Security Analysts' Incentive and Cognitive Processing Bias: Evidence from Analysts' Recommendations

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Abstract

This study examines how incentive- and behavior-based variables affect analyst recommendation revisions. We use duration analysis to test analysts' underreaction to information by isolating effects of incentives and cognitive processing biases on the timing of recommendation revisions. As controlling for favorable (unfavorable) preceding recommendations, we find that analysts delay conveying bad (good) news, which is consistent with the predictions of both incentives and cognitive dissonance hypotheses (only the cognitive dissonance hypothesis). We also find that analysts delay responses to favorable information for outperformers with lower representative information, suggesting that analysts' underreaction to new information is partially from the conservatism effect.

Keywords: Analyst recommendation; Cognitive processing bias; Cognitive dissonance; Conservatism; Incentive; Overreaction; Underreaction

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1. Introduction

Considerable prior research supports the notion that analysts' stock ratings are perceived to be informative.[1] Yet, although research confirms the importance of sell-side security analysts for their efficient functioning within capital markets, the credibility and objectivity of their stock recommendations remains a matter of considerable debate. Barber et al. (2006) find that in mid-2000 buy recommendations accounted for about three-fourths of total outstanding recommendations while sell recommendations totaled only 2 percent. Altinkilic and Hansen (2009) suggest that analyst recommendations are information-free because recommendation changes often piggyback on corresponding news. Therefore, we examine whether and how analysts bias their reports for either strategic or behavioral reasons.

Prior literature has shown that analysts' tendency to issue excessively optimistic stock recommendations can be linked to certain strategy-based incentives, including cultivating management relations to access private information (Francis and Philbrick 1993; Hodgkinson 2001; Boni and Womack 2002; Conrad et al. 2006), generating investment banking business (Dugar and Nathan 1995; Lin and McNichols 1998; Irvine 2004; O'Brien et al. 2005; Barber et al. 2006), and boosting trading commissions (Kim and Lustgarten 1998; Jackson 2005; Cowen et al. 2006; Niehaus and Zhang 2010).[2] Consistently issuing overly optimistic recommendations on most stocks analysts cover can result in limiting the investment value of their recommendations. Mikhail et al. (2004) show that investment strategies following analysts' recommendations do not generate better performance than average returns after taking transaction costs into account. Moreover, this skewness of the optimistic recommendation distribution catches the attention of policymakers. In mid-2002, the National Association of Securities Dealers (NASD) and the Securities and Exchange Commission (SEC) issued NASD 2711 and Rule 472, respectively, which require analysts to report the proportion of their buys, holds, and sells recommendations.[3] The disclosure requirement presumably pressures brokers and analysts to adopt a more balanced rating distribution and to curb potentially biased reports. However, the unbalanced recommendation distribution may attribute to not only incentives bias but also behavioral bias.

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[1] See Stickel (1995), Womack (1996), Barber et al. (2001, 2003, and 2006), Jegadeesh et al. (2004), Ramnath, Rock, Shane (2008) and Moshirian et al. (2009) for examples.

[2] Related literature also shows that analysts issue imperfect—and, on average, overly optimistic—earning forecasts (e.g., Brown 1993; Das et al. 1998; Dugar and Nathan 1995; Lys and Sohn 1990; Mendenhall 1991; O'Brien 1988).

[3] NASD proposed Rule 2711, *Research Analysts and Research Reports*, on February 7, 2002, which was approved by SEC on May 8, 2002, with an effective date for implementing the provisions of no later than September 9, 2002. A related provision of NASD 2711 also requires that all brokerage firms must disclose definitions for *buy, hold*, and *sell* in their reports. The modified NYSE Rule 472 has an identical reporting requirement of NASD 2711.

According to analysts' cognitive-based arguments, analysts may fail to set aside preexisting perceptions when processing information.[4] Prior studies provide substantial evidence that cognitive processing biases affect the formation of analysts' opinions. Barberis et al. (1998) study analyst behavior on overall firms and model how analysts overemphasize prior information and underemphasize new information when valuing firms. Cornell (2001) finds that analysts are reluctant to recognize negative changes in corporate fundamentals, and Eames et al. (2002) suggest that, when generating earnings forecasts, analysts tend to process information in a manner that biases forecasts in the direction that supports their investment recommendation. Abarbanell and Lehavy (2003) find that cognitive obstacles prevent analysts from revising their forecasts downward, and Friesena and Wellerb (2006) provide strong evidence that analysts are overconfident regarding the precision of their own information and are also subject to cognitive dissonance bias. Mokoaleli-Mokoteli and Taffler (2009) find evidence that analysts issue recommendations based on stereotypes instead of the underlying characteristics of the firms they follow.

These cognitive processing biases attribute to the analysts' inefficiency in generating timely and accurate recommendations. The unconscious tendency to process information in a manner that supports one's prior beliefs leads to cognitive dissonance (Festinger 1957), which is the psychological discomfort that accompanies evidence contradicting prior beliefs. To avoid this psychological discomfort, people tend to forget dissonant information (Wicklund and Brehm 1976). Conservatism, another cognitive processing bias regarding underreaction to new information, suggests that individuals do not update their beliefs adequately in the face of new evidence if they believe that the evidence is not representative (Edwards 1968). The difference between cognitive dissonance and conservatism is the characteristics of information: Whereas any discord information may create cognitive dissonance, conservatism is compounded by low representative information. The premise of investor conservatism stems from a number of studies reporting investors' underreaction to new information (Abarbanell and Bernard 1992; Barberis et al. 1998). Thus, according to our cognitive processing biases hypotheses, we posit that in generating recommendations, cognitive dissonance and conservatism cause analysts to deviate from rational Bayesian updating.

Building on these two lines of literature, we investigate the effects of incentives and cognitive processing biases on analysts' revision recommendations. To do so, we follow O'Brien et al (2005) to examine evidence concerning the time it takes for sell-side analysts to convey good news by issuing favorable recommendation revisions

[4] Some research suggests that forecast bias results from a cognitive-based perspective. See Kothari (2001) for a review.

relative to conveying bad news by issuing unfavorable recommendation revisions. We provide univariate and Cox hazard model tests to investigate the effects of incentives and cognitive processing biases and report the pattern of analysts conveying good news (favorable recommendation revisions) and analysts conveying bad news (unfavorable recommendation revisions) while controlling for preceding recommendations. We find that the difference in duration between analysts' favorable and unfavorable revisions is insignificant under the unconditioned circumstances. Thus, the notion of delayed response to the bad news of the incentive-based explanation is not supported. When we control for analysts' preceding recommendations, we find that analysts delay conveying bad news if they have previously issued favorable recommendations but they do not delay conveying bad news if they have previously issued unfavorable recommendations. The former result is consistent with the phenomenon of incentives and cognitive processing biases concerns. However, the latter result is not consistent with the incentives explanation and suggests that analysts' incentive to be unduly optimistic is not the only factor that influences recommendation revisions.

Analysts' slowness in conveying good news after having previously issued unfavorable recommendations may be explained by either slow stock price recovery by the firm itself or a sluggish stock market. To discriminate among these explanations, we examine the differences in the length of time elapsed to upgrade outperformers and underperformers between a prior unfavorable preceding recommendation and the current revision. This comparison also allows us to distinguish between the different criteria used to classify recommendations into favorable or unfavorable categories. For example, a longer time to convey good news may be due to an analyst's higher criterion of issuing favorable revisions. However, if the analyst delays upward revisions for outperformers but not underperformers, then the delay cannot be attributed to higher upgrade standards and is more likely linked to incentive- or cognitive dissociative-based reactions.

Results suggest that neither a slow price recovery of the previously unfavorably rated stocks nor a sluggish stock market explains the slower pace at which analysts make upward revisions. In addition, to examine the alternative explanation of risk compensation to the outperformers, we control market risk and find no support to suggest that risk compensation drives analysts to delay good news recommendations following preceding unfavorable recommendations. Thus, the findings once again suggest that cognitive dissonance impacts analysts' decision to delay upgrading stocks previously rated unfavorably.

The underreaction phenomenon is also consistent with conservatism, which suggests that individuals underreact to new information if they believe that the

information is not representative. Thus, we further investigate whether analysts delay updating their recommendations for outperformers due to conservatism. Using recommendation reversal as the proxy for low representative information, we find evidence that analysts delay their response to new favorable information for outperformers when they have prior experience in processing low representative information relative to high representative information. After our controlling analysts' coverage preference for size, earnings surprise, year, and industry, the results remain robust.

This paper contributes to the analyst recommendation literature in three ways. First, we show that incentive- and cognitive-based processing biases (i.e., cognitive dissonance and conservatism), affect analysts' timing of recommendation revisions. We use duration analysis to test directly analysts' underreaction to new information by isolating the effects of incentives and cognitive biases on the timing of their recommendation updates. As a result, this paper is a first step in empirically linking analyst recommendations with information processing biases. Thus, this study identifies factors that may, at least partially, explain the outstanding performance of value portfolios relative to glamour stocks—an anomaly that is pronounced even among stocks that are heavily followed by security analysts. Second, our evidence corroborates both incentive-based and behavior-based hypotheses on analysts' underreaction to new information when issuing recommendations. Specifically, we focus on analysts' processing of information to account for reorganization of the representativeness (high or low) of information. Thus, whereas prior literature typically attributes the underreaction phenomenon to conservatism without identifying information representation, we provide primary evidence that analysts' underreaction to new information is compounded by the effect of conservatism. Finally, this study provides assistance to analysts in developing decision aids and mitigating information processing biases.

The remainder of this paper is organized as follows. Section 2 describes the background and develops the hypotheses regarding analysts' timeliness of conveying new information. Section 3 describes the research design and data selection. Section 4 provides the empirical results. Section 5 provides robustness test results, and Section 6 concludes.

2. Hypothesis Development

2.1 Incentives and cognitive dissonance

This study builds on prior research that has explored the effects of incentives and

cognitive processing biases on analyst recommendations. The incentives hypothesis asserts that analysts issue unduly optimistic opinions regardless of their prior cognition; that is, they tend, in general, to underreact to bad news. On the other hand, the cognitive processing biases hypothesis stresses analysts' unconscious tendency to underreact to information with certain characteristics. In the case of cognitive dissonance, analysts are prone to underreact to bad (good) news if their prior beliefs are positive (negative). The effects of incentives and cognitive dissonance on analyst recommendations are illustrated in Figure 1. If analysts underreact to bad news, regardless of their prior beliefs, the incentives hypothesis dominates the cognitive processing biases hypothesis (i.e., both grids II and IV hold). However, if analysts with negative preceding beliefs underreact to good news and analysts with positive preceding beliefs underreact to bad news, the effect of cognitive processing biases exists (i.e., both grids II and III hold).

[INSERT FIGURE 1 ABOUT HERE]

To investigate whether incentives or cognitive processing biases come into play when analysts make stock recommendations, we examine the timeliness of recommendation updates. If analysts are prone to respond promptly to good news relative to bad news to maintain management relationships, we should observe that analysts favorably update firms in a more timely manner than unfavorably update firms with both positive and negative preceding opinions. If analysts are subject to cognitive processing biases, they are prone to respond promptly to good (bad) news when they have positive (negative) preceding belief. We classify recommendations simply as either favorable or unfavorable and include *hold* recommendations in our unfavorable category because the literature suggests that a *hold* recommendation is a euphemism for *sell* (e.g., Francis and Soffer 1997; Lin and McNichols 1998).[5] Therefore, our hypotheses stated in alternative form for incentives and cognitive processing biases are as follows:

H_1: Following favorable preceding recommendations, analysts reiterate upward recommendations in a more timely fashion than they make downward recommendation revisions, which is consistent with the incentives explanation and the cognitive dissonance explanation.

H_{2A}: Following unfavorable preceding recommendations, analysts issue upward recommendation revisions in a more timely fashion than they reiterate unfavorable recommendations, which is consistent with the incentives

[5] We also conduct tests with the unfavorable category consisting of only *sell* and *strong sell* recommendations. The third hypothesis test does not provide meaningful results due to the small sample size. The other robustness test results do not qualitatively change the conclusion of our paper. All untabulated results are available on request.

explanation.

H_{2B}: Following unfavorable preceding recommendations, analysts reiterate unfavorable recommendation revisions in a more timely fashion than they issue upward recommendations, which is consistent with the cognitive dissonance explanation.

2.2 Competing explanation

An alternative explanation for analysts' delaying conveying good news conditions on an unfavorable preceding recommendation is firms' slow recovery[6] or a sluggish stock market. To account for these circumstances, we extend the examination of the experimental group in the H_2 portfolio in which analysts' favorable recommendation revisions are conditioned on an unfavorable preceding recommendation. We partition the sample with extreme subsequent stock performance after the unfavorable preceding recommendations into two portfolios, underperformers and outperformers, and examine the difference in time lengths for upgrading the two subsamples. If analysts take more time to convey good news to underperformers than to outperformers (i.e., if the duration is longer between the initial recommendation and upward revision for underperformers than outperformers), the results would suggest that the delay can be attributed to firms' slow recovery rather than analysts' reluctance to issue opinions against their prior beliefs due to behavioral reasons, such as cognitive processing biases. We also control the price performance by employing a market model[7] to discriminate against the explanation of a sluggish stock market. Therefore, we offer the following hypothesis stated in alternative form:

H_3: Following analysts' unfavorable preceding recommendations, analysts issue upward recommendation revisions in a more timely fashion for underperformers than for outperformers.

2.3 Conservatism

Another source of cognitive processing bias is conservatism, which suggests that individuals do not update their beliefs adequately in the face of new evidence (Edwards 1968). According to Edwards' experiment, if new information is not representative, people overrely on their prior beliefs. Our empirical pattern of analyst underreaction to favorable new information for outperformers in H_3 is consistent with an underlying

[6] On the other hand, if the market underreacts to analysts' prior unfavorable recommendations, the duration between recommendations for companies with successive unfavorable recommendations may be shorter. Our untabulated test results, nevertheless, show that market underreaction does not appear to result in shorter duration for these firms.

[7] We use S&P500 returns as a benchmark and estimate the slope coefficients for the market model via (–120, 10) and (10, 120) windows to calculate abnormal returns.

psychological conservatism. To investigate whether the delay in updating their beliefs for the outperformers when new evidence appears is attributable to conservatism, we define a conservatism group consisting of only outperformers with immediate analyst experience of less representative information, and then examine the timeliness in which the analysts update their opinions upward for this subgroup. We use the prior recommendation reversal as an indicator of less representative information. If the recommendation reversal contributes to analysts' less timely release of a favorable opinion for the outperformer, the results would suggest that conservatism compounds the subsequent cognitive dissonance and leads to an identifiable underreaction to favorable new information for the outperformer. Accordingly, our fourth hypothesis focuses on the difference in the timeliness of analysts' upgrades for the conservatism group, which consists of outperformers with the prior recommendation reversal, and a matching group, which consists of outperformers with the prior recommendation reiteration. We develop the hypothesis stated in alternative form as follows:

> *H_4: Following analysts' unfavorable preceding recommendations, analysts issue upward recommendation revisions in a more timely fashion for outperformers with recommendation reiterations than for outperformers with recommendation reversals.*

3. Data and Research Design

3.1 Data

Analysts issue recommendations revisions when they recognize the current value of underlying firms is mispriced. To capture the timeliness of analysts' conveyance of good news and bad news, we compare the duration of analysts' issuance of upward revisions and downward revisions. Our sample consists of recommendations for S&P500 companies from January 1995 to May 2002. We obtain analyst recommendations from First Call, stock returns from CRSP, and earnings data from COMPUSTAT. We use S&P500 companies to test our hypotheses for two reasons. First, analysts tend to concentrate on large companies and issue more frequent recommendations for large capitalization companies. Second, if a small company performs poorly, it is more likely to be dropped by analysts rather than to receive an unfavorable recommendation.[8] Because First Call does not identify dropped coverage, using large capitalization companies exclusively helps mitigate potential noises. We fix the end of our observation window for revisions at 18 months after the issuance of prior

[8] McNichols and O'Brien (1997) suggest that analysts are prone to drop coverage when faced with unexpected bad earnings news rather than issue negative recommendations.

recommendations to further moderate the influence of discontinued coverage.[9] That is, revision observations with duration greater than 18 months following the prior recommendations are excluded.

Because NASD and SEC issued Rule 2711 and Rule 472, respectively, in mid-2002, which require that analysts report their proportion of *buys*, *holds*, and *sells* recommendations, we reexamine our hypotheses by using post-ruling observations to corroborate our conjecture. Two sample periods are conducted: June 2002 to 2004 and September 2002 to 2004. The former is from the month of SEC approving Rule 2711, and the latter is from the month of Rule 2711 implementation. The untabulated results show that incentives effect is statistically insignificant; the cognitive processing biases hypothesis still holds but is slightly less significant. We also conduct robustness test with controls on analysts' preference of coverage in Section 5.

3.2 Research model

We adopt Cox proportional hazard model to investigate the timeliness of analysts' responses to new information (O'Brien et al. 2005). Using duration analyses, we test whether analysts convey good news through recommendation revisions in a more timely fashion than they convey bad news. Namely, we examine the length of time before analysts making upward recommendation revisions relative to making downward revisions. We measure the duration in the hazard model as the number of days from the preceding recommendation to the current recommendation issued by the same analyst. For example, to test H_1 and H_{2A} we examine whether analysts issue favorable recommendations in a more timely fashion than they make downward revisions, following the analyst's favorable and unfavorable preceding recommendation, respectively. The duration before an upward revision is the number of calendar days between the preceding recommendation and the current favorable revision. We adopt downward revisions as a comparison base to measure the relative speed of upgrades.

The data for duration analyses have right censored observations and cannot be analyzed without taking into account the censored observations because longer-lived prior opinions are generally more likely to be censored. Another characteristic of our data is that responses cannot be negative. Accordingly, an adjustment such as a log transformation for the duration of two successive recommendations may be necessary or

[9] Barber et al. (2006) restrict their recommendation observations less than 12 months under the assumption that such a recommendation has become stale. We follow their assumption and the untabulated results are robust to the inclusion of observations with duration between the preceding and current recommendations of less than one year. We also repeat the analysis but exclude observations with duration between the preceding and current recommendations exceeding two years and obtain a similar result. We treat durations of two successive recommendations greater than two years as a presumed dropped coverage. Such exclusion trades off a decrease in the number of observations of less than 7% against an increase in the standard deviation of a duration of more than 60%.

that specialized methods may be more appropriate than those that assume a normal distribution for the error term. Cox (1972, 1975) introduced the partial likelihood function to estimate the unknown regression parameters associated with the explanatory variables. Adopting the Cox regression, we can estimate unbiased and asymptotically normal coefficients without identifying the form of the baseline hazard function. The general form of the Cox proportional standard continuous-time model is

$$h_i(t) = \lambda_0(t)\exp(Z_i'\beta), \quad (1)$$

where $\lambda_0(t)$ is an unspecified baseline hazard function, Z_i is the vector of explanatory variables for the i^{th} observation, and β is the vector of coefficients.

4. Empirical Results

4.1 Univariate analysis for incentives and cognitive dissonance hypotheses

Table 1 provides descriptive statistics on recommendations and durations. Panel A reports distributions of analysts' preceding recommendations and matched current recommendation revisions. Our distribution of outstanding stock recommendations is similar to Barber et al.'s (2006) Figure 1, showing that before NASD 2711 went into effect in September 2002, the percentage of *strong buy* and *buy* recommendations is approximately 65%; *strong sell* and *sell* recommendations, less than 5%; and *hold* recommendation, around 30%. Panel B reports distributions of analysts' recommendations and recommendation revisions. The percentages of preceding and current favorable recommendations are 68.80% and 65.75%, respectively. The results show that the number of analysts conveying good news is greater than those conveying bad news regardless of whether they issued a favorable or an unfavorable opinion on the preceding recommendation. These findings are consistent with previous studies, suggesting that analysts are prone to be optimistic when valuing firms.

[INSERT TABLE 1 HERE]

We conduct a univariate test to determine the pattern of analysts conveying good (bad) news by releasing favorable (unfavorable) recommendation revisions. Panel C of Table 1 shows that analysts take approximately 170 (175) days to convey positive (negative) information through favorably reiterating (downgrading) the stocks from favorable preceding recommendations.[10] Both mean and median differences in duration

[10] The equality-of-variances test results suggest unequal variances for the unconditioned case, for which the folded F statistic is 1.04, with p = 0.0474. We thus use the Satterthwaite test to obtain t values assuming unequal variance.

between favorable and unfavorable revisions are significant, consistent with the notion that analysts spend less time to upgrade than to downgrade a firm. This result is consistent with the incentives hypothesis, showing analysts' tendency to issue favorable opinions to maintain good relations with management. Moreover, this result is consistent with cognitive processing biases hypothesis, which suggests that analysts are more likely to accept evidence that is consistent with their prior opinions.

In terms of H_{2A} and H_{2B}, the results in panel C of Table 1 show that analysts take approximately 171 (137) days to convey positive (negative) information through upgrading (negatively reiterating) the stocks, when the preceding recommendation is unfavorable.[11] In this case, cognitive processing biases dominate analysts' incentives to issue optimistic recommendations. Therefore, when we condition on the unfavorable preceding recommendation, analysts appear to convey bad news more promptly than good news. Collectively, when we control for the preceding recommendations, the univariate tests show that analysts are not biased against conveying bad news as opposed to good news, at least when measured in terms of timeliness. The descriptive statistics support the notion that the incentives hypothesis is, at best, not the only factor that influences analysts' recommendation revisions and analysts are subject to cognitive processing biases when revising their recommendations.

4.2 Hazard model analysis for incentives and cognitive dissonance hypotheses

We further use a hazard model to test the difference in duration between analysts' decision to revise favorably and to revise unfavorably. We adopt unfavorable revisions as a baseline to measure the timeliness in which analysts convey good news and report the results of Cox regressions for our hypotheses of upward recommendation revisions. Panel A of Table 2 provides the results of the likelihood ratio, score, and Wald test statistics to show the suitability of the upgrade indicator as an explanatory variable.

[INSERT TABLE 2 HERE]

In Panel B of Table 2, the negative coefficient for stocks with unfavorable preceding recommendations indicates that analysts take more time to upgrade than to downgrade previously unfavorably rated stocks. The hazard ratio of 0.746 suggests that, conditional on having arrived at time *t* without an update, analysts are 74.6% likely to revise upward than downward for stocks previously receiving unfavorable recommendations. The Cox regression result confirms the univariate test and refutes the view that analysts convey good news in a more timely manner than they convey bad news when we control for unfavorable preceding recommendations. In terms of

[11] The folded *F* statistic is 1.35, with $p = <0.0001$, suggesting that the hypothesis of equality of variances is not supported; therefore, we use the Satterthwaite test to obtain *t* values assuming unequal variance.

conditioning on the favorable preceding recommendation, the hazard ratio for favorable revision is 1.016, indicating that analysts are 101.6% likely to revise upward than downward for stocks previously receiving favorable recommendations. The insignificant hazard ratio does not statistically support the incentives hypothesis. Because analysts issued favorable recommendations previously, they may have weaker incentives to reiterate favorable opinions, echoing the finding of O'Brien et al. (2005), analysts are more likely to downgrade from an initial favorable recommendation. Another explanation is that our study considers both affiliated and unaffiliated analysts' optimism on the issuance of recommendations; however, related research mainly focuses on analysts with investment banking ties or market makers (e.g., Michaely and Womack 1999; O'Brien et al. 2005; Bradley et al. 2008; Madureira and Underwood 2008). The weaker incentives of our observations could be driven by less biased revisions of our unaffiliated analysts. Likewise, when assessing stocks with previously unfavorable recommendations, analysts may delay a favorable recommendation longer than reiterating an unfavorable recommendation due to market or behavioral reasons.

4.3 Competing explanation and recommendation drift

Panel A of Table 3 presents 531 and 586 observations for outperformers (i.e., within the last quartile of cumulative abnormal stock returns) and underperformers (i.e., within the first quartile of cumulative raw returns) with favorable revisions conditioned on unfavorable preceding recommendations. The mean (median) cumulative abnormal interim return is 66.30% (44.99%) for the outperformers and –47.55% (–36.91%) for the underperformers. These results show that even when we control for the risk premium, a significant difference exists in returns between outperformers and underperformers.

If analysts rationally rate the stocks in the unfavorable preceding category, we should observe a longer length of time for upward revisions for underperformers than for outperformers, because underperformers exhibit a slower stock price recovery. Conversely, panel B shows that the time length for upward revisions of outperformers is 234 calendar days, which is approximately 10% greater than for underperformers. When we adopt cumulative raw returns as the base to partition the underperformers and outperformers, untabulated results show that the time elapsed for outperformers is 259 days, which is approximately 40% longer than the time required for updating underperformers. This result also helps resolve the concern of different criteria used to classify recommendations into the favorable or unfavorable category. That is, if analysts withhold upgrades longer due to the higher criterion for issuing favorable revisions than unfavorable revisions, they would not revise underperformers sooner than revise outperformers.

[INSERT TABLE 3 HERE]

Prior research has shown that analyst recommendations embody information perceived as valuable by the market. After analysts issue unfavorable recommendations, stock prices decline. Therefore, stocks with an unfavorable preceding recommendation may take longer to reach higher cumulative abnormal returns than to reach lower cumulative abnormal returns before being upgraded to the favorable category. That is, the duration for the outperformers is inherently longer than the duration for the underperformers. To determine whether the delayed response to the outperformers stems from cognitive dissonance, we lessen the effect of the capital market reaction to the unfavorable recommendations. According to Womack (1996), because the three-trading-day cumulative abnormal return surrounding the recommendation date significantly declines for *added-to-sell* recommendation changes, we exclude three-trading-day abnormal returns after the unfavorable preceding recommendations and recalculate the highest and the lowest quartiles for both outperformers and underperformers to lessen the negative effect of capital market reaction after unfavorable recommendations are released.[12] The untabulated results support our previous finding that, when assessing stocks with an unfavorable preceding recommendation, analysts delay upgrading those stocks with better subsequent performance and, in contrast, upgrade in a more timely manner those stocks with inferior performance. Thus, the rejection of the third hypothesis suggests that a slow stock price recovery of previously unfavorably rated stocks or a sluggish stock market is not an explanation for the slower pace at which analysts make upward revisions.

We next examine the timeliness of analysts conveying good news for outperformers and underperformers in the third hypothesis. The duration analysis results are presented in Panels A and B of Table 4. The negative coefficient in H_3 provides evidence that analysts issue upward revisions to outperformers in a less timely manner than to underperformers. That is, analysts are reluctant to upgrade outperformers relative to underperformers. The hazard ratio of 0.854 for the outperformers means that, conditional on having arrived at time *t* without any upgrade, analysts are 85.4% likely to upgrade outperformers than to upgrade underperformers. This ancillary result confirms our univariate tests. Namely, cognitive processing biases may serve as variables to examine why analysts delay revising their recommendations for stocks with preceding unfavorable recommendations.

[INSERT TABLE 4 HERE]

[12] We also exclude five-trading-day cumulative return and seven-trading-day cumulative return after unfavorable recommendations. The tenor of the results is unchanged.

We also inspect the stock market reaction to the favorable recommendation revisions. Panel C of Table 4 reports cumulative returns after the issuance of the current recommendation revisions for 21 and 126 trading days. The results show that the 21-trading-day cumulative abnormal return is 28.90% greater for the outperformers than for the underperformers. During the 126 trading days subsequent to when analysts upgrade the outperformers, cumulative abnormal returns are 70.17%, which is significantly greater than for the underperformers. In addition, outperformers do better than underperformers both before and after the favorable recommendation revisions (see Panel A of Table 3 and Panel C of Table 4, respectively). Further, the panels show that cumulative abnormal returns are greater before the upgraded recommendations are issued relative to after they are issued. The result suggests that analysts take longer to convey good news for outperformers than underperformers when conditioned on the preceding issuance of the negative opinions. Such underreaction phenomenon for outperformers in the univariate test persists for almost all sample years regardless of whether the outperformers are identified based on cumulative abnormal returns or cumulative raw returns. Thus, the results are inconsistent with the returns providing compensation for risk.

4.4 Univariate and hazard model analyses for conservatism hypothesis

To explore whether the conservatism contributes to the underreaction to good news for the 531 outperformers, conditioned on the unfavorable preceding recommendations (in H_3), we partition the observations with the underreaction effect into a conservatism subgroup and a matching subgroup. The conservatism subgroup of 454 observations contains outperformers from which analysts receive less representative information and generates recommendation reversals. The matching group of 77 observations contains outperformers from which analysts receive highly representative information and reiterates their recommendations.[13]

[INSERT TABLE 5 HERE]

Panel A of Table 5 shows that analysts take, on average, 243 (180) days to upgrade the stocks in the conservatism (matching) portfolio. Panels B and C report the results for H_4 with the hazard model. The negative coefficient in H_4 shows that analysts upgrade the conservatism group in a less timely manner than the matching group. Namely, analysts delay their response to new favorable information for outperformers when they

[13] To reduce the influence of analysts who drop coverage, we exclude observations with duration longer than four years between the second last prior recommendation and the current revision. We also exclude observations with duration longer than eighteen months between the last recommendation and the current favorable revision in both the conservative and matching groups. We also conduct the sensitivity tests with recommendations separated by less than two years and three years for conservatism and matching groups. The untabulated test results are consistent with our findings.

have experienced processing less representative information relative to highly representative information. The hazard ratio of 0.605 for the conservatism group suggests that, conditional on having arrived at time *t* without an upgrade, analysts are approximately 61% likely to upgrade outperformers with less representative information than to upgrade outperformers with highly representative information. This finding echoes the result from the univariate analysis which shows that analysts take longer to convey favorable opinions for stocks previously downgraded from the favorable category than those previously receiving unfavorable recommendations. Namely, analysts' underreaction to new information may be compounded by conservatism resulting from less representative information.

Panel D of Table 5 shows that the analysts with immediately prior experience of interpreting less representative information on firms do not upgrade their recommendations on these firms until their mean cumulative abnormal return reaches 66.92%, which is approximately 4% greater than the matching firms' cumulative abnormal return of 62.68%.

4.5 Recommendation drifts for conservatism and matching groups

Panel A in Table 6 indicates that the mean abnormal return on the recommendation date is 2.74% for the conservatism group and 2.14% for the matching group; the corresponding raw returns are 2.28% and 0.89%, respectively. On average, currently favorably rated companies have both significantly positive raw returns and abnormal returns. The results confirm previous evidence that recommendations convey information regarding the investment value (e.g., Barber et al., 2001, 2003, 2006; Womack, 1996). The insignificant difference in abnormal return between the conservatism and matching groups shows that investors do not distinguish analysts' upgrades for the conservatism group from upgrades for the matching group after controlling for the risk premium.

[INSERT TABLE 6 HERE]

Panel B of Table 6 reports the cumulative returns subsequent to the current favorable recommendation revisions for both conservatism and matching groups. As the panel shows, the subsequent cumulative abnormal returns for 21 trading days for the conservatism and the matching groups are 16.62% and 17.27%, respectively. Both cumulative abnormal returns are approximately 25% of the corresponding abnormal returns between the recommendation dates in Panel C in Table 5. Similarly, 21-trading-day cumulative raw returns (untabulated) are approximately 20% of the corresponding raw returns for both groups. Moreover, for the conservatism group, the cumulative abnormal return for 126 trading days after the current recommendation

revision is 72.77% (Panel B, Table 6), which is greater than the return of 66.92% during the period between the two recommendations (Panel C, Table 5). In contrast, the cumulative abnormal return for the matching group is 54.82%, which is merely 87% of the corresponding duration return of 62.68%. Collectively, one-month buy-and-hold returns of analysts' upgraded stocks arrive at one-fifth to one-fourth of the returns between the two recommendations. After being held for six months, the stocks generate cumulative abnormal return accounting for at least 87% of the abnormal returns between the recommendations. The six-month buy-and-hold abnormal return for the conservatism group is notably greater than the return for the matching group.

5. Robustness Test

Prior studies suggest that analysts pay less attention not only to smaller firms but also to firms with fewer earnings surprises. If so, restricting our sample to S&P500 companies may not be sufficient to control for analysts' coverage preference. Moreover, the duration variable may be a function of factors such as firm size and market value. To test the sensitivity of our results to the these concerns, we use variables that affect analysts' preference for coverage as proxies to select firms that are more likely to be consistently followed (Heckman 1979; Rajan and Servaes 1997) and restrict the sample to the selected firms to mitigate analysts' selection bias.

We adopt a logistic model with proxies for analyst inclination to cover a stock. We define a dummy dependent variable, with Y_0 as a representative firm that analysts are unlikely to follow and Y_1 as the opposite. If analysts issue recommendations accompanying the quarterly earnings announcements, then we define the firm as a member of group Y_1. The logistic model is

$$P(Y_0, Y_1) = \{1+ \exp [-(\alpha_0 + \alpha_1 \times MV + \alpha_2 \times UE + \sum \beta_i \times DY_i + \sum \gamma_j \times DI_j)]\}^{-1} + \varepsilon, \quad (2)$$

where MV is the natural logarithm of the market value; UE is the absolute earnings surprise on the basis of the random walk model; DY_1 is a dummy variable that equals 1 when the earnings announcement is between 1995 and 1997, and zero otherwise; and DY_2 is a dummy variable that equals 1 when the announcement date is between 1998 and 1999, and zero otherwise; dummy variables DI_j, j=1,…8, represent the j^{th} industry classified by one-digit SIC codes; ε is an error term; and α, β, and γ are coefficients of the corresponding variables.

The untabulated results indicate that the natural logarithm of the market value, earnings surprise, and most of the independent dummy variables are appropriate

variables for analyst coverage. When a firm's estimated probability in the logit model is greater than 0.5, we categorize the firm as part of the group that analysts are more likely to follow. We reexamine our hypotheses with the sample selected by this logit model. The finding indicates that our hypothesis test results are robust.

6. Conclusion

This study isolates effects of incentives and cognitive processing biases and directly tests analysts' underreaction to new information when updating their opinions through recommendation revisions. We provide univariate and Cox hazard model tests to investigate the effects of incentives and cognitive processing biases and report the pattern of analysts conveying good news and analysts conveying bad news with controlling for preceding recommendations. We find that the difference in duration between analysts' favorable and unfavorable revisions is insignificant under the unconditioned circumstances. Thus, the notion of delayed response to the bad news of the incentive-based explanation is not supported. We further control for analysts' preceding opinions. We find that analysts delay conveying bad news if they have previously issued favorable recommendations, but they do not delay conveying bad news if they have previously issued unfavorable ones. The former result is consistent with the phenomenon of incentives and cognitive processing biases concerns. However, the latter result is not consistent with the incentives explanation and suggests that analysts' incentive to be unduly optimistic is not the only factor that influences recommendation revisions.

We also discriminate the alternative explanations of firms' slow recovery, a sluggish market, and analysts' different criteria of upgrades and downgrades through controlling stocks performance before analysts' revision issuance. We find that when we control for unfavorable preceding recommendations, less time passes before analysts convey good news, which is consistent with the hypothesis of cognitive processing biases. Because the preceding negatively recommended stocks are candidates for a contrarian strategy, this study provides an explanation for the effectiveness in value stock investment. We also find evidence for the conservatism bias proposed by Edwards (1968), under which analysts delay their response to new favorable information for outperformers when they have processed less representative information as compared with highly representative information. Our results lend support to the notion that analysts' underreaction to new information is compounded by the effect of conservatism.

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Figure 1
Incentives and cognitive processing biases effects

Prior belief	Underreact to good news	Underreact to bad news
Positive	I N/A	II Incentives hypothesis Cognitive processing biases hypothesis – Cognitive dissonance effect
Negative	III Cognitive processing biases hypothesis – Cognitive dissonance effect	IV Incentives hypothesis

Table 1

This table provides descriptive statistics for analyst recommendations, January 1995–May 2002, with the length of time between two consecutive recommendations

Panel A: Distributions of analysts' preceding recommendations and matched current recommendation revisions

Recommendation Level	Number and Percentage of Preceding and Current Recommendations			
	Preceding Recommendation		Current Recommendation Revision	
	n	%	*n*	%
Strong Buy	6,309	29.30	6,368	29.58
Buy	8,501	39.49	7,786	36.17
Hold	6,159	28.61	6,817	31.66
Sell	380	1.77	393	1.83
Strong Sell	178	0.83	163	0.76
all observations	21,527	100.00	21,527	100.00

Panel B: Distributions of analysts' recommendations, recommendation revisions conditioned on preceding recommendations

Preceding Recommendation	Number and Percentage of Current Recommendation Revision					
	Favorable revision (good news)		Unfavorable revision (bad news)		All observations	
	n	%	*n*	%	*n*	%
Favorable	8,306	38.58	6,504	30.21	14,810	68.80
Unfavorable	5,848	27.17	869	4.04	6,717	31.20
Unconditioned (all observations)	14,154	65.75	7,373	34.25	21,527	100.00

Panel C: Durations of recommendation revisions conditioned on preceding recommendations

Preceding Recommendation	Duration for Current Recommendation Revision								Difference in Duration			
	Favorable revision (good news)				Unfavorable revision (bad news)				Favorable rev. – Unfavorable rev.			
	n	Mean	Median	Std. dev.	*n*	Mean	Median	Std. dev.	Mean	*t*	Median	*Z*
Favorable	8,306	169.72	132	139.96	6,504	175.33	140	138.50	–5.61	–2.43***	–6	–6.25***
Unfavorable	5,848	170.66	132	139.66	869	136.66	96	120.20	34.00	7.61***	36	3.39***
Unconditioned (all observations)	14,154	170.11	132	139.83	7,373	170.78	133	137.04	–0.67	–0.34	–1	–1.39

The favorable category includes analysts' *strong buy* and *buy* recommendations, and the unfavorable category contains analysts' *strong sell*, *sell*, and *hold* recommendations. Panel A reports distributions of analysts' preceding recommendations and matched current recommendation revisions. Panel B reports portfolios formed by recommendations and recommendation revisions, with number and percentage of all observations. Panel C presents the distribution of the duration between recommendations conditioned on favorable preceding recommendations and unfavorable ones. The equality-of-variances test results support the notion of unequal variances for unconditioned case (the folded F statistic is 1.04, with $p = 0.0474$) and for conditioning on unfavorable preceding recommendations (the folded F statistic is 1.35, with $p \leq 0.0001$), but suggests equal variances for conditioning on favorable preceding recommendations (the folded F statistic is 1.02, with $p = 0.3726$). If the hypothesis of equality of variances is rejected, we use the Satterthwaite test to calculate t values assuming unequal variance. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 2
Hazard model test of the speed of favorable recommendation revisions conditioned on favorable or unfavorable preceding recommendation

Panel A: Likelihood ratio, Score, and Wald tests for conditioned favorable recommendations (H_1) and unfavorable recommendations (H_{2A} and H_{2B})

Preceding Recommendation	Recommendation revision	LR Chi-square	Score Chi-square	Wald Chi-square
Favorable	favorable	35.98	35.96	35.89
Unfavorable	favorable	26.29 ***	28.36 ***	28.25 ***
Unconditioned	favorable	41.63	41.69	41.87

Panel B: Cox regressions of the duration of two successive recommendations within an 18-month period for unconditioned favorable recommendations (H_1) and unfavorable recommendations (H_{2A} and H_{2B})

Preceding Recommendation	Recommendation revision	Coefficient estimate	*p*-value	Hazard ratio
Favorable	favorable	0.0154	0.5491	1.016
Unfavorable	favorable	–0.2927	<.0001	0.746
Unconditioned	favorable	–0.0145	0.5176	0.986

The favorable category includes analysts' *strong buy* and *buy* recommendations, and the unfavorable category contains analysts' *strong sell*, *sell*, and *hold* recommendations. The window for revisions is 18 months after the issuance of prior recommendations. Panel A demonstrates the statistics of likelihood ratio, score and Wald tests for favorable recommendation revisions conditioned on prior favorable and unfavorable recommendations. Panel B presents the results of Cox regressions for conditioned favorable (H_1) and unfavorable recommendations (H_{2A} and H_{2B}). The baseline for H_1 and H_2 are unfavorable revisions. We use partial likelihood method to estimate the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 3
Comparison of the between-recommendation stock performance and speed of conveying good news for outperformers versus underperformers with a delay between two successive recommendations

Panel A: Cumulative abnormal returns for outperformers and underperformers for stocks with favorable revisions conditioning on the unfavorable preceding recommendations

Preceding recommendation	Recommendation revision		Abnormal return between the two recommendations: $CAR_{[-1, 0]}$			
			n	Mean	Median	Std. dev.
Unfavorable	Favorable (good news)	Outperformer (1)	531	0.6630	0.4499	0.6379
		Underperformer (2)	586	–0.4755	–0.3691	0.3543
		Other	1,134	0.0009	–0.0026	0.0928
		Difference (1–2) (*t* or *Z* statistic)		1.1385 (36.36***)	0.8190 (28.90***)	

Panel B: Difference in duration for outperformers and underperformers for stocks with favorable revisions conditioning on the unfavorable preceding recommendations

Preceding recommendation	Recommendation revision		Duration between the two recommendations			
			n	Mean	Median	Std. dev.
Unfavorable	Favorable (good news)	Outperformer (1)	531	234.11	210.00	142.32
		Underperformer (2)	586	211.08	182.00	140.83
		Other	1,134	123.27	81.50	120.45
		Difference (1–2) (*t* or *Z* statistic)		23.03 (2.72***)	28.00 (2.80***)	

The favorable category includes analysts' *strong buy* and *buy* recommendations, and the unfavorable category contains analysts' *strong sell*, *sell*, and *hold* recommendations. $CAR_{[-1, 0]}$ is the cumulative abnormal return between the preceding and the current recommendation. Outperformers and underperformers are formed, respectively, by the last- and the first-quartile between-recommendation cumulative abnormal stock returns and cumulative raw returns. Panel A reports cumulative returns for outperformers and underperformer between the unfavorable preceding recommendation and the favorable recommendation revision. Panel B shows speeds of issuing upward revisions for the outperformers and underperformers conditioning on unfavorable preceding recommendations. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 4
Comparison of the speed of conveying good news and revision drift for outperformers versus underperformers with a delay between two successive recommendations

Panel A: Likelihood ratio, Score, and Wald tests for outperformers (H_3) with favorable revisions conditioning on unfavorable categories

Preceding recommendation	Recommendation revision	Stock performance between the two recommendations	LR Chi-square	Score Chi-square	Wald Chi-square
Unfavorable	Favorable	H_3: outperformers	7.03***	7.03***	7.02***

Panel B: Cox regressions for outperformers (H_3) with favorable revisions conditioning on unfavorable categories

Preceding recommendation	Recommendation revision	Stock performance between the two recommendations	Coefficient estimate	*p*-value	Hazard ratio
Unfavorable	Favorable	H_3: outperformers	–0.1576	0.0080	0.854

Panel C: Cumulative abnormal returns subsequent to revisions for outperformers and underperformers

Preceding recommendation	Recommendation revision	Stock Performance between the two recommendations	Recommendation revision drift		
			CAR (21)	*CAR* (126)	*CAR* (252)
Unfavorable	Favorable (good news)	Outperformer (1)	0.1671	0.7017	1.1632
		Underperformer (2)	–0.1219	–0.5704	–0.9602
		Other	–0.0010	–0.0586	–0.1201
		Difference (1–2)	0.2890	1.2721	2.1230
		(*t* or *Z* statistic)	(24.18***)	(29.89***)	(25.03***)

The favorable category includes analysts' *strong buy* and *buy* recommendations, and the unfavorable category contains analysts' *strong sell*, *sell*, and *hold* recommendations. *CAR* (t) is the cumulative abnormal returns for *t* trading days subsequent to the recommendation revision to capture the successive performance after analysts update their current opinions. Panels A and B present the results of Cox regression for outperformers (H_3) with favorable recommendation revisions conditioning on unfavorable categories. The baseline for H_3 is underperformers. We use partial likelihood method to estimate coefficients. Panel C reports cumulative returns after the current recommendation revisions for 21 and 126 trading days. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 5
Comparison of the speed of conveying good news and distribution of between-recommendation price performance for conservatism versus matching groups

Panel A: Difference in speed of conveying good news by issuing favorable recommendation revisions for outperformers with less representative and highly representative information (H_4)

	Information representative	Preceding two successive recommendation	Duration			
			n	Mean	Median	Std. dev.
Conservatism group	Low	Recommendation reversal: favorable to unfavorable	454	243.26	221.50	139.56
Matching Group	High	Recommendation reiteration: unfavorable to unfavorable	77	180.17	149.00	147.29
Difference (*t* or *Z* statistic)				63.09 (3.64***)	72.50 (4.06***)	

Panel B: Likelihood ratio, Score, and Wald tests for conservatism group (H_4) with favorable revisions conditioning on unfavorable categories

Preceding recommendation	Recommendation revision	Stock performance between the two recommendations	LR Chi-square	Score Chi-square	Wald Chi-square
Unfavorable	Favorable	H_4: conservatism	15.80 ***	18.22 ***	17.84 ***

Panel C: Cox regressions for conservatism group (H_4) with favorable revisions conditioning on unfavorable categories

Preceding recommendation	Recommendation revision	Stock performance between the two recommendations	Coefficient estimate	*p*-value	Hazard ratio
Unfavorable	Favorable	H_4: conservatism	–0.5029	<.0001	0.6050

Panel D: Difference in between-recommendation performance for outperformers with less representative and highly representative information

	Information representativeness	Preceding two successive recommendation	Between-recommendation performance: $CAR_{[-1, 0]}$			
			n	Mean	Median	Std. dev.
Conservatism group	Low	Recommendation reversal: favorable to unfavorable	454	0.6692	0.4527	0.6679
Matching Group	High	Recommendation reiteration: unfavorable to unfavorable	77	0.6268	0.4299	0.4215
Difference (*t* or *Z* statistic)				0.0420 (0.74)	0.0228 (0.3763)	

The favorable category includes analysts' *strong buy* and *buy* recommendations, and the unfavorable category contains analysts' *strong sell*, *sell*, and *hold* recommendations. $CAR_{[-1, 0]}$ is the cumulative abnormal return between the preceding and the current recommendations. Panels A and B present the results of Cox regression for conservatism group (H_4) with favorable recommendation revisions conditioned on an unfavorable category. The baseline for H_4 is non-conservatism (matching) group. We use partial likelihood method to estimate coefficients. Panel C demonstrates the difference in between-recommendation abnormal returns for outperformers with less representative and

highly representative information. Panel D presents the difference in between-recommendation for outperformers with less representative information and for outperformers with highly representative information. We adopt prior recommendation reversal as a proxy of experiencing information representativeness. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 6
Return on recommendation day and recommendation revision drifts for conservatism versus matching groups

Panel A: Return on favorable recommendation day for outperformers with less representative information and with highly representative information

	Information representativeness	Preceding two successive recommendation	Return on favorable recommendation day					
			Abnormal			Raw		
			Mean	Median	Std. dev.	Mean	Median	Std. dev.
Conservatism group	Low	Recommendation reversal: favorable to unfavorable	0.0274	0.0177	0.0570	0.0228	0.0164	0.0532
Matching Group	High	Recommendation reiteration: unfavorable to unfavorable	0.0214	0.0069	0.0494	0.0089	0.0009	0.0400
Difference (*t* or *Z* statistic)			0.0060 (0.87)	0.0108 (1.03)		0.0139 (2.68***)	0.0155 (2.64***)	

Panel B: Cumulative abnormal and raw returns subsequent to favorable recommendation revisions for outperformers with less representative information and with highly representative information

	Information representativeness	Preceding two successive recommendation	Recommendation revision drift		
			CAR (21)	*CAR* (126)	*CAR* (252)
Conservatism group	Low	Recommendation reversal: favorable to unfavorable	0.1662	0.7277	1.2292
Matching Group	High	Recommendation reiteration: unfavorable to unfavorable	0.1727	0.5482	0.7742
Difference (*t* or *Z* statistic)			0.0065 (–0.24)	0.1790 (1.70*)	0.4550 (2.15**)

The favorable category includes analysts' *strong buy* and *buy* recommendations, and the unfavorable category contains analysts' *strong sell*, *sell*, and *hold* recommendations. *CAR* (t) is the cumulative abnormal returns for *t* trading days subsequent to the recommendation revision to capture the performance after analysts update their current opinions. Panel A presents returns on the favorable recommendation day for outperformers with low representative information and for outperformers with high representative information. We adopt prior recommendation reversal as a proxy of experiencing information representativeness. Panel B presents both 21- and 126-trading-day cumulative abnormal returns subsequent to favorable recommendation revisions for outperformers with less representative information and for outperformers with highly representative information. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.