. For example, 1981 and 1982 account for 99 (21.7%) and 184 (40.3%) of the downgrades across classes. There is less clustering in the upgrades, with 1980 accounting for the maximum of 53 (21.8%) of the total of 243 upgrades across classes.

Table 2 provides information concerning the transition matrix of rating changes for both Moody's and Standard and Poor's. The main diagonal of the transition matrix reports the number of within-class rating changes, both up and down, in the sample. The far right column indicates the percentage of

[5] A rating change is within class if the change occurs within any of the three gradations for a given class, e.g., AA + to AA or AA − . A rating change is across classes if it changes from AA − to A + . Moody's has no within-class rating changes prior to 1982. For notational convenience, we adopt the Standard and Poor's classification scheme when we describe ratings and changes in the remainder of the paper.

within-class rating changes that are downgades for each class. The diagonal just above the main diagonal reports the distribution of the 434 across-class downgrades of one class. Observations above that diagonal indicate that there are 22 downgrades of more than one class, of which 13 change to D. The diagonal just below the main diagonal indicates the distribution of the 223 upgrades across one class. Observations below that diagonal indicate that the sample contains 20 upgrades of two or more classes, of which 12 change to AAA. If a rating of BBB or above represents investment grade, 65 ratings fall below investment grade while 30 ratings change to investment grade from BB or lower.

For each observation in the sample, we identified concurrent information releases by searching the *Wall Street Journal* Index and noting the date of any stories appearing during the four trading days, day -1 to day $+2$, where day 0 is the press release date. If any story in the four-day window described the rating change, we read that story to determine whether it contained information from a source other than the rating agency. If there was information from another source, the observation was classified as contaminated.[6] Observations were also classified as contaminated if there were other stories about the firm in the *Wall Street Journal* Index in the four-day window. Remaining observations were classified as non-contaminated.

Coverage of bond rating changes in the *Wall Street Journal* is far from complete, but we underestimate the coverage by relying on the Index. There are index references to 442 (43.6%) of the 1,014 rating change announcements; 33 on the trading day of the press release, 379 the following trading day; and all but one within five trading days. None of the indexed stories about the rating change precedes the press release date. Downgrades are reported more frequently than upgrades, and there is little difference between the reporting frequencies for rating changes within a class and across classes. For example, of 456 across-class downgrades, 235 (51.5%) are indexed, compared with 98 (53.6%) of 183 within-class downgrades; but only 75 (30.9%) of the 243 across-class upgrades are reported, and 34 (25.8%) of the within-class upgrades are reported. The coverage varies slightly from year to year, but does not increase systematically in later years.

4. Mean stock price impact of rating change announcements

This section contains an outline of the methodology and a description of the results of the mean stock price impact of rating change announcements. A more detailed explanation of the methodology is presented in the appendix. If bond rating agencies provide information about the distribution of a firm's

[6] Three individuals coded the stories independently. Disagreements resulted in the stories being classified as contaminated.

cash flows when they rerate debt, that information is relevant for valuing both debt and equity. It is unclear whether the effect is more readily identified with bond or stock price data because both the signal and the noise vary across the two securities. We rely on stock price data because these data are available at low cost, and because stocks listed on the New York and American Stock Exchanges trade regularly. Bond data are costly to obtain, and few bond issues trade regularly. Using bond data restricts the sample of firms with usable observations.

We report mean results separately for upgrades and downgrades. Implicitly, we assume that the sign of the abnormal performance is homogeneous within each type of rating change. There are two reasons to question the homogeneity assumption in the stock price tests reported. First, we do not control for the market's expectation of a rating change. If rating changes provide information, the sign (and magnitude) of the abnormal performance depend on whether the market fully anticipated the downgrade, or expected a more severe downgrade. Controlling for the market's expectation of a rating change would improve the power of the tests. Second, if a rating change provides information about the probability of default on a firm's bonds, it can have ambiguous effects on stock prices under some circumstances. If the probability of default changes because the value of the firm changes, *ceteris paribus*, the value of the debt and the equity should change in the same direction. However, if the probability of default changes because the variance of the firm's cash flows change, *ceteris paribus*, option pricing theory suggests that the value of the equity changes in a direction opposite to that of the debt. We are unable to identify which rating changes, if any, result from changes in the variance of the firm's cash flows. This constitutes another source of noise in our tests.

4.1. Methodology for estimating abnormal performance

The stock price impact of rating change announcements is estimated using prediction errors from the market model.[7] The daily prediction error, PE_{it}, for each sample firm i on each event day t during the period of interest is estimated as

$$PE_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}),$$

where

R_{it} ≡ continuously compounded rate of return on the common stock of firm i on event day t;

[7]See Fama (1976) for a discussion of the market model.

R_{mt} ≡ continuously compounded rate of return on the equally weighted New York and American Stock Exchange index on event day t;[8] and

$\hat{\alpha}_i, \hat{\beta}_i$ ≡ ordinary least squares estimates of market model parameters.[9] Parameters are estimated over the 300 day period, day +61 to day +360. If there are fewer than 100 days in that period, the parameters are estimated using data from the combined before (−600 to −301) and after (+61 to +360) period. The observation is excluded if there are fewer than 100 daily returns available in the combined 600 day period.[10]

The prediction errors, PE_{it}, are averaged across the N_t firms in the subsample on each event day t to form an average prediction error,

$$APE_t = \frac{1}{N_t} \sum_{i=1}^{N_t} PE_{it}.$$

The average prediction errors are cumulated from day −300 to form cumulative average prediction errors (CPE). The average prediction errors are also cumulated over various subperiods to form window average prediction errors ($WAPE$). The statistic testing whether abnormal performance is significantly different from zero in a window of interest is based on the time series variance of portfolio average prediction errors for the 100 days from day +61 to day +160. This statistic has a t-distribution with 99 degrees of freedom, and incorporates any cross-sectional dependence in the daily prediction errors. Details of its construction and assumptions are contained in the appendix.[11]

[8] The announcement period results are not sensitive to the choice of the equally weighted or value-weighted index.

[9] The results are not sensitive to the choice between ordinary least squares estimates of the market model parameters and Scholes and Williams (1977) estimates.

[10] Results over short intervals, such as the windows immediately around the event date are not sensitive to the choice of the estimation period, or the use of alternative specifications such as returns or returns minus the market. Estimates over longer periods, such as 60 days or a year, are sensitive to the choice of the estimation period. The estimation method reported is the most appropriate if firms experience abnormal returns, or risk shifts, in the period immediately preceding the rating change, and if rating agencies respond, at least in part, to information that has been released previously.

[11] The significance tests are not sensitive to the choice of the test statistic. We also calculate, but do not report, significance levels by first standardizing each firm's daily prediction error by the square root of the estimated forecast variance of the prediction error. The standardized prediction errors are then averaged across firms each day, yielding a statistic which is distributed unit normal. Significance tests are sensitive to the period used to obtain the variance estimate. Test statistics generally indicate greater significance if the variance is estimated in a prior period. The post event period is more appropriate for variance estimation since it incorporates any change in variance associated with the rating change.

In addition to the test statistic based on an estimate of the time series variance of the portfolio, a t-statistic is calculated based on the cross-sectional standard deviation of firms' abnormal returns for an event window of interest. The degrees of freedom of this statistic are one fewer than the number of firms, assuming cross-sectional independence in the abnormal returns of firms and homoscedasticity across firms in the event window. The cross-sectional t-statistic incorporates any increase in the variance of returns associated with the event in the window examined.

Some results are based on differences in returns between two portfolios. In these tests, an average prediction error is first formed for each portfolio for each event date t. The average prediction errors of the two portfolios are then differenced on each event date. The t-statistic for testing the statistical significance of the difference between abnormal performance of the two portfolios is based on the time series variance of the difference in the average prediction errors over the 100 day period, day +61 through day +160. Further details are contained in the appendix.

We define day 0, the date of initial public disclosure, as the press release date supplied by Moody's and Standard and Poor's.[12] When measuring the price response to the announcement, we examine the two-day window, day 0 and day +1, since the press release can occur after the close of trading on day 0.

As we discuss in sections 5 and 6, some rating changes are resolutions of a previous addition to the Credit Watch List by Standard and Poor's. Those resolutions should have less information content if the actual direction of the rating change is the same as the expected direction. Consequently, 75 bond rating changes are eliminated from the tests in this section because those changes are resolutions of Credit Watch. Tests of resolutions are contained in sections 5 and 6.

4.2. *Summary of results*

This section summarizes the mean results of the stock price tests for the across-class and within-class subsamples of downgrades and upgrades, and for the contaminated and non-contaminated subsamples of downgrades across classes. Subsequent sections provide detailed discussion of the specific results.

(i) Announcements of downgrades across rating classes are associated with negative abnormal stock returns that are statistically significant. No such abnormal returns are detected for downgrades within rating classes.

[12] For the 33 cases where the date of the *Wall Street Journal* story is the same as the press release date, we define day 0 as the day before the press release date. Clearly, in these cases, the information was released to the *Wall Street Journal* on the previous day, and it might have been released to some market participants on that day via, for example, a *Broad Tape* news item.

(ii) Announcements of upgrades are not associated with significant abnormal returns, even if the upgrades cross rating classes.

(iii) Announcements of downgrades across classes have information content even after observations containing other contemporaneous announcements are removed.

In tests not reported, there is no difference in the information content of rating changes announced by Moody's and those announced by Standard and Poor's for the entire sample or for the various subcategories discussed in (i) through (iii). Consequently, all of the reported results are based on the combined sample of Moody's and Standard and Poor's announcements. We separate within-class and across-class rating changes to provide more powerful tests of the mean stock price effect, and because Moody's did not issue within-class rating changes prior to April 1982. In section 5, the regression tests examine the effect of the magnitude of the rating change.

4.3. *Downgrades – Across classes and within class*

Table 3 contrasts the abnormal returns of downgrades across rating classes with the abnormal returns of downgrades within classes. Average prediction errors (APE) and cumulative average prediction errors (CPE) are presented for each subset of downgrades, as well as for the difference between the two groups. The lower portion of table 3 presents the window average prediction errors ($WAPE$) and associated t-statistics for four windows, day -300 to day -61, day -60 to day -1, day 0 to day 1 (the announcement window), and day 2 to day 60.

The abnormal performance on day 0 and 1 is -2.66% for downgrades across classes, and is -0.27% for within class downgrades. Downgrades across classes have a t-statistic of -12.51 for the 0 to $+1$ window, while the t-statistic for the within-class downgrades is -1.06. The difference in the price response between the two groups on days 0 and $+1$ is -2.39%, with a t-statistic of -6.99. The proportion of observations with negative returns during the announcement window is 62.5% and 54.8% for across- and within-class downgrades. The P-values testing whether the indicated proportion of negative returns is significantly greater than 50% are 0.000 and 0.093. The cross-sectional t-statistics which control for any change in variance around the event are -5.04 for the across-class downgrades and -0.96 for the within-class downgrades. Both subsamples experience abnormal returns of at least -15% over the five prior quarters, and abnormal returns for downgrades across classes are -3.35% in the subsequent quarter, while the within-class group gains 1.06%. The abnormal returns of -3.35% in the subsequent quarter are reliably less than zero. This may suggest evidence of a trading rule, but we do

Table 3

Percentage average prediction errors (*APE*), cumulative average prediction errors (*CPE*), window average prediction errors (*WAPE*), and *t*-statistics (*t*-stat.) for various windows: across-class downgrades vs. within-class downgrades.[a] Based on stock returns for sample of 578 downgrades of corporate debt announced by Moody's and Standard and Poor's, 1977–1982.

	Across-class downgrades (402 observations)[c]		Within-class downgrades (166 observations)[d]		Difference	
Trading days[b]	*APE*	*CPE*	*APE*	*CPE*	*APE*	*CPE*
−300 to −61	−13.63	−13.63	−14.19	−14.19	0.56	0.56
−60 to −51	−0.92	−14.55	−0.13	−14.32	−0.78	−0.22
−50 to −41	−1.07	−15.62	−0.41	−14.73	−0.66	−0.88
−40 to −31	−1.72	−17.34	−0.21	−14.94	−1.51	−2.39
−30 to −21	−0.54	−17.88	−0.40	−15.34	−0.13	−2.52
−20 to −11	−0.78	−18.66	−0.42	−15.76	−0.37	−2.89
−10	−0.02	−18.68	0.17	−15.59	−0.19	−3.08
−9	−0.08	−18.76	−0.03	−15.62	−0.05	−3.13
−8	−0.01	−18.77	−0.23	−15.85	0.22	−2.91
−7	−0.36	−19.13	−0.15	−16.00	−0.21	−3.12
−6	−0.24	−19.37	−0.20	−16.20	−0.05	−3.17
−5	−0.29	−19.66	−0.02	−16.22	−0.26	−3.43
−4	−0.05	−19.71	−0.06	−16.28	0.01	−3.42
−3	−0.17	−19.88	−0.13	−16.41	−0.04	−3.46
−2	−0.53	−20.41	−0.28	−16.69	−0.25	−3.71
−1	−0.73	−21.14	−0.06	−16.75	−0.68	−4.39
0	−1.30	−22.44	−0.06	−16.81	−1.23	−5.62
+1	−1.36	−23.80	−0.20	−17.01	−1.16	−6.78
+2	−0.70	−24.50	−0.12	−17.13	−0.58	−7.36
+3	−0.03	−24.53	0.19	−16.94	−0.22	−7.58
+4	−0.18	−24.71	0.10	−16.84	−0.28	−7.86
+5	0.05	−24.66	−0.11	−16.95	0.16	−7.70
+6	0.09	−24.57	0.18	−16.77	−0.09	−7.79
+7	−0.08	−24.65	−0.01	−16.78	−0.06	−7.85
+8	0.26	−24.39	0.16	−16.62	0.09	−7.76
+9	−0.21	−24.60	−0.16	−16.78	−0.05	−7.81
+10	−0.15	−24.75	−0.20	−16.98	0.05	−7.76
+11 to +20	−0.31	−25.06	0.32	−16.66	−0.63	−8.39
+21 to +30	−0.45	−25.51	0.55	−16.11	−1.00	−9.39
+31 to +40	−1.24	−26.75	−0.14	−16.25	−1.10	−10.49
+41 to +50	0.28	−26.47	−0.20	−16.45	0.47	−10.02
+51 to +60	−0.68	−27.15	0.50	−15.95	−1.16	−11.18
Trading days	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.
−300 to −61	−13.63	−5.86	−14.19	−5.13	0.56	0.15
−60 to −1	−7.51	−6.46	−2.56	−1.85	−4.95	−2.64
0 to +1	−2.66	−12.51	−0.27	−1.06	−2.39	−6.99
+2 to +60	−3.35	−2.90	1.06	0.77	−4.40	−2.37

[a]Across classes or within class indicates whether the rating change takes place within gradations of a major class (e.g., AA + to AA −) or whether the rating change crosses classes (e.g., AA − to A +). Moody's did not designate gradations within classes until 1982.

[b]Day 0 is the press release date supplied by Moody's and Standard and Poor's or the day before if the *Wall Street Journal* announcement date is the same as the press release date.

[c]Represents the number of observations on day 0. The number of observations varies between 386 and 412. There are 411 observations on day −1 and day +2, and 386 observations between days +40 and +60.

[d]Represents the number of observations on day 0. The number of observations varies between 165 and 166.

not investigate whether the returns associated with an *implementable* trading strategy are statistically significant.[13]

4.4. Upgrades – Across classes and within class

Table 4 presents the evidence on upgrades, again comparing changes across classes and within class in the same format as table 3. In contrast with the downgrades, there is no evidence of an economically or statistically significant average price response to the announcement of an upgrade. For example, upgrades across classes gain only 0.08% in the period day 0 to day +1. Further, the proportion of observations with negative returns is 50.6%. The *P*-value indicating whether that proportion is significantly greater than 50% is 0.397. There is evidence of positive abnormal performance over the prior five quarters, but little evidence of abnormal performance subsequent to day +1 for upgrades.

Several explanations are consistent with finding price responses for across-class downgrades but not for across-class upgrades. First, the loss function of the rating agency may not be symmetric. Consequently, upgrades may not be as 'timely' as downgrades. Second, management's incentives to release information may not be symmetric. For example, Chambers and Penman (1984) document that, on average, 'good news' accounting earnings reports are 'early', whereas 'bad news' earnings reports are late. This issue could be investigated further by constructing an expectations model of rating changes based on publicly available data at the time of the announcement of the change to determine if significant returns are associated with those upgrades that were least expected.

4.5. Downgrades across classes – Contaminated and non-contaminated[14]

Table 5 presents evidence comparing the contaminated and non-contaminated announcements for all downgrades across rating classes. In the announcement period, the contaminated sample earns −4.77%, while the non-contaminated sample earns −0.96% with *t*-statistics of −13.16 and −3.44. Thus, losses to both groups are statistically significant, but the contaminated group loses an additional 3.81%, and that difference is reliably less than zero. The proportion of contaminated observations with negative abnormal performance in the window day 0 to day +1 is 59.8%, whereas

[13] Similar puzzling results have been documented for earnings reports, dividend announcements and Value Line rank changes (among others). See Ball (1978). These results do not necessarily suggest implementable trading rules because they are calculated in event time, not calendar time, and because they ignore transactions costs.

[14] Results are not reported for contaminated versus non-contaminated upgrades since neither group experiences mean abnormal performance reliably different from zero.

Table 4

Percentage average prediction errors (*APE*), cumulative average prediction errors (*CPE*), window average prediction errors (*WAPE*), and *t*-statistics (*t*-stat.) for various windows: across-class upgrades vs. within-class upgrades.[a] Based on stock returns for sample of 360 upgrades of corporate debt announced by Moody's and Standard and Poor's, 1977–1982.

	Across-class upgrades (235 observations)[c]		Within-class upgrades (125 observations)[d]		Difference	
Trading days[b]	*APE*	*CPE*	*APE*	*CPE*	*APE*	*CPE*
−300 to −61	11.91	11.91	9.43	9.43	2.48	2.48
−60 to −51	1.03	12.94	0.22	9.65	0.80	3.28
−50 to −41	−0.04	12.90	0.38	10.03	−0.40	2.88
−40 to −31	−0.21	12.69	−0.12	9.91	−0.10	2.78
−30 to −21	0.75	13.44	0.92	10.83	−0.17	2.61
−20 to −11	0.83	14.27	0.72	11.55	0.10	2.71
−10	0.04	14.31	0.18	11.73	−0.13	2.58
−9	0.12	14.43	0.02	11.75	0.09	2.67
−8	0.08	14.51	−0.11	11.64	0.20	2.87
−7	−0.05	14.46	0.14	11.78	−0.19	2.68
−6	0.08	14.54	0.01	11.79	0.07	2.75
−5	0.04	14.58	0.24	12.03	−0.21	2.54
−4	0.16	14.74	−0.08	11.95	0.25	2.79
−3	0.08	14.82	−0.08	11.87	0.16	2.95
−2	0.31	15.13	−0.02	11.85	0.33	3.28
−1	0.05	15.18	−0.07	11.78	0.12	3.40
0	0.08	15.26	0.14	11.92	−0.06	3.34
+1	0.00	15.26	0.21	12.13	−0.21	3.13
+2	0.16	15.42	−0.14	11.99	0.30	3.43
+3	−0.22	15.20	0.23	12.22	−0.45	2.98
+4	0.13	15.33	−0.07	12.15	0.20	3.18
+5	0.16	15.49	−0.14	12.01	0.29	3.47
+6	−0.09	15.40	0.03	12.04	−0.11	3.36
+7	0.10	15.50	0.04	12.08	0.06	3.42
+8	−0.03	15.47	−0.10	11.98	0.08	3.50
+9	0.08	15.55	−0.03	11.95	0.10	3.60
+10	0.32	15.87	−0.15	11.80	0.47	4.07
+11 to +20	−0.59	15.28	0.80	12.60	−1.39	2.68
+21 to +30	0.28	15.56	0.12	12.72	0.16	2.84
+31 to +40	0.75	16.31	0.01	12.73	0.74	3.58
+41 to +50	0.03	16.34	−0.38	12.35	0.41	3.99
+51 to +60	0.49	16.83	−0.22	12.13	0.71	4.70
Trading days	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.
−300 to −61	11.91	6.45	9.43	3.28	2.48	0.80
−60 to −1	3.27	3.55	2.35	1.64	0.92	0.60
0 to +1	0.08	0.48	0.36	1.36	−0.27	−0.98
+2 to +60	1.57	1.72	0.00	0.00	1.57	1.03

[a]Across classes or within class indicates whether the rating change takes place within gradations of a major class (e.g., AA + to AA −) or whether the rating change crosses classes (e.g., AA − to A +). Moody's did not designate gradations within classes until 1982.

[b]Day 0 is the press release date supplied by Moody's and Standard and Poor's or the day before if the *Wall Street Journal* announcement date is the same as the press release date.

[c]Represents the number of observations on day 0. The number of observations varies between 231 and 235.

[d]Represents the number of observations on day 0. The number of observations varies between 123 and 125.

Table 5

Percentage average prediction errors (*APE*), cumulative average prediction errors (*CPE*), window average prediction errors (*WAPE*), and *t*-statistics (*t*-stat.) for various windows: contaminated vs. non-contaminated across-class downgrades.[a] Based on stock returns for sample of 412 downgrades of corporate debt announced by Moody's and Standard and Poor's, 1977–1982.

	Contaminated across-class downgrades (183 observations)[c]		Non-contaminated across-class downgrades (224 observations)[d]		Difference	
Trading days[b]	*APE*	*CPE*	*APE*	*CPE*	*APE*	*CPE*
−300 to −61	−12.31	−12.31	−14.74	−14.74	2.43	2.43
−60 to −51	−1.02	−13.33	−0.84	−15.58	−0.19	2.24
−50 to −41	−0.90	−14.23	−1.22	−16.80	0.33	2.57
−40 to −31	−2.74	−16.97	−0.86	−17.66	−1.88	0.69
−30 to −21	−0.95	−17.92	−0.19	−17.85	−0.75	−0.06
−20 to −11	−0.89	−18.81	−0.70	−18.55	−0.19	−0.25
−10	−0.14	−18.95	0.09	−18.46	−0.24	−0.49
−9	−0.01	−18.96	−0.13	−18.59	0.14	−0.35
−8	0.04	−18.92	−0.05	−18.64	0.08	−0.27
−7	−0.48	−19.40	−0.27	−18.91	−0.21	−0.48
−6	−0.40	−19.80	−0.11	−19.02	−0.29	−0.77
−5	−0.50	−20.30	−0.10	−19.12	−0.40	−1.17
−4	0.15	−20.15	−0.24	−19.36	0.39	−0.78
−3	−0.25	−20.40	−0.09	−19.45	−0.16	−0.94
−2	−0.65	−21.05	−0.43	−19.88	−0.22	−1.16
−1	−1.48	−22.53	−0.11	−19.99	−1.38	−2.54
0	−2.26	−24.79	−0.54	−20.53	−1.71	−4.25
+1	−2.51	−27.30	−0.41	−20.94	−2.10	−6.35
+2	−0.91	−28.21	−0.53	−21.47	−0.38	−6.73
+3	−0.16	−28.37	0.08	−21.39	−0.24	−6.97
+4	−0.16	−28.53	−0.19	−21.58	0.03	−6.94
+5	0.12	−28.41	−0.01	−21.59	0.13	−6.81
+6	−0.06	−28.47	0.22	−21.37	−0.28	−7.09
+7	0.34	−28.13	−0.43	−21.80	0.77	−6.32
+8	0.13	−28.00	0.36	−21.44	−0.23	−6.55
+9	−0.44	−28.44	−0.02	−21.46	−0.43	−6.98
+10	−0.39	−28.83	0.03	−21.43	−0.41	−7.39
+11 to +20	−0.23	−29.06	−0.36	−21.79	0.13	−7.26
+21 to +30	−1.11	−30.17	0.07	−21.72	−1.19	−8.45
+31 to +40	−1.02	−31.19	−1.41	−23.13	0.40	−8.05
+41 to +50	1.72	−29.47	−0.87	−24.00	2.59	−5.46
+51 to +60	−0.49	−29.96	−0.81	−24.81	0.32	−5.14
Trading days	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.
−300 to −61	−12.31	−3.11	−14.74	−4.85	2.43	0.47
−60 to −1	−10.22	−5.15	−5.25	−3.45	−4.98	−1.91
0 to +1	−4.77	−13.16	−0.96	−3.44	−3.81	−8.01
+2 to +60	−2.66	−1.35	−3.87	−2.57	1.20	0.47

[a]Across classes or within class indicates whether the rating change takes place within gradations of a major class (e.g., AA + to AA −) or whether the rating change crosses classes (e.g., AA − to A +). Moody's did not designate gradations within classes until 1982. Observations are classified as contaminated if there is a story about the firm in the *Wall Street Journal* during the period −1 to +2 containing information other than the rating change announcement.

[b]Day 0 is the press release date supplied by Moody's and Standard and Poor's or the day before if the *Wall Street Journal* announcement date is the same as the press release.

[c]Represents the number of observations on day 0. The number of observations varies between 170 and 188. There are 187 observations on day −1 and day +2, and only 170 observations by day +31.

[d]Represents the number of observations on day 0. The number of observations varies between 215 and 224.

64.7% of the non-contaminated observations have negative abnormal returns. Associated *P*-values from the binomial test for assessing the probability of observing these proportions or higher, if the true population proportion is 50%, are 0.003 and 0.000. Cross-sectional *t*-statistics are −4.36 for the contaminated sample and −3.15 for the non-contaminated sample. The difference between the time series and cross-sectional *t*-statistics for the contaminated sample reflects the large increase in variance around the rating change. Both groups experience statistically significant negative abnormal performance in the five previous quarters, as does the non-contaminated group in the subsequent quarter. Again, there is evidence consistent with a trading rule, but the returns are not independent of those documented in table 3.

The *Wall Street Journal* may not routinely follow many of the firms we classify as having non-contaminated announcements. Consequently, our non-contaminated sample could contain observations for firms which are more likely to be monitored by other news media. We repeated the tests for that subset of observations with a story about the rating change in the *Wall Street Journal* Index so that there is some evidence that the *Wall Street Journal* follows the firm at the time of the rating change. That subset of 207 observations contains 98 non-contaminated observations and 109 contaminated observations. In the announcement window, the non-contaminated sample earns −1.27% with a *t*-statistic of −4.04, and 73.5% of the firms have negative abnormal performance during the announcement window with a *P*-value of 0.000. The abnormal returns in the announcement period are reliably less than zero.

The results for the non-contaminated sample suggest that rating agencies provide information to the capital markets via downgrades. However, as stated previously, we cannot be certain that we have eliminated *all* concurrent announcements. The results for the contaminated sample of downgrades suggest that, at a minimum, the rating agencies respond quickly to bad news which is released, or which they know will be released. The contaminated sample includes firms with contaminating stories in the period day −1 to day +2. The press release date of the rating change is day 0. Since the announcement window is day 0 to day +1, rating agencies either predict the upcoming news story, know it will be released, or are able to change ratings within one day of a news release. Alternatively, the results on the contaminated sample support the view that rating agencies provide information, or provide additional incentives for management to disclose information.

5. Cross-sectional analysis of abnormal performance

In the results that follow, multivariate regressions are employed to explain cross-sectional variation in abnormal performance in the announcement period, day 0 to day +1. The regressions are estimated separately for downgrades and

upgrades, and for contaminated and non-contaminated announcements in the following form:

$$WPE_j = \beta_0 + \beta_1(\#GRADES_j) + \beta_2(INV\ GRADE_j),$$
$$+ \beta_3(CR\ WATCH_j) + \beta_4(PREV_j) + \beta_5(PRE/POST_j),$$

where

WPE_j ≡ abnormal performance for observation j in the window day 0 to day +1;[15]

$\#GRADES_j$ ≡ the number of grades changed (old rating less new rating) – a cardinal variable measured on the scale of 28 (for rating AAA) to 1 (for rating D);[16]

$INV\ GRADE_j$ ≡ dummy variable equal to one if the rating change moves a bond into investment grade (BBB or above) from below or out of investment grade from above, zero otherwise;

$CR\ WATCH_j$ ≡ dummy variable equal to one if the rating change is a resolution of Credit Watch, zero otherwise;

$PREV_j$ ≡ natural log of the reciprocal of the number of days since the previous rating change in the same direction by the other agency. The number of days is set equal to 60 if both agencies change on the same day, if the previous change by the other agency was in the opposite direction, or if the previous change by the other agency was more than 60 days earlier; and

$PRE/POST_j$ ≡ dummy variable equal to one if the rating change is post December 31, 1980, zero otherwise.

The variable $\#GRADES$ is positive (negative) for downgrades (upgrades), since it is calculated as old rating less new rating. Hence, if downgrades (upgrades) are associated with negative (positive) abnormal performance, the coefficient on $\#GRADES$ should be negative (positive). The variable $INV\ GRADE$ is included to test whether rating changes which move a bond into or out of investment grade are associated with larger absolute price responses. Thus, for downgrades (upgrades), the coefficient on $INV\ GRADE$ should be negative (positive).

[15]Similar results are obtained if standardized abnormal performance is employed as the dependent variable to control for heteroscedasticity.

[16]There are ten major rating classes from D to AAA. Since some classes have three gradations, every class was assigned three numbers. Classes without gradations (D, C, CC, CCC, AAA and all Moody's classes prior to April 20, 1982) are assigned the midpoint of the three numbers. The midpoint is 28 for AAA and 1 for D.

The variable *CR WATCH* allows expectations of a bond rating change to vary across observations. If the change is a resolution of Credit Watch, the intercept for these observations can vary, but the coefficients on the other variables are held constant. We anticipate smaller absolute price responses associated with rating changes that are Credit Watch resolutions resolved in the indicated direction. A positive (negative) sign is predicted for downgrades (upgrades) on this variable. Rating changes not in the direction originally indicated by Credit Watch were eliminated from the regression.

The variable *PREV* provides a test for whether a rating change by one agency has the same price impact if it follows a similar rating change by the other agency. For downgrades (upgrades), the coefficient on *PREV* should be positive (negative) if the information content of the subsequent change is reduced by a similar previous change.

Finally, it has been conjectured that competition among rating agencies has increased and that agencies are monitoring companies more closely now.[17] The variable *PRE/POST* splits the sample roughly in half, and takes on a value of one if the rating change is post 801231. If the above conjectures are true, the coefficient on *PRE/POST* should be negative (positive) for downgrades (upgrades). Similarly to the Credit Watch variable, the *PRE/POST* variable allows post 801231 observations to have a different intercept, but assumes that the coefficients on the other variables are the same.[18]

The results of four separate regressions are reported in table 6. Panel A contains results for the contaminated and non-contaminated downgrades. Panel B contains results for the contaminated and non-contaminated upgrades. The explanatory power of the regression for the non-contaminated downgrades is low (0.3%). The variables *#GRADES* and *INV GRADE* are negative, as predicted, and are significant at the 10% and 5% level, respectively, in a one-tailed test. However, the *F*-statistic implies that the regression as a whole has no explanatory power.

The explanatory power of the regression for the contaminated downgrades is high (31.9%). For those observations, consistent with predictions, the estimated coefficient on *#GRADES* is reliably less than zero (*t*-statistic of −11.23). The coefficient on *#GRADES* suggests that the marginal effect on abnormal performance of a change in rating of one grade (e.g., AA+ to AA or AA− to A+) is −3.69%. The same figure for the non-contaminated

[17]See, for example, 'Moody's Dominance in Municipals Market is Slowly Being Eroded', *Wall Street Journal*, November 2, 1981, pp. 1 and 20, and 'When a City's Debt Rating Falls, Its Costs Go Up, Officials Get Mad', *Wall Street Journal*, October 14, 1985, p. 15.

[18]Alternative specifications of the regression format allow the slope coefficients on variables like *INV GRADE* and *#GRADES* to be different for Credit Watch resolutions and post 801231 observations. We found no strong evidence that these regressions fit the data better using a test for whether the slope coefficients of the various groups were different when the intercepts are allowed to vary. See Maddala (1977, pp. 194–201) for a discussion of tests of linear restrictions.

Table 6

Regression tests of announcement effects: non-contaminated and contaminated downgrades and upgrades.[a] Sample of 1005 rating changes of corporate debt of New York and American Stock Exchange firms announced by Moody's and Standard and Poor's, 1977–1982 (dependent variable is abnormal stock return for each observation measured on day 0 and day +1).

	Independent variables[b]						Adj R^2	#	F-	Studentized
	INTERCEPT	*# GRADES*	*INV GRADE*	*CR WATCH*	*PREV*	*PRE/POST*	(%)	obs.	stat.	range
				Panel A: Downgrades						
Predicted sign		(−)	(−)	(+)	(+)	(−)				
Non-contaminated										
Estimated coefficient	−0.0023	−0.0030	−0.0135	−0.0024	−0.0063	0.0016	0.3	362	1.2	15.53
t-statistic[c]	−0.16	−1.48	−1.76	−0.28	−0.20	0.32				
Mean of variable	1.000	1.994	0.097	0.083	−3.877	0.635				
Std. error of variable	0.000	1.124	0.296	0.276	0.723	0.482				
Contaminated										
Estimated coefficient	0.1123	−0.0369	0.0229	0.0363	0.0133	−0.0243	31.9	270	26.2	11.07
t-statistic[c]	4.15	−11.23	1.11	1.67	2.15	−1.81				
Mean of variable	1.000	2.426	0.111	0.104	−3.645	0.607				
Std. error of variable	0.000	1.978	0.315	0.305	1.031	0.489				

Table 6 (continued)

	Independent variables[b]						Adj R^2	#	F-	Studentized
	INTERCEPT	*# GRADES*	*INV GRADE*	*CR WATCH*	*PREV*	*PRE/POST*	(%)	obs.	stat.	range
				Panel B: Upgrades						
Predicted sign		(+)	(+)	(−)	(−)	(+)				
Non-contaminated										
Estimated coefficient	−0.0128	0.0012	−0.0026	0.0061	−0.0045	0.0006	0.0	214	0.9	7.10
t-statistic[c]	−0.95	1.21	−0.44	0.66	−1.39	0.17				
Mean of variable	1.000	−2.22	0.098	0.037	−3.986	0.407				
Std. error of variable	0.000	1.75	0.298	0.190	0.523	0.492				
Contaminated										
Estimated coefficient	−0.0147	0.0003	−0.0038	−0.0003	−0.0043	−0.0017	0.0	159	0.8	8.56
t-statistic[c]	−1.47	0.20	−0.44	−0.03	−1.84	−0.40				
Mean of variable	1.000	−2.226	0.057	0.031	−3.860	0.403				
Std. error of variable	0.000	1.343	0.232	0.175	0.858	0.492				

[a] Observations are classified as contaminated if there is a story about the firm in the *Wall Street Journal* during the period −1 to +2 containing information other than the rating change announcement. Day 0 is the press release date supplied by Moody's and Standard and Poor's, or the day before, if the *Wall Street Journal* announcement date is the same as the press release date.

[b] *GRADES*: Previous rating − new rating, with ratings measured on a 28 point scale (28 = AAA, 1 = D).
INV GRADE: Rerated across investment grade [BBB or above] (1) vs. not across investment grade (0).
CR WATCH: Rating change is a resolution of previous Credit Watch announcement (1) vs. rating change is not a Credit Watch resolution (0).
PREV: Natural log of reciprocal of number of days since previous rating change by the other agency. Number of days = 60 if both agencies change on same day, if previous change was in different direction or if previous change is more than 60 days earlier.
PRE/POST: First half of sample pre 810101 (0) vs. second half of sample post 801231 (1).

[c] Tests the statistical significance of the difference between the estimated coefficient and zero.

sample is −0.30%. The coefficient on *PRE/POST*, which is significant at the 5% level (one-tail test) is consistent with the conjecture that rating agencies performance has improved subsequent to December 31, 1980. Further, the evidence suggests that resolutions of Credit Watch provide less information than rating changes not preceded by Credit Watch announcements since the coefficient on *CR WATCH* is significant at the 5% level (one-tail test). Similarly, rating changes which closely follow a change by the other agency have less impact. The coefficient on *PREV* is 0.0133 with a *t*-statistic of 2.15.[19] Crossing investment grade does not cause a bigger price response in the contaminated sample. (The *t*-statistic on *INV GRADE* is 1.11, but the coefficient is predicted to be negative.)

The contrast between the regressions for the contaminated and non-contaminated observations is not due to differences in the intercepts. A statistical test easily rejects the hypothesis that the regressions for the contaminated and non-contaminated observations have the same slope coefficients, when the intercepts are allowed to vary.[20] The evidence on the contaminated sample implies that the price response in the announcement period is correlated with rating change variables. Thus, the contamination (the contemporaneous news release) is not simply noise. For example, price declines in the announcement period are a function of the magnitude of the rating change. Even though it is impossible to identify whether the rating change or the concurrent news provided the information, at a minimum the regression results provide evidence that rating agencies respond within one day to a subset of news about the firm which is released, or which they know will be released.

The regressions for the upgrades reported in panel B have no explanatory power, and only one of the variables has an estimated slope coefficient reliably different from zero.[21] The variable *PREV* in the regressions of contaminated and non-contaminated observations is negative as predicted, and is significantly different from zero at the 5% and 10% level (one-tail test).

We conclude that announcements of bond rating downgrades provide information to investors. That conclusion suggests that announcements of

[19]Alternative versions of the *PREV* variable yield similar results to those reported in table 6, e.g., if the variable is defined as the reciprocal of the number of days, the square root of the number of days, or a 0/1 dummy variable set equal to 1 if the changes are within 10 days of each other. Two features of our data reduce the power of tests on the *PREV* variable. First, agencies other than Moody's and Standard and Poor's, such as Fitch, may have announced a rating change shortly before the changes in our sample. Second, our sample does not include Moody's rating changes of industrial revenue bonds nor does it include commercial paper rating changes by any agency.

[20]The *F*-statistic for this test is 18.64, compared with a critical value of 3.02 at the 1% level for (5 and 620) degrees of freedom.

[21]A statistical test cannot reject the hypothesis that the estimated slope coefficients are identical for the contaminated and non-contaminated upgrades. The *F*-statistic with (5 and 361) degrees of freedom is 0.36.

additions to Standard and Poor's Credit Watch List should have information content as well. The remainder of the paper investigates those announcements.

6. Standard and Poor's Credit Watch List additions and resolutions

6.1. Sample of Credit Watch List additions and resolutions

Standard and Poor's instituted the Credit Watch List in November, 1981. Firms are added to the Credit Watch List when Standard and Poor's believes that an upgrading or downgrading is likely, or when the situation is in flux ('developing'), and a rating change of unknown direction is likely. Standard and Poor's announces additions to the Credit Watch List on Fridays. Resolutions resulting in a rating are announced similarly to other rating changes. If Standard and Poor's removes a company from its Credit Watch List and affirms the current rating (i.e., there is no rating change), the announcement is typically made at the same time as new additions to the Credit Watch List. Information about additions to the Credit Watch List is contained in *Standard and Poor's Credit Week*. Moody's does not offer an equivalent product. However, our reading of the *Wall Street Journal* suggests that Moody's has recently adopted a policy of issuing press releases about contemplated rating changes. (See, for example, 'Fruehauf's Debt is Studied by Moody's, May be Upgraded', *Wall Street Journal*, August 31, 1984, p. 10.)

The sample of Credit Watch additions and resolutions includes observations from its inception in November 1981 through December 31, 1983 for firms listed on the New York or American Stock Exchange.[22] Observations are included in the sample if companies have debt other than commercial paper listed for possible rerating. Table 7 summarizes the additions and resolutions of the Credit Watch List and the resolution time for the observations meeting our data requirements. 'Indicated direction' refers to the outcome predicted by Standard and Poor's when the firm is added to the Credit Watch List. 'Actual direction' refers to the action Standard and Poor's eventually took (the resolution). The sample contains 256 additions to the Credit Watch List and 222 resolutions, with 34 actions in the sample still pending as of December 31, 1983. Of the 256 additions, 71.5% (183) are indicated downgrades, 21.5% (55) are indicated upgrades, and 7.0% (18) are listed as developing. The actual direction frequently differs from the indicated direction. For example, 52 of 166 (31.3%) indicated downgrades remain unchanged, and 1.8% (3 of 166) are actually upgraded. For the indicated upgrades, 23.9% (11 of 46) are not resolved in the indicated direction. Rating changes occur within 60 days of the Credit Watch announcement for over 60% of the sample.

[22] The sample includes all observations through 1983 (as opposed to 1982 for the rating changes) to increase the sample size.

Table 7

Credit Watch additions and resolutions. Sample of 256 additions to Standard and Poor's Credit Watch List and their resolution from inception (November 2, 1981) to December 31, 1983.

Panel A: Comparison of actual and indicated direction of Credit Watch additions (number and percentage of observations)

Indicated direction at time of Credit Watch announcement	Actual direction			Total resolved 12/31/83	Unresolved 12/31/83	Total
	Affirmed[a]	Downgrade	Upgrade			
Developing[b]	5 (50.0)[c]	4 (40.0)	1 (10.0)	10 (100.0)	8	18
Downgrade	52 (31.3)	111[d] (66.9)	3 (1.8)	166 (100.0)	17	183
Upgrade	10 (21.7)	1 (2.2)	35 (76.1)	46 (100.0)	9	55
Total	67	116	39	222	34	256

Panel B: Summary resolution time for Credit Watch announcements (number of trading days between addition of observations to Credit Watch List and subsequent resolution)

Time to resolution		Observations	
		#	%
0 to	20 trading days	24	10.8
21 to	40 trading days	59	26.6
41 to	60 trading days	55	24.8
61 to	80 trading days	32	14.4
81 to	100 trading days	26	11.7
More than	101 trading days	26	11.7
Total		222	100.0
Mean: 61.7 trading days			

[a]Affirmed means that the rating of the company's bonds is not changed and the company is removed from the Credit Watch List.

[b]Developing means that a rating change is likely, with the direction of the change uncertain.

[c]Figure in parentheses indicates percentage of observations of an indicated direction which are resolved in a particular direction. For example, 50% of observations indicated as developing (which have been resolved) were affirmed.

[d]Includes two firms whose bond ratings were suspended.

Many rating changes occur even though the firm is not first added to the Credit Watch List. Of the 223 rating changes by Standard and Poor's in our sample subsequent to November 2, 1981, only 33.6% (75) are a resolution of the Credit Watch List.[23] Of these, 60 are downgrades and 15 are upgrades.

Coverage for the Credit Watch additions and resolutions in the *Wall Street Journal* is more complete than for the bond rating change sample as a whole. Of 256 additions to the Credit Watch List, 88.7% (227) are listed in the *Wall Street Journal* Index, and 68.9% (153 of 222) of the resolutions are reported in

[23]The proportion of rating changes which are resolutions of Credit Watch is approximately 35%, even after allowing for a reasonable start-up period.

the *Wall Street Journal* Index. Again, these are underestimates of coverage because we rely on the Index.

6.2. Results – Credit Watch additions[24]

Additions to the Credit Watch List are associated with negative abnormal performance if the indicated action is a downgrade, for both the contaminated and non-contaminated samples. For indicated upgrades, there is little evidence of a stock price impact, although there is a larger price response for the non-contaminated than for the contaminated sample. We do not examine Credit Watch additions indicated as developing because there are only 18 such observations in the sample.

Since all firms placed on Credit Watch in a given week are announced on the same day, we form equally weighted portfolios of all firms in the sample or subsamples with announcements on the same calendar date.[25] Abnormal performance for each firm is calculated in the same manner as for firms in the rating change sample, and the portfolio abnormal performance is an equally weighted average of the abnormal performance of all firms sharing that calendar date. The abnormal performance for the sample or subsample on any event day is the equally weighted average of the abnormal performance of all portfolios in the sample or subsample. The t-statistics are based on the standard deviation of the time series calculated over the period day +60 to day +161. Further details of the test are contained in the appendix.

As in the rating change evidence, results are reported separately for contaminated and non-contaminated observations. Table 8 presents results for the abnormal performance of Credit Watch additions when a downgrade is indicated. Both contaminated and non-contaminated subsamples are reported. Each group contains 58 separate portfolios. Unlike the rating change sample, both the contaminated and non-contaminated subsamples have approximately equal announcement effects. In the announcement window, 0 to +1, abnormal performance for the contaminated sample is −1.47% (with a t-statistic of −2.94), and −1.28% (with a t-statistic of −3.17) for the non-contaminated sample. The difference in abnormal performance is small and statistically insignificant. Cross-sectional t-statistics are −2.35 for the contaminated sample, and −2.24 for the non-contaminated sample. The proportions of

[24]After we circulated the first draft of this paper, we read Wansley and Clauretie (1985). That paper contains a smaller sample, but reports some results similar to those discussed here.

[25]Additions to the Credit Watch List are typically announced each week on Friday at approximately 2:30–3:00 Eastern time. If Friday is a holiday, the announcement is made on Thursday. Typically, the *Wall Street Journal* story about the Credit Watch additions appears on Monday. We define Friday as the event date, day 0, if the *Wall Street Journal* story appears on Monday. If the *Wall Street Journal* story precedes Monday, day 0 is defined as the day before the *Wall Street Journal* story. Since we concentrate on announcement effects, we examine the two-day window, day 0 to day +1.

Table 8

Percentage average prediction errors (*APE*), cumulative average prediction errors (*CPE*), window average prediction errors (*WAPE*), and *t*-statistics (*t*-stat.) for various windows: contaminated vs. non-contaminated Credit Watch additions – indicated downgrades.[a] Based on stock returns for sample of 183 indicated downgrades on Standard and Poor's Credit Watch List from inception (November 2, 1981) to December 31, 1983.

	Contaminated Credit Watch indicated downgrades (58 portfolios)[c]		Non-contaminated Credit Watch indicated downgrades (58 portfolios)[d]		Difference	
Trading days[b]	*APE*	*CPE*	*APE*	*CPE*	*APE*	*CPE*
−300 to −61	−6.80	−6.80	−18.46	−18.46	11.67	11.67
−60 to −51	0.11	−6.69	−1.53	−19.99	1.63	13.30
−50 to −41	−0.81	−7.50	−1.53	−21.52	0.72	14.02
−40 to −31	0.44	−7.06	−0.80	−22.32	1.24	15.26
−30 to −21	−1.67	−8.73	−1.01	−23.33	−0.66	14.60
−20 to −11	1.54	−7.19	−1.71	−25.04	3.25	17.85
−10	−0.12	−7.31	0.38	−24.66	−0.50	17.35
−9	−0.22	−7.53	0.30	−24.36	−0.52	16.83
−8	0.35	−7.18	−0.27	−24.63	0.62	17.45
−7	0.70	−6.48	0.07	−24.56	0.64	18.09
−6	0.01	−6.47	−0.08	−24.64	0.09	18.18
−5	−0.60	−7.07	−0.04	−24.68	−0.58	17.60
−4	0.10	−6.97	−0.38	−25.06	0.49	18.09
−3	−0.08	−7.05	0.82	−24.24	−0.90	17.19
−2	−0.25	−7.30	0.09	−24.15	−0.34	16.85
−1	−0.51	−7.81	0.17	−23.98	−0.68	16.17
0	−0.81	−8.62	−0.59	−24.57	−0.22	15.95
+1	−0.66	−9.28	−0.69	−25.26	0.03	15.98
+2	−0.17	−9.45	−0.50	−25.76	0.33	16.31
+3	0.04	−9.41	−0.43	−26.19	0.47	16.78
+4	0.15	−9.26	0.35	−25.84	−0.19	16.59
+5	−0.20	−9.46	−0.32	−26.16	0.10	16.69
+6	−0.18	−9.64	−0.17	−26.33	0.00	16.69
+7	0.02	−9.62	−0.05	−26.38	0.07	16.76
+8	−0.01	−9.63	−0.25	−26.63	0.24	17.00
+9	0.36	−9.27	0.23	−26.40	0.12	17.12
+10	0.36	−8.91	0.05	−26.35	0.32	17.44
+11 to +20	−0.62	−9.53	0.23	−26.12	−0.86	16.58
+21 to +30	−0.31	−9.84	−0.98	−27.10	0.68	17.26
+31 to +40	0.64	−9.20	0.68	−26.42	−0.03	17.23
+41 to +50	0.40	−8.80	−0.12	−26.54	0.51	17.74
+51 to +60	0.47	−8.33	−0.77	−27.31	1.24	18.98
Trading days	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.
−300 to −61	−6.80	−1.25	−18.46	−4.16	11.67	1.75
−60 to −1	−1.01	−0.37	−5.51	−2.48	4.50	1.35
0 to +1	−1.47	−2.94	−1.28	−3.17	−0.18	−0.30
+2 to +60	0.95	0.35	−2.04	−0.93	2.99	0.91

[a] Observations are classified as contaminated if there is a story about the firm in the *Wall Street Journal* during the period −1 to +2 containing information other than the Credit Watch announcement.

[b] Day 0 is the date of the Credit Watch announcement or the day before the *Wall Street Journal* announcement if the *Wall Street Journal* announcement precedes the Credit Watch announcement.

[c] Represents the number of portfolios on day 0. The number of portfolios varies between 53 and 58. There are only 53 portfolios by day +51. Equally weighted portfolios are formed for all firms in the subsample with announcements on the same calendar date.

[d] Represents the number of portfolios on day 0. The number of portfolios varies between 56 and 58.

Table 9

Percentage average prediction errors (*APE*), cumulative average prediction errors (*CPE*), window average prediction errors (*WAPE*), and *t*-statistics (*t*-stat.) for various windows: contaminated vs. non-contaminated credit watch additions – indicated upgrades.[a] Based on stock returns for sample of 55 indicated upgrades on Standard and Poor's Credit Watch List from inception (November 2, 1981) to December 31, 1983.

	Contaminated Credit Watch indicated upgrades (15 portfolios)[c]		Non-contaminated Credit Watch indicated upgrades (28 portfolios)[d]		Difference	
Trading days[b]	*APE*	*CPE*	*APE*	*CPE*	*APE*	*CPE*
−300 to −61	2.05	2.05	22.35	22.35	−20.29	−20.29
−60 to −51	0.30	2.35	1.25	23.60	−0.95	−21.24
−50 to −41	1.93	4.28	−1.93	21.67	3.86	−17.38
−40 to −31	−2.30	1.98	1.45	23.12	−3.75	−21.13
−30 to −21	2.05	4.03	0.56	23.68	1.49	−19.64
−20 to −11	2.67	6.70	1.81	25.49	0.86	−18.78
−10	−0.78	5.92	−0.02	25.47	−0.77	−19.55
−9	−0.44	5.48	1.05	26.52	−1.48	−21.03
−8	0.19	5.67	−0.24	26.28	0.43	−20.60
−7	0.30	5.97	−0.23	26.05	0.53	−20.07
−6	2.37	8.34	0.10	26.15	2.27	−17.80
−5	6.14	14.48	0.33	26.48	5.80	−12.00
−4	−5.69	8.79	−0.47	26.01	−5.21	−17.21
−3	2.62	11.41	−0.33	25.68	2.96	−14.25
−2	0.87	12.28	−0.14	25.54	1.00	−13.25
−1	0.18	12.46	−0.03	25.51	0.21	−13.04
0	−0.16	12.30	0.31	25.82	−0.48	−13.52
+1	0.26	12.56	0.79	26.61	−0.52	−14.04
+2	−0.22	12.34	−0.50	26.11	0.28	−13.76
+3	0.21	12.55	0.65	26.76	−0.44	−14.20
+4	−0.04	12.51	0.05	26.81	−0.08	−14.28
+5	0.05	12.56	0.02	26.83	0.02	−14.26
+6	0.13	12.69	0.38	27.21	−0.24	−14.50
+7	0.43	13.12	0.03	27.24	0.38	−14.12
+8	−0.91	12.21	−0.09	27.15	−0.81	−14.93
+9	0.04	12.25	0.10	27.25	−0.06	−14.99
+10	−0.38	11.87	−0.30	26.95	−0.07	−15.06
+11 to +20	1.41	13.28	−1.12	25.83	2.51	−12.55
+21 to +30	1.85	15.13	−0.34	25.49	2.21	−10.34
+31 to +40	2.79	17.92	0.81	26.30	1.97	−8.37
+41 to +50	−1.88	16.04	0.38	26.68	−2.26	−10.63
+51 to +60	2.47	18.51	−0.10	26.58	2.58	−8.05
Trading days	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.	*WAPE*	*t*-stat.
−300 to −61	2.05	0.19	22.35	3.96	−20.29	−1.70
−60 to −1	10.41	1.94	3.15	1.12	7.25	1.22
+0 to +1	0.10	0.10	1.10	2.14	−1.00	−0.92
+2 to +60	5.95	1.12	−0.04	−0.01	5.99	1.01

[a] Observations are classified as contaminated if there is a story about the firm in the *Wall Street Journal* during the period −1 to +2 containing information other than the Credit Watch announcement.

[b] Day 0 is the date of the Credit Watch announcement or the day before the *Wall Street Journal* announcement if the *Wall Street Journal* announcement precedes the Credit Watch announcement.

[c] Represents the number of portfolios on day 0. The number of portfolios varies between 11 and 15. There are only 11 portfolios by day +51. Equally weighted portfolios are formed for all firms in the subsample with announcements on the same calendar date.

[d] Represents the number of portfolios on day 0. The number of portfolios varies between 25 and 28.

contaminated and non-contaminated portfolios with negative returns in the announcement period are 56.9% and 62.1%, with P-values of 0.179 and 0.043. Abnormal per formance prior to the change is not reliably different from zero for the contaminated observations, but it is reliably different from zero for the non-contaminated observations. In contrast to the rating change announcements, there is no evidence of systematic abnormal performance subsequent to the Credit Watch announcement.

Table 9 reports results for the additions to the Credit Watch List when a potential upgrade is indicated. The contaminated sample consists of 15 portfolios and the non-contaminated sample consists of 28 portfolios. The contaminated sample gains 0.10% in the announcement window, but 60% of the portfolios experience negative abnormal performance. In the same period, the non-contaminated group experiences positive abnormal performance of 1.10% with a t-statistic of 2.14 and a cross-sectional t-statistic of 2.18. Only 32.1% of the non-contaminated portfolios experience negative abnormal performance over days 0 to +1. The probability of obtaining a sample proportion of 32.1% or less from a sample of 28 is 0.018 if the true population proportion is 50%. Thus, for the first time, there is evidence of positive abnormal performance associated with upgrades. There is no evidence of abnormal performance subsequent to the announcement.

6.3. Results – Credit Watch resolutions

Resolutions of the Credit Watch List occur when the bond rating is changed, or when Standard and Poor's affirms the current rating of the company. Regression results in table 6 for contaminated downgrades suggest that 75 rating changes representing resolutions of Credit Watch prior to 1983 provide less information than rating changes not preceded by Credit Watch additions. In unreported tests of the mean effect of 222 resolutions through 1983, we find little evidence of significant abnormal performance, regardless of whether the rating was revised in the indicated direction or affirmed. Reliable inferences about resolutions contrary to the indicated direction are hampered by small sample sizes. Larger sample sizes available with the passage of time will provide more insight into the announcement effect of those resolutions.

7. Summary and conclusions

Our results suggest that rating agencies provide information to the capital market. Previous studies have either failed to find significant price responses to rating change announcements, or found price responses using monthly data. Using monthly data, instead of daily data, increases the probability that the price response is due to other information released during the month. We use a two-day window to measure abnormal performance and eliminate observa-

tions if other stories contained in the *Wall Street Journal* could have affected prices in the two-day window.

Results for the non-contaminated sample may overstate the price response to a rating change because of concurrent information releases not included in the *Wall Street Journal* Index. On the other hand, the procedure can understate the response for three reasons. First, in some cases, the rating change may induce management to disclose information because rating agencies warn firms when they are about to announce a rating change. Second, our classification scheme eliminates observations where the rating agency responds quickly to an event, or even predicts one. The faster the agency responds, the more likely the observation is eliminated. For example, when Moody's lowered the ratings on Cleveland Electric's debt on Thursday, the *Wall Street Journal* reported that 'the rating agency's move was the first response of the investment community to a Wednesday ruling by the Ohio Supreme Court', and Standard and Poor's 'made a similar lowering of the company's securities even before the court ruling'. (See *Wall Street Journal*, July 17, 1981, p. 41.) Third, in some cases, the company changes its intended actions because of the rating change. We classify those observations as contaminated if news of the intended action is released around the time of the rating change. For example, Houston Lighting and Power cancelled a $35 million issue of preferred stock and reduced the maturity of $125 million in mortgage bonds from 30 to 10 years because of a downgrade. (See *Wall Street Journal*, November 25, 1981.)

An expectations model of rating changes could provide more powerful tests of the effect of rating change announcements by concentrating on those which are least expected. Comments in the financial press suggest that at least some rating changes are expected:

> 'Most analysts said they had been expecting the move [rating change] and added that it probably wouldn't have any severe impact on Ford's borrowing plans. The lower ratings were a 'forgone conclusion,' said one auto analyst.' (*Wall Street Journal*, March 20, 1980, p. 36)

Some managers are even more candid:

> 'I'm surprised we weren't put on the [Credit Watch] list before,' Andrew Sigler, Champion's Chairman and chief executive officer, said: 'We're doing fine within the industry but the entire forest industry is in terrible shape. Business is rotten.' (*Wall Street Journal*, June 7, 1982, p. 28)

An expectations model of rating changes could be based on yields to maturity of bonds of a given class. Differential yields within a given class might imply which rating changes are more or less expected.

Appendix

A.1. Statistical test of significance

As discussed in the text, the time series of the average prediction errors, APE_t, is calculated from day -300 through day $+60$ relative to the announcement of the bond rating (i.e., day 0). An estimate of the variance of this series, $\hat{\sigma}^2_{APE}$, is calculated from the 100 days from $+61$ through $+160$ as

$$\hat{\sigma}^2_{APE} = \frac{1}{99} \sum_{t=+61}^{+160} \left(APE_t - \overline{APE}\right)^2,$$

where $\overline{APE}$ is the mean average prediction error for the 100 days.

The abnormal return over a variety of holding periods is of interest. To calculate the abnormal return for any period of k days from t to $t+k$, the average prediction errors are cumulated over the k days from t through $t+k$, to form window average prediction errors ($WAPE$),

$$WAPE_{t,t+k} = \sum_{\tau=t}^{t+k} APE_\tau.$$

The significance of $WAPE_{t,t+k}$ is estimated using the test statistic

$$t = WAPE_{t,t+k} / \sqrt{k}\,\hat{\sigma}_{APE},$$

which is distributed Student-t with 99 degrees of freedom if the average prediction errors, the APE_t, are normally distributed and independent through time.

A.2. Difference in returns

The time series of the difference between the average prediction errors for each of two portfolios, APE^1_t and APE^2_t, is calculated from day -300 through day $+60$ relative to the press release date, i.e.,

$$DPE_t = APE^1_t - APE^2_t, \qquad t = -300, \ldots, +60.$$

The time series of the difference is then considered a portfolio return. Abnormal returns are calculated over a variety of holding periods, and their statistical significance is calculated using the t-statistic discussed above. That statistic for the difference is distributed Student-t with 99 degrees of freedom, if each of the average prediction error series (APE^1_t and APE^2_t) is normally distributed, and each is independent through time.

A.3. Binomial tests of proportions

The paper reports the proportion of firms with negative prediction errors for various periods of interest. The associated P-values indicate the probability of observing at least that proportion of firms with negative prediction errors if the population proportion is 50%. The P-values assume that the individual observations represent independent draws from a binomial distribution with a mean of 50% and a variance of ($n \times 50\% \times 50\%$), where n is the number of firms.

A.4. Portfolio returns for Credit Watch

For the Credit Watch sample, portfolios are formed for each announcement day in calendar time because Credit Watch announcement dates contain multiple observations. Prediction errors, PE_{it}, for each firm are first averaged across the n_t firms that share the same *calendar* announcement day to form a portfolio prediction error,

$$PE_{pt} = \frac{1}{n_t} \sum_{i=1}^{n_t} PE_{it}.$$

To form an average prediction error, APE_t, for each *event* day, the portfolio prediction errors, PE_{pt}, are then averaged across the N_t portfolios, where each portfolio consists of all observations announced on the same *calendar* day,

$$APE_t = \frac{1}{N_t} \sum_{p=1}^{N_t} PE_{pt}.$$

The average prediction errors are then cumulated over various windows, and test statistics are calculated as described above.

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