Journal of Behavioral and Experimental Finance 35 (2022) 100708

Contents lists available at ScienceDirect

Journal of Behavioral and Experimental Finance

journal homepage: www.elsevier.com/locate/jbef

Full length article

Analysts' forecast optimism: The effects of managers' incentives on analysts' forecasts

Anna Bergman Brown [a,*], Guoyu Lin [a], Aner Zhou [b]

[a] Clarkson University, United States of America
[b] California State University at San Marcos, United States of America

ARTICLE INFO

Article history:
Received 24 March 2022
Received in revised form 16 June 2022
Accepted 1 July 2022
Available online 4 July 2022

JEL classification:
G14
G29
M40

Keywords:
Analyst forecast optimism
Earnings management
Managerial reporting incentives

ABSTRACT

Sell-side analysts are rewarded for forecasting accurately, yet prior literature shows that analysts' earnings forecasts exhibit an optimistic bias, which is generally attributed to analysts' compensation structure or a desire to extract private information from managers. Building upon the theoretical model from Beyer (2008), we propose that analysts make decisions about forecasting while considering both optimism and accuracy: analysts forecast optimistically in anticipation of managers' upward manipulation of earnings in order to meet or beat forecasts. We find that the upward bias in analysts' earnings forecasts is increasing in the cost of managers missing forecasts (measured using leverage) and the volatility of earnings (using the standard deviation of ROA), and decreasing in the cost of earnings management (measured using Big 4 auditor, a pre- vs. post-Sarbanes Oxley test, and a DID test of larger vs. smaller firms, pre- vs. post-Sarbanes Oxley Section 404 implementation). Further tests suggest that these results are attributable to a lower (higher) incidence of earnings management for Big 4 and post-Sarbanes Oxley firms (firms with higher leverage and more volatile earnings). Our results provide evidence of a rational explanation for analysts' decision making that considers both forecast optimism and a strategy to forecast accurately.

1. Introduction

Sell-side financial analysts provide valuable information to capital markets by processing and synthesizing financial data into earnings forecasts that retail and institutional investors rely upon for making trading decisions. However, analysts' forecasts tend to be optimistically biased, which is generally attributed to compensation incentives or a desire to obtain private information from managers — both of which are at odds with analysts' incentives to forecast accurately. In addition, managers face a set of decisions about whether and how to manage earnings: managers face strong pressures from capital markets to meet or beat analysts' forecasts, with substantial repercussions for failing to do so, for example, in the form of forced turnover (Degeorge et al., 1999; Mergenthaler et al., 2012). In this paper, we test a new strategy for analysts' financial decision making that is consistent with both analysts' optimism and forecast accuracy: building upon the theoretical model from Beyer (2008), we test the idea that analysts forecast optimistically in anticipation of managers' incentives to manipulate earnings upward in order to meet or beat forecasts.

A longstanding literature documents that analysts' forecasts are somewhat optimistically biased; that is, the mean forecasts are on average higher than actual earnings. Prior studies attribute this optimistic bias to incentives that run in conflict with analysts' desire to forecast accurately. Specifically, analysts may purposely bias their forecasts upward because they desire to maintain relationships with managers or gain access to managers' private information (Francis and Philbrick, 1993; Lim, 2001; Darrough and Russell, 2002; Richardson et al., 2004), or they are compensated for doing so, either by generating trades (Cowen et al., 2006), receiving bonuses for reporting favorably about investment banking clients (Lin and McNichols, 1998; Michaely and Womack, 1999; Dechow et al., 2000; Hong and Kubik, 2003; O'Brien et al., 2005), or temporarily boosting stock prices for investors to benefit from short-term gains (Rajan and Servaes, 1997; Aggarwal, 2002). On the other hand, analysts are also rewarded for more accurate forecasts (Mikhail et al., 1999; Hong et al., 2000; Hong and Kubik, 2003; Jackson, 2005; Kadous et al., 2009), and analysts tend to forecast more accurately when working at firms with reputation concerns (Cowen et al., 2006; Simon and Curtis, 2011). Thus, analysts make decisions about how to forecast earnings while facing seemingly conflicting incentives: on one hand, to forecast accurately in order to protect their reputation, and on the other hand, to forecast somewhat optimistically, for compensation or relationship concerns.

* Corresponding author.
E-mail address: annabrown@clarkson.edu (A.B. Brown).

https://doi.org/10.1016/j.jbef.2022.100708
2214-6350/

Managers' decision making incentives with respect to reporting earnings necessarily interplay with analysts' forecasts. It is well established that managers are strongly rewarded for meeting or beating analysts' forecasts, and punished for not doing so, through stock returns, bonus compensation, and CEO turnover (Degeorge et al., 1999; Graham et al., 2005; Burgstahler and Eames, 2006; Mergenthaler et al., 2012). The earnings management literature shows that managers are often able to manipulate earnings in order to achieve the goal of meeting or beating analysts' forecasted earnings (Burgstahler and Dichev, 1997), in particular, via the manipulation of accruals (Matsumoto, 2002). In addition, both the incentive to meet/beat analysts' forecasts and the incidence of doing so have increased over the last several decades (Brown, 2001; Brown and Caylor, 2005).

Despite well-established literatures separately developing analysts' forecasting incentives and managers' reporting incentives, insufficient attention has been paid to the interplay between these incentives, especially with respect to managers' incentives to manipulate earnings. In this paper, we propose that analysts know what types of firms are more likely to manipulate earnings, and bias their forecasts accordingly, similar to the model proposed by Beyer (2008). To our knowledge, this idea has not been tested empirically in the prior literature, and may potentially offer a rational explanation for analysts' optimistic bias that is not in conflict with analysts' incentives to forecast accurately.

We use the interplay between analysts' and managers' incentives to develop and test three theory-motivated hypotheses. For our first hypothesis, we propose that the upward bias in analysts' forecasts is increasing in the cost to firms of missing forecasted earnings numbers. That is, when firms face greater costs from missing analysts' earnings forecasts, they have stronger incentives to meet or beat the forecasted earnings number. In this case, they will be more likely to manipulate earnings in order to achieve the target of meeting or beating analysts' forecasts. Analysts understand these incentives, and increase the optimistic bias of their earnings forecasts in order to anticipate managers' earnings manipulation. Our second hypothesis predicts that the upward bias in analysts' forecasts is decreasing in the cost of earnings management. When it is more costly for firms to manipulate earnings, they are less likely to be able to do so, and therefore, analysts do not need to bias their forecasts upward as much in anticipation of earnings management. Finally, our third hypothesis is that the upward bias in analysts' forecasts is increasing in the volatility of reported earnings. By definition, more volatile earnings mean a larger standard deviation of earnings, such that "real" earnings may be significantly lower or higher than analysts' expectations. If earnings are significantly higher, then managers have little incentive to manage earnings upward, as they will already meet/beat analysts' expectations. However, if earnings are significantly lower, managers face greater incentives to manipulate earnings upward by a larger amount. In anticipation of managers' incentives to manage earnings upward by a larger amount, analysts should therefore bias their forecasts more optimistically. Taken together, our three hypotheses offer a rational explanation for analysts' forecasting decision making that suggest that at least part of the optimistic bias may in fact be cohesive with analysts' incentives to forecast accurately.

To test our first hypothesis, we use leverage to measure the cost of missing analysts' forecasts. Firms with higher leverage face greater incentives to manage earnings in general because they are closer to financial distress and face greater bankruptcy risk (Bowen et al., 1981; Zmijewski and Hagerman, 1981; Daley and Vigeland, 1983; Johnson and Ramanan, 1988; LaBelle, 1990; Malmquist, 1990; Balsam et al., 1995); in addition, more highly leveraged firms face greater consequences from failing to meet or beat analysts' forecasted earnings (Jiang, 2008). Further, short sellers look for firms close to default to sell short, and failing to meet or beat earnings targets may trigger such a short sale; firms wishing to avoid such stock market consequences therefore face strong incentives to meet or beat analysts' forecasts. We therefore predict that more highly-leveraged firms face stronger incentives to meet or beat analysts' forecasts, and the upward bias in analysts' forecasts should be increasing in firm leverage.

To test our second hypothesis, we use several measures for the cost of earnings management. First, we use an indicator variable for whether a firm has a Big 4 auditor or not. Firms with Big 4 auditors are constrained in their ability to manage earnings (Becker et al., 1998; Defond and Subramanyam, 1998; Francis et al., 1999; Kim et al., 2003). Therefore, the upward bias in analysts' forecasts should be lower for firms with Big 4 auditors, because analysts know the firms will be constrained in their ability to manage earnings upward to meet/beat forecasts. Second, accruals-based earnings management – the type of earnings management that the literature documents managers use in order to achieve earnings targets (Matsumoto, 2002) – decreased after the Sarbanes Oxley Act of 2002 (SOX), presumably due to the greater oversight under SOX (Cohen et al., 2008). In particular, SOX Section 404 required tests of internal controls, which most strongly affected larger firms (Iliev, 2010). We therefore expect that analysts' upward bias should decrease after both the passage of SOX (2002), as well as after SOX Section 404 (whose implementation was later, in 2004) for larger firms, as presumably analysts know that it will be more difficult for managers of these firms to manipulate accruals. Finally, in order to test our third hypothesis, we use the standard deviation of ROA to capture the volatility of earnings.

We employ a sample of analysts' forecast data from IBES over the period 1998 through 2019, and merge this sample with earnings data from CRSP and Compustat, yielding a sample of 34,192 firm-quarters for our baseline sample. First, we find that the bias in analysts' forecasts (measured using both mean and median forecast bias) is significantly positively associated with leverage; for more highly leveraged firms, analysts therefore bias their forecasts more optimistically, consistent with anticipating the greater likelihood of these firms managing earnings. We also find the same results using an indicator variable for more highly leveraged firms.

In tests of our second hypothesis, we find that having a Big 4 auditor is significantly negatively associated with the bias in analysts' forecasts; analysts therefore do not bias their forecasts as optimistically for firms with a Big 4 auditor. As we know that firms with Big 4 auditors are constrained in their ability to manage earnings, this is consistent with the upward bias in analysts' forecasts preempting the likelihood of earnings management. Next, we find that the post-SOX period is negatively associated with the bias in analysts' forecasts, using a sample of firm-years two years before and after the passage of SOX in 2002. Further, in a difference-in-differences analysis of larger firms vs. smaller firms (greater or less than $75 million market capitalization), pre- vs. post-SOX Section 404 implementation (two years before and after 2004), we find that the negative association between the post-SOX Section 404 period and the bias in analysts' forecasts is especially strong for larger firms, consistent with these firms being more affected by SOX Section 404. Taken together, our results strongly point to analysts' biasing their forecasts more (less) optimistically when firms face lower (greater) costs from managing earnings.

In tests of our third hypothesis, we find that the standard deviation of ROA is significantly positively associated with the upward bias in analysts' forecasts, although the results only hold using the mean, and not the median, forecast bias. We thus find some evidence that analysts bias their forecasts more optimistically for firms with more volatile earnings, consistent with our prediction that these firms face greater incentives to manage earnings upward by a larger amount.

In additional analyses, we directly test the proposed channel driving our results. That is, we propose that the positive association between leverage (standard deviation of ROA) and the bias in analysts' forecasts is driven by the increased likelihood of earnings management at firms that face greater costs from failing to meet/beat analysts' forecasts (that have more volatile earnings). Similarly the negative association between the bias in analysts' forecasts and Big 4, post-SOX, and larger firms post-SOX is driven by the decreased likelihood of earnings management at these types of firms, due to increased costs of earnings management. We therefore estimate regressions of the absolute value of discretionary accruals on leverage, Big 4, post-SOX, the interaction term between larger firms and post-SOX Section 404, and the standard deviation of ROA, to ascertain that, in our sample, these firms do vary in earnings management in the expected direction.[1] Most of the results are consistent with our primary hypotheses: more highly leveraged firms and firms with more volatile earnings have higher absolute value of discretionary accruals, consistent with managing earnings to meet/beat analysts' forecasts, while Big 4 and post-SOX firms have lower absolute value of discretionary accruals, consistent with less management of earnings to meet/beat analysts' forecasts. This test therefore provides direct evidence of the channel driving our primary results.

Further, we also provide evidence of how our results are impacted by a financial crisis period. In cross-sectional analyses, we show that the core tests of our first two hypotheses do not hold in the period of the financial crisis surrounding the Great Recession (2007–2009), and instead only hold for non-crisis years (pre-2007 or post-2009).[2] That is, analysts tend to forecast more optimistically when managers face greater costs from missing forecasts (more highly leveraged firms), and less optimistically when managers face greater costs from managing earnings (measured using the Big 4 auditor), but these results only hold in a non-crisis period. These results may be indicative of managers' differing reporting incentives during a financial crisis. For example, faced with poor earnings during a recession, managers likely have lower incentives to manage earnings upward (Kirschenheiter and Melumad, 2002); analysts thus should not have the same incentives to bias forecasts upward in anticipation of earnings management. That our core results fail to hold for a crisis period – when managerial reporting incentives should be different from a non-crisis period – highlights the importance of considering the interplay between analysts' and managers' incentives when predicting cross-sectional variation in forecast optimism.

Finally, we consider how our results reconcile to the broad analysts literature documenting that analysts revise forecasts downward (i.e., become more pessimistic) closer to the earnings announcement date (e.g., see O'Brien, 1988; Butler and Lang, 1991; Brown, 1997; Barron et al., 2013). Our primary results rely on the most recent forecast before the earnings announcement date (i.e., the latest forecast) in order to calculate forecast bias.[3] In untabulated robustness checks, we examine how our results differ when we instead calculate forecast errors using the first forecast before the earnings announcement date. We find the following: (1) forecast errors are more optimistic for this sample, consistent with analysts' forecasts being more optimistic in the long-term, and more pessimistic in the short-term (i.e., downward revisions of analysts' forecasts as the earnings announcement date approaches), and (2) overall, our empirical results hold and appear to be of greater magnitude for this sample, consistent with a stronger association between forecast optimism and the interplay between analysts' and managers' incentives using a sample of earlier forecasts.[4] We conclude that our results are consistent with the prior literature on downward forecast revisions as the earnings announcement date approaches.

This paper contributes to the literature on analysts' conflicting incentives in their forecasting decisions. While a wide body of literature reports that analysts' forecasts exhibit an optimistic bias, this bias is generally attributed to analysts facing conflicting incentives that run at odds with the incentive to forecast accurately. To our knowledge, ours is the first study to show that analysts' optimistic bias may in fact be part and parcel of an overall decision-making strategy to achieve maximum forecast accuracy by anticipating managers' earnings management.

We also contribute to the literature on the interplay between managers' and analysts' incentives. A number of theory papers develop models where analysts rationally weigh the incentives to forecast accurately vs. optimistically (Mittendorf and Zhang, 2005; Beyer, 2008). Other papers have built upon the interplay of managers' and analysts' incentives, often using the idea that analysts purposely report optimistically so that managers will voluntarily reveal private information (Matsumoto, 2002; Richardson et al., 2004; Xu and Tang, 2012; Lang, 2018), or to gain favor with managers and become "insiders" at the firm (Darrough and Russell, 2002). However, to our knowledge, no other paper has provided empirical evidence consistent with analysts forecasting optimistically in anticipation of managers' earnings management. Our paper is therefore the first, to our knowledge, to empirically show that analysts' forecast optimism may be consistent with analysts' incentives to forecast accurately.

The rest of the paper is structured as follows. Section 2 outlines the background for our study and develops our hypotheses. Section 3 provides an overview of our research design and describes our sample selection. Section 4 presents our descriptive statistics and main results, Section 5 presents additional analyses and robustness tests, and Section 6 concludes.

2. Background, theoretical model, and hypothesis development

2.1. Analysts' forecasting incentives and managers' reporting incentives

Analyst forecasting literature has long documented that analysts' forecasts tend to exhibit a slightly optimistic bias — that

[1] We use the absolute value of discretionary accruals, rather than signed discretionary accruals. If firms engage in upward earnings management, this would be reflected by positive (signed) discretionary accruals; however, discretionary accruals earnings management reverses in future years. Therefore, the absolute value of discretionary accruals is better at capturing earnings management over several years than signed discretionary accruals (Cohen et al., 2008).

[2] Technically, the Great Recession did not begin until December 2007. However, the rest of 2007 represented a significant market bubble, and managers' and analysts' incentives likely also differ during bubble periods. Therefore, we choose to isolate all of 2007–2009 as a period marked by differing market incentives due to a financial crisis.

[3] It is worth noting that our tests are tests of relative (cross-sectional) optimism, and not overall optimism. That is, we test whether analysts are more or less optimistic in their forecasts of some firms vs. others, and whether this variation is consistent with our theoretical predictions using the interplay of analysts' and managers' incentives. In fact, as can be seen from the mean and median levels of *Mean Forecast Error* in Table 2, average forecast errors are slightly optimistic in our sample (1%), while median forecast errors are slightly pessimistic (−0.03%).

[4] We do not run simultaneous regressions, so we cannot definitively conclude that the coefficients are of greater magnitude using the sample of earlier forecasts. However, the results are still significant, and the coefficients appear to be of greater magnitude.

is, mean forecasted quarterly earnings are, on average, slightly higher than actual quarterly earnings. This optimistic bias has generally been attributed to analysts' conflicting incentives, i.e., analysts do not always strictly follow the goal of providing the most accurate earnings forecasts. For example, analysts may purposely forecast optimistically in order to cultivate relationships with managers (Francis and Philbrick, 1993; Lim, 2001; Darrough and Russell, 2002), or as part of a game to incentivize managers to disclose private information (Matsumoto, 2002; Richardson et al., 2004). Alternatively, analysts' forecast optimism has been attributed to compensation structure, such as generating trades for a brokerage firm (Cowen et al., 2006), bonus compensation for favorable reports (Lin and McNichols, 1998; Michaely and Womack, 1999; Dechow et al., 2000; Hong and Kubik, 2003; O'Brien et al., 2005), or temporarily boosting stock prices for investors to reap short-term gains (Rajan and Servaes, 1997; Aggarwal, 2002).

A common thread tying all of these studies together is that they all explain optimism as driven by incentives that conflict with analysts' incentives to forecast accurately. However, analysts clearly need to maintain their reputation as accurate forecasters of earnings. Indeed, prior studies show that analysts are rewarded for accurate forecasts, and penalized for less accurate forecasts (Mikhail et al., 1999; Hong et al., 2000; Hong and Kubik, 2003, Jackson 2005; Kadous et al., 2009). In addition, analysts tend to forecast more accurately when working for firms with incentives to maintain a strong reputation (Cowen et al., 2006; Simon and Curtis, 2011).

Beyer's (2008) theoretical model predicts that managers' and analysts' decision making incentives may interplay, such that forecast optimism may in fact be part of a strategy to achieve the most accurate forecasts. Specifically, her model predicts that analysts' optimistic bias anticipates firms' earnings manipulation. Managers face strong incentives to meet or beat analysts' forecasts, and may be rewarded for doing so – through bonuses and a boost to stock price – and penalized for missing analysts' forecasts – through reduced compensation and forced turnover (Degeorge et al., 1999; Graham et al., 2005; Burgstahler and Eames, 2006). Therefore, once managers observe analysts' forecasted earnings, they may manipulate earnings, for example through discretionary accruals, in order to push earnings upward enough to meet or beat the analysts' forecasted number (Burgstahler and Dichev, 1997; Matsumoto, 2002). Therefore, it may be the case that analysts' forecast optimism is in fact simply an *anticipation* of firms' earnings management, and therefore serves to achieve the most accurate possible forecast.

2.2. Theoretical model

Here, we present a variant model from Beyer (2008) to generate the three empirical predictions more rigorously. Assume that ex-ante, a firm's unmanaged earnings are distributed normally with mean μ_x and variance of $\frac{1}{\tau_x}$ where τ_x is the precision. The actual realized earnings can only be observed by the managers. First, the analyst gives a forecast AF. After the analyst's forecast is announced publicly, the manager decides whether she wants to manage earnings upward in order to meet/beat the forecast, and if so, the amount of earnings management. The announced earnings is R, i.e., the amount of earnings management is $(R-x)$.

The utility of the manager is specified as:

$$U_m = \frac{k_f}{2}\,(R-AF)^2 + \frac{k_m}{2}\,(R-x)^2 \; if \;\; R < AF \tag{1}$$

and

$$U_m = \frac{k_m}{2}\,(R-x)^2 \; if \;\; R \geq AF \tag{2}$$

where $\frac{k_m}{2}\,(R-x)^2$ is the cost of earnings management and $\frac{k_f}{2}\,(R-AF)^2$ is the cost of falling short of the analyst's forecast. The analyst tries to forecast the firm's reported earnings as accurately as possible after observing an unbiased signal of the firm's actual earnings, $\omega = x + \epsilon_1$. The noise term ϵ_1 is normally distributed with mean 0 and variance of σ_1^2,i.e., $\epsilon_1 \sim N(0, \sigma_1^2)$. When deciding her forecast, the analyst minimizes the expected forecast errors. The forecast error is defined as the difference between reported earnings, $R(x, AF)$, and the analyst's forecast AF. i.e.,

$$Minimize\; E[|R(x, AF) - AF \parallel \omega] \tag{3}$$

The First-Order-Condition (F.O.C.) on the manager's maximization problem gives rise to the managerial optimal reporting (earnings management) behavior:

$$R\,(x, AF) = x + \max\{0, \frac{k_f}{k_f + k_m}(AF - x)\} \tag{4}$$

Eq. (4) suggests that, if the realized earnings are greater than the analyst's forecast, then the cost of falling short of the forecast is zero. As conducting earnings management is costly, the manager would not engage in earnings management. However, if the realized earnings are lower than the analyst's forecast, then the manager will trade off the two costs, namely, the cost of earnings management and the cost of falling short of the analyst's forecast. If falling short of the forecast is more costly (k_f is larger), then the manager will conduct more upward earnings management. On the contrary, if it is more costly to conduct earnings management (k_f is larger), then the manager will conduct less upward earnings management.

Given the manager's optimal reporting strategy, the analyst's optimal forecast strategy is to minimize the forecasting error. After some mathematical calculations,[5] the following equilibrium forecast behavior is in order:

$$AF\,(\omega) = (\frac{\tau_x}{\tau_x + \tau_1}\mu_x + \frac{\tau_1}{\tau_x + \tau_1}\omega) + \sqrt{\frac{2}{\tau_x + \tau_1}} \times \text{inverse of } erf\,.(\frac{k_f}{k_f + 2k_m}) \tag{5}$$

where $(\frac{\tau_x}{\tau_x+\tau_1}\mu_x + \frac{\tau_1}{\tau_x+\tau_1}\omega)$ is the analyst's unbiased forecast of the firm's earnings after knowing the prior mean of the earnings and observing the signal ω using Bayesian updating. The inverse of $erf\,.(\frac{k_f}{k_f+2k_m})$ is the inverse of the error function $erf\,(x) = \int_0^x e^{-t^2}dt$. We specify the amount of upward bias in analysts' forecasts in the following Proposition 1:

Proposition 1. *The amount of upward bias in analysts' forecast in the equilibrium is given by:*

$$\boldsymbol{Bias} = \boldsymbol{AF\,(\omega)} - (\frac{\boldsymbol{\tau_x}}{\boldsymbol{\tau_x + \tau_1}}\boldsymbol{\mu_x} + H\frac{\boldsymbol{\tau_1}}{\boldsymbol{\tau_x + \tau_1}}\boldsymbol{\omega}) = \sqrt{\frac{\mathbf{2}}{\boldsymbol{\tau_x + \tau_1}}} \times \textbf{inverse function of } \boldsymbol{erf}\,.(\frac{\boldsymbol{k_f}}{\boldsymbol{k_f + 2k_m}}).$$

Both the error function and the inverse of the error function are increasing functions. It is straightforward to conduct some comparative static analyses to show that the analyst's forecast bias is:

(1) increasing in the cost of missing forecasting k_f;
(2) decreasing in the cost of earnings management k_m;
(3) increasing in the volatility, or standard deviation of the firms' earnings $(1/\tau_1 = \sigma_1^2)$.[6]

[5] The detailed proof is available upon request.

[6] A full theoretical model including proofs is available upon request.

2.3. Hypothesis development

Based on the analytical model, we make three cross-sectional predictions to test the idea that analysts' forecast optimism serves to anticipate firms' earnings manipulation. First, if analysts forecast optimistically in anticipation of firms' manipulation of earnings, then analysts should increase their optimistic bias in settings where firms face a greater cost from failing to meet/beat analysts' forecasts. When firms face greater costs from failing to meet/beat forecasts, they have stronger incentives to manipulate earnings upward in order to meet/beat the forecast. Therefore, in anticipation of this, analysts likely increase the optimistic bias of their forecasts. Conversely, firms with lower incentives to meet/beat analysts' forecasts have lower incentives to manipulate earnings upward to meet/beat the forecast; analysts may anticipate this, and produce forecasts with a lower optimistic bias for these types of firms. This leads us to our first hypothesis, stated in alternative form:

H1: The upward bias in analysts' forecasts is increasing in the cost of managers failing to meet/beat analysts' forecasts.

Next, if the upward bias in analysts' forecasts is driven by analysts' anticipation of earnings management, then analysts should bias their forecasts less optimistically for firms that face greater costs from managing earnings. In certain circumstances, firms face a greater cost from earnings management — that is, they are constrained from managing earnings through accruals manipulations. For example, firms with Big 4 auditors and firms post-SOX or post implementation of SOX 404, are generally more carefully monitored for earnings management via accruals manipulations, and therefore are less likely to be able to manipulate earnings precisely to meet/beat analysts' targeted earnings projections. Presumably, analysts understand that these types of firms are less able to manipulate accruals in order to achieve the goal of meeting/beating forecasted earnings; thus, analysts' forecasts do not need to be as optimistically biased for firms that face a greater cost from managing earnings. This leads us to our second hypothesis, stated in alternative form:

H2: The upward bias in analysts' forecasts is decreasing in the cost of earnings management.

Third, we propose that the upward bias in analysts' forecasts should be higher for firms with more volatile reported earnings. When earnings are more volatile, this means that "real" earnings may be significantly lower or higher than analysts' expectations. As explained in our discussion of the game theory, if earnings are higher than analysts' expectations, managers will report the real earnings, as they will have already achieved the goal of meeting/beating analysts' forecasts. Thus, if firms with more volatile earnings have unusually high earnings in a given period, this should not affect managers' earnings management strategy or analysts' forecast bias. However, if firms with more volatile earnings have unusually low earnings in a given period, managers will face stronger pressure to manage earnings upward by a larger amount in order to meet/beat analysts' forecasts. Anticipating this, analysts should therefore bias their forecasts more optimistically for firms with more volatile earnings. This leads us to our third hypothesis:

H3: The upward bias in analysts' forecasts is increasing in the volatility of reported earnings.

3. Research design and sample selection

3.1. Research design

Our tests of **H1-H3** rely on OLS regressions using the bias in analysts' forecasts as the dependent variable, following similar models from Tan et al. (2011) and Francis et al. (2019):

$$Mean/Median\ Forecast\ Bias = \beta_1 CosttoMeet/Beat\ Forecasts/Cost\ of\ Earnings\ Management/Volatility\ of\ Earnings + \boldsymbol{X}'\boldsymbol{B} + \varepsilon \quad (6)$$

where the dependent variable is alternately the mean or median *Forecast Bias*, calculated as the difference between analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm, scaled by the stock price. Higher values of *Forecast Bias* represent more optimistically biased forecasts. Following the literature (Francis et al., 2019), we focus on firms with stock prices larger than one dollar and with an analyst following of at least three, in order to reduce the impact of small scalers and outlier forecasts. We do not include stale forecasts that are issued a year or more before the earnings announcement. To test **H1**, the main test variable for the cost of meeting/beating forecasts is *Leverage*, defined as the ratio of long-term debt to total assets. For **H1**, our main prediction is that $\beta_1 > 0$, indicating that the upward bias in analysts' forecasts is higher for more highly leveraged firms. As an alternative specification, we also use *Highly leveraged*, an indicator variable equal to 1 for above median values of *Leverage* in our sample, and 0 otherwise.

In tests of H2, we use several alternate measures of the cost of earnings management. First, we use *Big 4 auditor*, an indicator variable equal to 1 if the firm has a Big 4 auditor, and 0 otherwise; here we predict that $\beta_1 < 0$, consistent with analysts biasing their forecasts less optimistically for firms that have Big 4 auditors, and are therefore likely constrained in their ability to manage earnings. Next, we conduct two tests using the pre- vs. post-SOX periods. In the first, we estimate an OLS regression using, as the main independent variable of interest, *SOX*, an indicator variable equal to 1 for the post-SOX period, and zero for the pre-SOX period. In this test our sample period is two years before and after the passage of SOX in 2002. We once again predict that $\beta_1 < 0$, as it is more difficult to manipulate accruals post-SOX, and presumably analysts therefore do not need to bias their forecasts as optimistically in anticipation of earnings management. Similarly, we next perform a DID test using the following equation:

$$Mean/Median\ Forecast\ Bias = \beta_1 Large + \beta_1 Large * Post - SOX\ Section 404 + \boldsymbol{X}'\boldsymbol{B} + \varepsilon \quad (7)$$

where *Large* is an indicator variable for the larger firms more affected by SOX Section 404, defined using a cutoff of a market capitalization of $75 million. The interaction term *Large*Post-SOX Section 404* therefore captures the effect of larger firms in the post-SOX period on the bias in analysts' forecasts. For this test, we predict that $\beta_2 < 0$, consistent with larger firms being more strongly affected by SOX (Iliev, 2010), and therefore likely being even more constrained in their ability to manage accruals. The sample period for this test is two years before and after the implementation of SOX Section 404, starting in fiscal year 2004.

Finally, to test **H3**, we estimate Eq. (6) using *Std ROA* as the main test variable for the volatility of earnings, calculated as the standard deviation of the return on assets (Net Income scaled by Assets). For **H3**, our main prediction is that $\beta_1 > 0$, indicating that the upward bias in analysts' forecasts is higher for firms with more volatile earnings. Both equations include a vector of control variables, **B**. This includes controls for determinants of analysts' forecasts properties – *Horizon* and *Analyst following*. We also include several control variables for firm characteristics – *Loss, Assets, Cash, Lagged stock return, Book-to-market ratio, Intangible, Asset intensity, and ROA* (Tan et al., 2011; Francis et al., 2019). All control variables are defined in Appendix. Finally, our regressions include industry and year fixed-effects. Standard errors are clustered at the industry level.

Table 1
Sample selection.

U.S. firm-years with available Compustat Annual data for 1998 to 2019		145,258
(Observations with unavailable CRSP data)	39,536	
Observations with unavailable IBES data)	41,378	
Observations in the finance and utilities industries)	11,853	
Observations with unavailable data for accruals)	3,684	
Observations with unavailable control variables)	14,615	
Firm-year observations with available data during our sample period		34,192

This table documents our sample selection process. Firm accounting information is obtained from Compustat, stock market return information is from CRSP data, and analyst forecast information is from IBES data. Firms with missing information from any of these data sources or with missing control variables are not included in the final sample. Firms in the finance (NAICS2 = 52) and utilities (NAICS2 = 22) sectors are also not included.

Table 2
Descriptive statistics.

Panel A Summary statistics

	N	Mean	SD	Min	P25	Median	P75	Max
Mean Forecast Bias	34,192	0.0101	0.0906	−0.2230	−0.0025	−0.0003	0.0022	0.7665
Median Forecast Bias	34,192	0.0058	0.0664	−0.2180	−0.0022	−0.0003	0.0010	0.5407
Leverage	34,192	0.5103	0.2402	0.0601	0.3316	0.5079	0.6583	1.2442
Big 4 auditor	34,192	0.9106	0.2854	0.0000	1.0000	1.0000	1.0000	1.0000
Std_ROA	34,192	0.0561	0.0782	0.0000	0.0123	0.0278	0.0647	0.7654
Horizon	34,192	4.7247	0.3395	3.5787	4.5392	4.7493	4.9477	5.4790
Analyst following	34,192	2.4408	0.5919	1.3863	1.9459	2.3979	2.8904	3.6889
Loss	34,192	0.2840	0.4509	0.0000	0.0000	0.0000	1.0000	1.0000
Assets	34,192	7.1089	1.6789	3.0859	5.8944	7.0200	8.2165	12.0074
Cash	34,192	0.1301	0.1398	0.0002	0.0289	0.0840	0.1829	0.7550
Lagged stock return	34,192	0.0173	0.0245	−0.0395	−0.0046	0.0188	0.0361	0.0664
Book-to-market ratio	34,192	0.5184	0.4652	−0.2404	0.2337	0.4074	0.6703	2.8171
Intangible	34,192	0.1918	0.1963	0.0000	0.0209	0.1290	0.3110	0.7222
Asset intensity	34,192	0.5107	0.3975	0.0152	0.1917	0.3944	0.7499	1.7841
ROA	34,192	0.0016	0.1672	−0.8301	−0.0123	0.0406	0.0808	0.2523

Table 2 Panel A provides descriptive statistics for our main sample of 34,192 observations. The sample selection process is documented in Table 1. Continuous variables are winsorized at the 1st and 99th percentile. Variables are as defined in the Appendix.

Panel B Correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Mean Forecast Bias	1.0000														
2. Median Forecast Bias	0.946***	1.0000													
3. Leverage	0.047***	0.050***	1.0000												
4. Big 4 auditor	−0.050***	−0.044***	0.087***	1.0000											
5. Std_ROA	0.130***	0.116***	−0.030***	−0.044***	1.0000										
6. Horizon	0.095***	0.096***	−0.022***	−0.049***	0.053***	1.0000									
7. Analyst following	−0.098***	−0.097***	0.111***	0.157***	−0.091***	−0.079***	1.0000								
8. Loss	0.238***	0.227***	0.026***	−0.064***	0.313***	0.069***	−0.146***	1.0000							
9. Assets	−0.135***	−0.129***	0.382***	0.193***	−0.255***	−0.155***	0.585***	−0.244***	1.0000						
10. Cash	0.092***	0.074***	−0.311***	−0.079***	0.305***	0.027***	−0.120***	0.247***	−0.343***	1.0000					
11. Lagged stock return	−0.014***	−0.011***	−0.042***	0.011***	0.016***	−0.028***	0.029***	−0.057***	−0.0040	−0.009**	1.0000				
12. Book-to-market ratio	0.040***	0.034***	−0.144***	−0.031***	−0.060***	0.036***	−0.132***	0.119***	0.046***	−0.199***	−0.014***	1.0000			
13. Intangible	−0.039***	−0.032***	0.107***	−0.010***	−0.068***	0.020***	0.059***	−0.035***	0.206***	−0.143***	−0.018***	−0.027***	1.0000		
14. Asset intensity	−0.021***	−0.023***	0.252***	0.054***	−0.072***	−0.124***	0.138***	−0.089***	0.261***	−0.368***	0.011***	0.163***	−0.344***	1.0000	
15. ROA	−0.290***	−0.269***	−0.057***	0.074***	−0.349***	−0.094***	0.164***	−0.687***	0.286***	−0.326***	0.062***	−0.015***	0.044***	0.123***	1.0000

Table 2 Panel B reports the Pearson correlations for the main variables used in our analyses. *** Denotes significance at the 0.01 level. Variables are as defined in the Appendix.

3.2. Sample selection

Our sample starts with all U.S. firms with available Compustat annual data between 1998 and 2019.[7] We next merge with CRSP and IBES, which yields a sample of 64,344 firm-years. We drop firms in the finance and utilities industries, firms with insufficient data to calculate accruals, and firms with insufficient data to calculate our control variables; this yields a final sample of 34,192 firm-years for our baseline analysis.

4. Descriptive statistics and main results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics for the variables included in our primary analyses using Eqs. (6) and (7). The mean and median *Forecast Bias* are approximately 1% and 0.6%, which is consistent with prior literature. Mean *Leverage* is 0.51, while *Big 4 auditor* is 0.91 and mean *Std ROA* is 0.06. Our analysts' characteristics, *Horizon* and *Analyst following* have means of 4.72 and 2.44, respectively, which are consistent with prior literature. The remainder of the variables presented in Table 2 are control variables, and are roughly consistent with prior literature. Further, Panel B of Table 2 presents a correlation matrix. Consistent with our hypotheses, *Mean Forecast Bias* and *Median Forecast Bias* are positively correlated with *Leverage* and *Std ROA*, and negatively correlated with *Big 4 auditor*.

4.2. Main results

4.2.1. Tests of H1

Table 3 presents our tests of **H1**, the association between the upward bias in analysts' forecasts and the cost of managers failing to meet/beat analysts' forecasts, measured using *Leverage*. In Panel A of Table 3, we use the continuous variable, *Leverage*; Column (1) uses the dependent variable *Mean Forecast Bias* while Column (2) uses *Median Forecast Bias*. Consistent with our expectations, in both Columns (1) and (2), the coefficient on *Leverage* is positive and significant ($p < 0.01$). In Panel B of Table 3, we use *Highly leveraged*, an indicator variable for above-median values of leverage. Similarly, in this Panel, the coefficient on *Highly leveraged* is positive and significant ($p < 0.01$) in both columns. Analysts therefore bias their forecasts more optimistically for highly leveraged firms. These results are consistent with our prediction that the upward bias in analysts' forecasts anticipates firms' earnings management; highly leveraged firms have stronger incentives to meet/beat analysts' forecasts, and therefore, stronger incentives to manipulate accruals upward (and in Table 8, we later confirm that this is the case). Thus, analysts' forecast optimism preempts highly leveraged firms' incentives to manipulate earnings upward.

7 Key variables, such as market value, became available starting in 1998.

4.2.2. Tests of H2

Table 4 presents our first test of **H2**, the association between the upward bias in analysts' forecasts and the cost of earnings management. In Table 4, we measure the cost of earnings management using *Big 4 auditor,* an indicator variable for the presence of a Big 4 auditor. Firms with Big 4 auditors are constrained from managing accruals, since Big 4 auditors monitor accruals carefully (Becker et al., 1998; Defond and Subramanyam, 1998; Francis et al., 1999; Kim et al., 2003). Consistent with this expectation, in both Column (1) and Column (2) of Table 4 (dependent variable of *Mean Forecast Bias* and *Median Forecast Bias*, respectively), the coefficient on *Big 4 auditor* is negative and significant ($p < 0.01$). Analysts therefore bias their forecasts less optimistically for firms with Big 4 auditors, presumably because these firms are constrained from managing accruals (which we empirically verify in later tests).

Table 5 presents our second test of **H2**, an analysis of the bias in analysts' forecasts in the pre- vs. post-SOX periods. Our main variable of interest is *SOX,* an indicator variable for the post-SOX period. Accruals earnings management tends to be lower in the post-SOX period, presumably because the greater oversight after SOX constrains firms from managing accruals upward in order to meet/beat analysts' forecasts (Cohen et al., 2008). In Table 5, the coefficient on *SOX* is negative and significant in both columns ($p < 0.05$); the upward bias in analysts' forecasts is therefore lower in the post-SOX period, consistent with analysts' anticipating the lower likelihood of accruals earnings management post-SOX, and therefore not needing to bias their forecasts as optimistically.

Our final test of **H2** is presented in Table 6. Table 6 presents the results of a DID analysis of firms with a market capitalization above \$75 million (*Large* = *1*) and below \$75 million (*Large* = 0), pre- vs. post-SOX Section 404 (Iliev, 2010). Larger firms were subject to more stringent SOX requirements than smaller firms, such as the auditor's attestation of management's assessment over internal controls from SOX Section 404(b). We therefore predict that the effect of SOX in constraining accruals earnings management should be especially strong for larger firms. Consistent with this expectation, in Table 6, the coefficient on the interaction term, *Large**Post-SOX Section 404*, is negative and significant ($p < 0.10$).

4.2.3. Tests of H3

Table 7 presents our tests of **H3**, the association between the upward bias in analysts' forecasts and the volatility of earnings. Our main variable of interest is *Std ROA,* the standard deviation of the return on assets. Consistent with our predictions, in Column (1), the coefficient on *Std ROA* is positive and significant ($p < 0.05$). However, the coefficient in Column (2) is positive but insignificant. We therefore provide some evidence that firms with more volatile earnings have a more optimistic bias in analysts' forecasts, consistent with analysts anticipating that these firms are more likely to manage earnings upward by a larger amount.

5. Additional analyses and robustness tests

5.1. Channel test

We propose that the mechanism driving the association between the upward bias in analysts' forecasts and the cost of failing to meet/beat analysts' forecasts is that firms that face a higher cost of failing to meet/beat analysts' forecasts are more likely to manipulate earnings (specifically, via accruals) in order to achieve the goal of meeting/beating analysts' forecasts. Similarly, we propose that the mechanism driving the association between the upward bias in analysts' forecasts and the cost of earnings management is that firms that face a higher

Table 3
Cost to Meet/Beat analysts' forecasts.

Panel A Leverage		
Variables	(1) *Mean Forecast Bias*	(2) *Median Forecast Bias*
Leverage	0.021***	0.015***
	(4.74)	(4.75)
Horizon	0.015***	0.011***
	(6.76)	(6.63)
Analysts following	−0.003	−0.002
	(−1.24)	(−1.43)
Loss	0.007	0.006*
	(1.42)	(1.92)
Assets	−0.002***	−0.002***
	(−2.99)	(−2.87)
Cash	0.016	0.006
	(1.29)	(0.84)
Lagged stock return	−0.053**	−0.047**
	(−2.08)	(−2.36)
Book-to-market ratio	0.009**	0.006**
	(2.51)	(2.11)
Intangible assets	0.000	−0.000
	(0.01)	(−0.06)
Asset intensity	0.004	0.001
	(0.64)	(0.31)
ROA	−0.103***	−0.065***
	(−9.23)	(−8.88)
Constant	−0.058***	−0.043***
	(−4.64)	(−4.88)
Observations	34,192	34,192
R-squared	0.079	0.066
Year FE	Yes	Yes
Industry FE	Yes	Yes
Panel B Indicator variable for high and low leverage		
Variables	(1) *Mean Forecast Bias*	(2) *Median Forecast Bias*
Highly leveraged	0.005***	0.003***
	(2.85)	(2.73)
Horizon	0.015***	0.011***
	(8.11)	(8.07)
Analysts following	−0.004**	−0.003***
	(−2.42)	(−2.98)
Loss	0.008***	0.007***
	(2.86)	(3.60)
Assets	−0.002**	−0.001**
	(−2.34)	(−2.16)
Cash	0.014	0.004
	(1.50)	(0.60)
Lagged stock return	−0.052	−0.046*
	(−1.57)	(−1.81)
Book-to-market ratio	0.007***	0.004**
	(2.76)	(2.24)
Intangible assets	0.001	0.000
	(0.22)	(0.09)
Asset intensity	0.005	0.002
	(1.56)	(0.93)
ROA	−0.108***	−0.069***
	(−8.55)	(−7.95)
Constant	−0.053***	−0.039***
	(−5.42)	(−5.40)
Observations	34,192	34,192
R-squared	0.078	0.065
Year FE	Yes	Yes
Industry FE	Yes	Yes

This table tests the association between the upward bias in analysts' forecasts and the cost of managers failing to meet/beat analysts' forecasts, measured using leverage in Panel A, and above-median values of leverage in Panel B. The upward bias in analysts' forecasts is measured by *Mean (Median) Forecast Bias*, the mean (median) difference between the analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm, scaled by the stock price at the beginning of the year. Standard errors are clustered by industries. T-statistics are reported in parentheses. ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. See the Appendix for variable definitions.

Table 4
Cost of earnings management.

Variables	(1) *Mean Forecast Bias*	(2) *Median Forecast Bias*
Big 4 auditor	−0.007***	−0.005***
	(−2.84)	(−2.75)
Horizon	0.015***	0.011***
	(6.84)	(6.77)
Analysts following	−0.005**	−0.004**
	(−2.12)	(−2.24)
Loss	0.008	0.007**
	(1.64)	(2.16)
Assets	−0.001	−0.000
	(−0.68)	(−0.54)
Cash	0.013	0.003
	(0.94)	(0.39)
Lagged stock return	−0.053**	−0.047**
	(−2.09)	(−2.36)
Book-to-market ratio	0.006	0.003
	(1.56)	(1.18)
Intangible assets	0.002	0.001
	(0.15)	(0.10)
Asset intensity	0.006	0.003
	(1.01)	(0.78)
ROA	−0.110***	−0.070***
	(−10.21)	(−9.83)
Constant	−0.050***	−0.037***
	(−3.88)	(−4.11)
Observations	34,192	34,192
R-squared	0.078	0.065
Year FE	Yes	Yes
Industry FE	Yes	Yes

This table tests the association between the upward bias in analysts' forecasts and the cost of earnings management, measured by the presence of a Big 4 auditor. The upward bias in analysts' forecasts is measured by *Mean (Median) Forecast Bias*, the mean (median) difference between the analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm, scaled by the stock price at the beginning of the year. Standard errors are clustered by industries. T-statistics are reported in parentheses. ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. See the Appendix for variable definitions.

Table 5
Pre- vs. Post-SOX.

Variables	(1) *Mean Forecast Bias*	(2) *Median Forecast Bias*
SOX	−0.004**	−0.003**
	(−2.45)	(−2.40)
Horizon	0.016***	0.012***
	(5.28)	(4.78)
Analysts following	−0.005	−0.004
	(−1.26)	(−1.46)
Loss	0.012**	0.009**
	(2.24)	(2.42)
Assets	−0.002	−0.001
	(−0.83)	(−0.83)
Cash	0.017	0.002
	(0.86)	(0.18)
Lagged stock return	−0.074**	−0.051*
	(−2.21)	(−1.77)
Book-to-market ratio	0.000	0.003
	(0.03)	(1.29)
Intangible assets	0.016	0.005
	(1.15)	(0.63)
Asset intensity	0.017**	0.007
	(2.00)	(1.37)
ROA	−0.071***	−0.035***
	(−3.89)	(−3.26)
Constant	−0.057***	−0.044***
	(−4.37)	(−3.62)
Observations	5872	5872
R-squared	0.084	0.064
Industry FE	Yes	Yes

This table analyzes the bias in analysts' forecasts in the pre- vs. post-SOX periods. *Post-SOX* is an indicator variable for the post-SOX period. The sample consists of firm-years two years before and after the passage of SOX in 2002. The upward bias in analysts' forecasts is measured by *Mean (Median) Forecast Bias*, the mean (median) difference between the analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm, scaled by the stock price at the beginning of the year. Standard errors are clustered by industries. T-statistics are reported in parentheses. ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. See the Appendix for variable definitions.

cost of earnings management are constrained from manipulating accruals in order to achieve the goal of meeting/beating analysts' forecasts. Likewise for our third hypothesis, we propose that the mechanism driving the positive association between the upward bias in analysts' forecast and the volatility of earnings is that firms with more volatile earnings are more likely to manage earnings upward by a larger amount.[8] Therefore, in additional analyses, we empirically verify that these relationships hold in our sample. That is, we test whether more highly leveraged firms and firms with more volatile earnings have higher discretionary accruals, and Big 4 firms, post-SOX firms, and larger firms in the post-SOX Section 404 period have lower discretionary accruals. While some of these results have been documented in prior literature (e.g., post-SOX lower discretionary accruals, Cohen et al., 2008), it is important to verify that the relationships hold in our setting, in order to lend support to our argument about the mechanism/channel driving our results. In Table 8, we test for this channel effect, using the following model:

$$|Discretionary\ Accruals| = \beta_1 Cost\ to\ Meet/Beat\ Forecasts/Cost\ of\ Earnings\ Management/Volatility\ of\ Earnings + \boldsymbol{X}'\boldsymbol{B} + \varepsilon \quad (8)$$

where the dependent variable is |*Discretionary Accruals*|,[9] calculated as the absolute value of the residual from the modified Jones model estimated for each two-digit SIC-year group. Similar to our test of **H1**, the variable for the cost to meet/beat forecasts is *Leverage*. We predict that $\beta_1 > 0$: more highly leveraged firms should have higher absolute discretionary accruals, consistent with more upward earnings management in order to meet/beat analysts' forecasts. Similar to our tests of **H2**, the variables for the cost of earnings management are *Big 4 auditor*, *Post-SOX*, and *Large*Post-SOX Section 404*. For these three variables, we predict that $\beta_1 < 0$: Big 4 firms and post-SOX firms (and larger firms post-SOX Section 404) should have lower discretionary accruals, consistent with these firms being constrained from managing earnings upward in order to meet/beat analysts' forecasts. Finally, similar to tests of **H3**, we use *Std ROA* to capture the volatility of earnings, and we predict that $\beta_1 > 0$: firms with more volatile earnings should have higher discretionary accruals, consistent with these firms engaging in greater upward earnings management.

Table 8 presents the results of the test of Eq. (3). In Column (1), the coefficient on *Leverage* is positive and significant ($p < 0.05$); more highly leveraged firms do in fact have higher absolute discretionary accruals in our sample, consistent with greater earnings management to meet/beat analysts' forecasts.

[8] Firms with more volatile earnings will only be more likely to manage earnings upward in periods when earnings are unusually low, and not periods when earnings are unusually high. However, this fits with the game from Beyer (2008) in which *all* firms are only more likely to manage earnings upward when "real" earnings fall short of analysts' expectations. Therefore, the key difference for firms with more volatile earnings is that when earnings fall short of analysts' expectations, they likely do so by a larger amount, requiring more upward earnings management to meet/beat analysts' expectations.

[9] We also try an alternative proxy for earnings management, which is the discretionary accruals without taking the absolute value, and find significant results for specifications (1), (2), (3) and (4).

Table 6
DID of Pre- vs. Post-SOX 404 implementation.

Variables	(1) *Mean Forecast Bias*	(2) *Median Forecast Bias*
*Large*Post SOX Section 404*	−0.053*	−0.048**
	(−1.84)	(−2.19)
Large	0.002	0.004
	(0.21)	(0.48)
Horizon	0.010***	0.007***
	(3.51)	(3.84)
Analyst following	−0.001	0.000
	(−0.30)	(0.05)
Loss	0.011*	0.009**
	(1.72)	(2.02)
Assets	−0.001	−0.001
	(−0.74)	(−0.74)
Cash	0.030	0.013
	(0.77)	(0.59)
Lagged stock return	−0.032	−0.088
	(−0.29)	(−1.08)
Book-to-market ratio	−0.008	−0.002
	(−1.35)	(−0.45)
Intangible assets	0.007	−0.0002
	(0.38)	(−0.18)
Asset intensity	0.011	0.005
	(1.37)	(1.15)
ROA	−0.088***	−0.043**
	(−3.43)	(−2.11)
Constant	−0.011	−0.007
	(−0.50)	(−0.49)
Observations	5976	5976
R-squared	0.088	0.064
Year FE	Yes	Yes
Industry FE	Yes	Yes

This table presents DID tests of larger vs. smaller firms, pre- vs. post-implementation of SOX 404. The sample consists of firm-years two years before and after the implementation of SOX Section 404 starting in fiscal year 2004. The upward bias in analysts' forecasts is measured by *Mean (Median) Forecast Bias*, the mean (median) difference between the analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm, scaled by the stock price at the beginning of the year. Standard errors are clustered by industries. T-statistics are reported in parentheses. ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. See the Appendix for variable definitions.

Table 7
Volatility of reported earnings.

Variables	(1) *Mean Forecast Bias*	(2) *Median Forecast Bias*
Std_ROA	0.033**	0.016
	(2.18)	(1.34)
Horizon	0.015***	0.011***
	(6.86)	(6.79)
Analysts following	−0.005**	−0.004**
	(−2.29)	(−2.37)
Loss	0.007	0.007**
	(1.51)	(2.05)
Assets	−0.001	−0.000
	(−0.69)	(−0.65)
Cash	0.010	0.001
	(0.73)	(0.19)
Lagged stock return	−0.053**	−0.047**
	(−2.08)	(−2.34)
Book-to-market ratio	0.006*	0.004
	(1.71)	(1.29)
Intangible assets	0.002	0.001
	(0.17)	(0.11)
Asset intensity	0.006	0.003
	(0.89)	(0.68)
ROA	−0.108***	−0.069***
	(−9.76)	(−9.60)
Constant	−0.057***	−0.041***
	(−4.23)	(−4.27)
Observations	34,192	34,192
R-squared	0.078	0.065
Year FE	Yes	Yes
Industry FE	Yes	Yes

This table tests the association between the upward bias in analysts' forecasts and the volatility of earnings. The upward bias in analysts' forecasts is measured by *Mean (Median) Forecast Bias*, the mean (median) difference between the analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm, scaled by the stock price at the beginning of the year. The volatility of earnings is measured by the standard deviation of the return on assets (net income/total assets) in the past three years. Standard errors are clustered by industries. T-statistics are reported in parentheses. ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. See the Appendix for variable definitions.

In Column (2), the coefficient on *Big 4 auditor* is negative and significant ($p < 0.05$), in Column (3), the coefficient on *SOX* is negative and significant ($p < 0.01$), and in Column (4), the coefficient on *Large*Post-SOX Section 404* is not significant. We therefore document that, in our sample, Big 4 firms and post-SOX firms have lower absolute discretionary accruals, consistent with less upward earnings management for these firms. The test of larger firms post-SOX 404 implementation likely suffers from confounding effects in this time period, as the post-SOX 404 period begins in 2004. Therefore, larger firms may have already reduced earnings management after SOX, or in anticipation of the implementation of SOX 404, which could be why we do not document a significantly negative coefficient for *Large*Post-SOX Section 404*. Last, in our test of the volatility of earnings we observe that the coefficient on *Std_ROA* is positive and significant ($p < 0.01$), consistent with more earnings management for firms with more volatile earnings.

5.2. Testing for the effects of a financial crisis period

In our second additional analysis, we provide evidence of how our results are impacted by a financial crisis period. During financial crises, such as recessions, depressions, and market bubbles, managers face different reporting incentives than in normal periods. For example, if earnings are already significantly negative, managers' earnings management incentives would likely be to manage earnings downward (taking a ''big bath''), rather than managing earnings upward (Kirschenheiter and Melumad, 2002). For this reason, we expect that the association between forecast bias and the interplay between analysts' and managers' incentives may be different for crisis periods. We test this prediction by isolating the Great Recession financial crisis years (2007–2009) from the rest of our sample.[10]

In Table 9, we estimate our core tests from **H1** and **H2** separately for the period around the Great Recession (*Financial crisis* = *1*, for observations in 2007–2009) and non-crisis years (*Financial crisis* = 0, for observations pre-2007 or post-2009). Panel A of Table 9 presents tests of the association between *Mean/Median Forecast Error* and *Leverage* (similar to Panel A of Table 3), while Panel B of Table 9 presents tests of the association between *Mean/Median Forecast Error* and *Big 4 auditor* (similar to Table 4). In both panels, we find that **H1** and **H2** do not hold in the period around the Great Recession, and instead only hold for non-crisis years. That is, only in non-crisis periods, analysts tend to forecast more (less) optimistically when managers face greater costs from missing forecasts (from managing earnings). These results are consistent with our expectation that managers' reporting incentives are different during a crisis period; the fact that our core results do not hold during this period of differing managerial

[10] We include all of 2007, as most of 2007 represented a market bubble preceding the Great Recession, in which analysts' and managers' incentives were likely different from normal reporting periods.

Table 8
Channel test of earnings management.

Variables	(1) |Discretionary accruals|	(2) |Discretionary accruals|	(3) |Discretionary accruals|	(4) |Discretionary accruals|	(5) |Discretionary accruals|
Leverage	0.024**				
	(2.07)				
Big 4 auditor		−0.004**			
		(−2.58)			
SOX			−0.029***		
			(−3.74)		
Large				−0.008	
				(−0.83)	
*Large * Post SOX Section 404*				−0.003	
				(−0.16)	
Std_ROA					0.054***
					(4.03)
Loss	−0.001	−0.000	−0.020***	−0.002	−0.001
	(−0.37)	(−0.01)	(−3.50)	(−0.48)	(−0.42)
Cash flow from operation	0.173***	0.171***	0.130***	0.193***	0.175***
	(13.40)	(12.97)	(4.03)	(8.49)	(14.10)
Book-to-market ratio	0.005	0.002	0.004	0.002	0.003
	(0.88)	(0.43)	(1.14)	(0.46)	(0.58)
Net operating assets	−0.001***	−0.001***	−0.002***	−0.002***	−0.001***
	(−6.16)	(−8.51)	(−6.10)	(−7.68)	(−8.66)
Lagged total accruals	−0.021**	−0.023**	−0.043***	−0.027*	−0.013
	(−2.03)	(−2.18)	(−2.72)	(−1.95)	(−1.15)
ROA	−0.268***	−0.271***	−0.318***	−0.306***	−0.268***
	(−7.84)	(−8.45)	(−16.76)	(−11.59)	(−8.34)
Asset growth	0.450***	0.437***	0.463***	0.365***	0.435***
	(12.30)	(13.12)	(7.25)	(7.06)	(13.12)
Intangible assets	−0.066***	−0.061***	−0.050***	−0.049***	−0.059***
	(−6.06)	(−6.87)	(−3.32)	(−4.25)	(−6.64)
Constant	0.059***	0.075***	0.094***	0.068***	0.069***
	(6.77)	(24.23)	(17.06)	(10.56)	(25.72)
Observations	34,192	34,192	5872	5976	34,192
R-squared	0.224	0.221	0.280	0.263	0.222
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

This tables tests the association between the absolute value of accruals and our main variables of interest, including *Leverage*, *Big 4 auditor*, *SOX*, the interaction between *Large* and *Post SOX Section 404*, and *Std_ROA*. Accruals are measured as the residual from the modified Jones model estimated for each two-digit SIC-year group. Standard errors are clustered by industries. T-statistics are reported in parentheses. ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. We also try an alternative proxy for earnings management, which is the discretionary accruals without taking the absolute value, and find significant results for specifications (1), (2), (3) and (4). See the Appendix for variable definitions.

incentives highlights the importance of considering the interplay between analysts' and managers' incentives for predicting cross-sectional variation in forecast optimism.

5.3. Reconciliation of results to prior literature on analysts' forecast revisions

In a robustness test, we consider how our results reconcile to the broad analysts literature documenting that analysts revise forecasts downward (i.e., become more pessimistic) closer to the earnings announcement date (e.g., see O'Brien, 1988; Butler and Lang, 1991; Brown, 1997; Barron et al., 2013). Our primary tests are tests of *relative* and not *absolute* optimism; that is, we test whether analysts are more or less optimistic in their forecasts of certain firms, and whether this cross-sectional variation lines up with the interplay between analysts' and managers' incentives. However, as a large prior literature documents analysts becoming more pessimistic closer to the earnings announcement date, it is important to reconcile our results to these findings.

Therefore, in untabulated robustness checks, we recalculate our *Mean/Median Forecast Error* variables as the difference between analysts' first forecast (instead of the last/most recent forecast before the earnings announcement date) and the actual earnings for the firm, scaled by the stock price. We then run all of our tests in Tables 3–8 using this later sample of analysts' forecasts errors.

First, we find that forecast errors are more optimistic for this sample, consistent with analysts' forecasts being more optimistic in the long-term, and more pessimistic in the short-term (i.e., downward revisions of analysts' forecasts as the earnings announcement date approaches). Again, this is consistent with prior literature documenting that analysts revise earnings forecasts downward as the earnings announcement date approaches. Next, we find that our empirical results hold (are of similar statistical significance) and appear to be of greater magnitude for this sample, consistent with a stronger association between forecast optimism and the interplay between analysts' and managers' incentives using a sample of earlier forecasts.[11] We conclude that our results are consistent with the prior literature on downward forecast revisions as the earnings announcement date approaches.

6. Conclusion

In this study, we examine whether analysts' forecasting decision making can be explained by the interplay between managers' reporting incentives and analysts' forecasting incentives. The optimistic bias in analysts' forecasts has traditionally been attributed to a desire to gain access to managers' private information or maintain relationship with managers (Francis and Philbrick, 1993; Lim, 2001; Darrough and Russell, 2002; Richardson et al., 2004), additional compensation for generating trades (Cowen et al., 2006), receiving bonuses for reporting favorably

11 Although the results appear to be stronger (i.e., the coefficients are of greater magnitude), we are not running simultaneous regressions, so we cannot directly compare coefficients across these different regression samples.

Table 9
Cross-sectional analyses of great recession financial crisis vs. Non-crisis periods.

Panel A Test of H1				
Variables	*Mean Forecast Bias*	(2) *Median Forecast Bias*	(3) *Mean Forecast Bias*	(4) *Median Forecast Bias*
	Financial crisis = 0	Financial crisis = 0	Financial crisis = 1	Financial crisis = 1
Leverage	0.022***	0.016***	0.006	0.006
	(5.25)	(5.21)	(0.73)	(0.96)
Horizon	0.015***	0.011***	0.014***	0.012***
	(6.13)	(6.23)	(3.51)	(3.03)
Analysts following	−0.002	−0.002	−0.012***	−0.010**
	(−0.74)	(−0.93)	(−2.67)	(−2.55)
Loss	0.006	0.006*	0.010*	0.007*
	(1.20)	(1.72)	(1.74)	(1.76)
Assets	−0.002***	−0.002***	−0.001	−0.001
	(−3.25)	(−3.11)	(−0.52)	(−0.42)
Cash	0.020	0.008	−0.013	−0.013
	(1.32)	(0.96)	(−1.02)	(−1.27)
Lagged stock return	−0.054	−0.044	−0.039	−0.061
	(−1.41)	(−1.52)	(−0.25)	(−0.53)
Book-to-market ratio	0.011**	0.007**	−0.003	−0.003
	(2.53)	(2.15)	(−0.71)	(−0.70)
Intangible	0.001	−0.000	−0.013	−0.006
	(0.13)	(−0.01)	(−0.76)	(−0.43)
Asset intensity	0.004	0.001	−0.005	−0.004
	(0.81)	(0.44)	(−0.33)	(−0.35)
ROA	−0.098***	−0.060***	−0.136***	−0.095***
	(−7.56)	(−6.31)	(−6.33)	(−5.01)
Constant	−0.062***	−0.045***	−0.015	−0.015
	(−4.43)	(−4.73)	(−0.70)	(−0.85)
Observations	29,431	29,431	4761	4761
R-squared	0.079	0.066	0.093	0.086
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Panel B Test of H2				
Variables	(1) *Mean Forecast Bias*	(2) *Median Forecast Bias*	(3) *Mean Forecast Bias*	(4) *Median Forecast Bias*
	Financial crisis = 0	Financial crisis = 0	Financial crisis = 1	Financial crisis = 1
Big 4 auditor	−0.007***	−0.004**	−0.007	−0.007
	(−2.80)	(−2.65)	(−1.12)	(−1.47)
Horizon	0.015***	0.011***	0.015***	0.012***
	(6.19)	(6.36)	(3.50)	(3.01)
Analysts following	−0.004*	−0.003*	−0.012***	−0.010***
	(−1.71)	(−1.85)	(−3.17)	(−2.88)
Loss	0.008	0.007*	0.010*	0.007*
	(1.43)	(1.97)	(1.79)	(1.84)
Assets	−0.001	−0.000	−0.000	0.000
	(−0.72)	(−0.66)	(−0.11)	(0.17)
Cash	0.016	0.005	−0.013	−0.014
	(0.99)	(0.55)	(−1.09)	(−1.32)
Lagged stock return	−0.053	−0.043	−0.043	−0.065
	(−1.37)	(−1.48)	(−0.27)	(−0.56)
Book-to-market ratio	0.007	0.004	−0.005	−0.004
	(1.66)	(1.32)	(−1.16)	(−1.24)
Intangible	0.003	0.001	−0.012	−0.006
	(0.27)	(0.17)	(−0.73)	(−0.41)
Asset intensity	0.007	0.003	−0.004	−0.004
	(1.26)	(1.01)	(−0.29)	(−0.30)
ROA	−0.106***	−0.066***	−0.139***	−0.098***
	(−8.15)	(−6.81)	(−6.38)	(−5.12)
Constant	−0.054***	−0.040***	−0.011	−0.011
	(−3.71)	(−3.99)	(−0.50)	(−0.61)
Observations	29,431	29,431	4761	4761
R-squared	0.078	0.064	0.094	0.086
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

This table tests the association between the upward bias in analysts' forecasts and two of our main predictions, separately for the period surrounding the Great Recession (Financial crisis = 1, for 2007–2009) and for non-crisis periods (Financial crisis = 0, for pre-2007 or post-2009). Panel A tests for the association between the forecast bias and the cost of managers failing to meet/beat analysts' forecasts, measured using leverage; Panel B tests for the association between the forecast bias and the cost of earnings management, measured by the presence of a Big 4 auditor. The upward bias in analysts' forecasts is measured by *Mean (Median) Forecast Bias*, the mean (median) difference between the analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm, scaled by the stock price at the beginning of the year. Standard errors are clustered by industries. T-statistics are reported in parentheses. ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. See the Appendix for variable definitions.

about investment banking clients (Lin and McNichols, 1998; Michaely and Womack, 1999; Dechow et al., 2000; Hong and Kubik, 2003; O'Brien et al., 2005), or temporarily boosting stock prices for investors to benefit from short-term gains (Rajan and Servaes, 1997; Aggarwal, 2002). However, analysts also have incentives to forecast accurately, which seemingly lie at odds with the incentives traditionally attributed to forecast optimism. Therefore in this paper we empirically test the novel idea that analysts make decisions about forecasting optimistically in anticipation of managers' reporting incentives, consistent with the model from Beyer (2008).

Using a sample of analysts' forecasts and firm earnings from 1998 to 2019, we first find that analysts' forecast optimism is higher for firms that are more highly leveraged. As firms with higher leverage are more likely to face more severe penalties from failing to meet/beat analysts' forecasts, these results are consistent with analysts forecasting more optimistically in anticipation of the greater likelihood that managers manipulate earnings upward for more highly leveraged firms. Second, we find that analysts' forecast optimism is lower for Big 4 firms and for firms post-SOX. These are two categories of firms that are likely monitored more closely, and therefore their ability to manage earnings upward to meet/beat analysts' forecasts is more limited. Similarly, we find that forecast optimism is even lower for larger firms post-implementation of SOX 404, compared to the change for smaller firms. These results are therefore consistent with analysts forecasting less optimistically for firms whose ability to manage earnings upward is constrained, and thus the analyst's forecast does not need to be as optimistically biased in anticipation of earnings management. Third, we find some evidence that analysts' forecast optimism is higher for firms with more volatile earnings, consistent with these firms being more likely to manage earnings upward by a larger amount. Fourth, we confirm that, for our sample of firms, many of our test variables predict earnings management through discretionary accruals in the predicted direction: more highly leveraged firms and firms with more volatile earnings have higher absolute discretionary accruals, and Big 4 and post-SOX firms have smaller absolute discretionary accruals. This provides additional evidence that the likelihood of managing earnings through discretionary accruals is a likely channel driving our main results. We show that our results do not hold for financial crisis periods (the period surrounding the Great Recession, 2007–2009), consistent with differing managerial reporting incentives during crisis periods, and we show that our results are still consistent with analysts' revising forecasts downward as the earnings announcement date approaches.

This paper contributes to the literature on analysts' decision making when faced with seemingly conflicting incentives; we provide unique empirical results that analysts' incentives to forecast accurately may actually not be at odds with their incentives to forecast optimistically, and may rather be part of a strategy to achieve the most accurate forecasts by anticipating managers' likelihood of managing earnings upward. In addition, we contribute to the limited literature on the interplay of managers' and analysts' incentives (Mittendorf and Zhang, 2005; Beyer, 2008; Lang, 2018), by showing that analysts may have the ability to anticipate managers' incentives, and incorporate them into their forecasts.

We caution that, as an archival study covering a long sample period over several decades, our study is clearly subject to the same inherent limitations as most such archival studies. Specifically, we make every effort to control for observable firm characteristics, use year fixed effects to control for time-varying effects, and industry fixed effects to control for unobservable industry-level characteristics that may impact our inferences. That said, we cannot completely rule out that there may be some unobservable characteristics of firm, industry, or time that would impact the conclusions of our study (i.e., correlated omitted variables leading to general endogeneity problems). Further, our study relies on a sample of data from U.S. firm-years; as such, readers are cautioned against extrapolating our study's conclusions in an international setting.

Our study opens pathways to several potential avenues of research. First, as noted earlier, our study relies on a sample of U.S. firms; thus, future studies may explore similar predictions in an international setting to ascertain whether managers and analysts face the same interplay of reporting and forecasting incentives outside of the U.S. Next, there are other theoretical predictions from Beyer (2008) that remain to be tested. For example, Beyer's (2008) model predicts that the upward bias in analysts' forecasts is increasing in the variance of the signal that analysts receive. Further, prior analyst forecasting literature develops alternative measures of analysts' forecasts which may be interesting to test in our setting; for example, Barron et al.' (1998) measures of common and private information precision capture the degree to which analysts rely on common information vs. privately held information in their forecasting decisions. Future studies could therefore examine how the common vs. private information precision measures interact with managers' reporting incentives.

CRediT authorship contribution statement

Anna Bergman Brown: Writing – original draft, Writing – review & editing, Supervision. **Guoyu Lin:** Conceptualization, Methodology, Software, Formal analysis, Data curation. **Aner Zhou:** Software, Formal analysis, Data curation.

Appendix. Variable definitions

Variables	Definitions
Mean Forecast Bias	The mean difference between the analysts' most recent forecast before the earnings announcement data and the actual earnings for the firm. The variable is scaled by the stock price at the beginning of the year. Larger values represent more positively biased forecasts.
Median Forecast Bias	The median difference between the analysts' most recent forecast before the earnings announcement date and the actual earnings for the firm. The variable is scaled by the stock price at the beginning of the year. Larger values represent more positively biased forecasts.
Leverage	The ratio of long-term debts to total assets.
Highly leveraged	An indicator variable equal to one if the firm's leverage is above the median.

Variables	Definitions
Big 4 auditor	An indicator variable equal to one if the firm is audited by one of the Big 4 auditors.
Std ROA	Standard deviation of ROA from t-3 to t-1. ROA is the ratio of net income to assets.
Horizon	The natural logarithm of the average number of days between the analyst forecast and the earning announcement date.
Analyst following	The natural logarithm of the number of analysts following the firm.
Loss	An indicator variable equal to one if the firm's net income is negative.
Assets	The natural logarithm of firm assets.
Cash	The ratio of cash to total assets.
Lagged stock return	Annual stock return for the firm in year t-1.
Book-to-market ratio	The ratio of the book value of equity to the market value of equity.
Intangible	The ratio of intangible assets to total assets.
Asset intensity	The ratio of property, plant, and equipment to total assets.
ROA	The ratio of net income to assets.
Post-SOX	An indicator variable equal to one for years after 2001.
Large	An indicator variable equal to one for firms with market value larger than 75 million.
Post-SOX Section 404	An indicator variable equal to one for years after 2004.
|Discretionary accruals|	The absolute value of the residual from the modified Jones model estimated for each two-digit SIC-year group
Cash flow from operation	Cash flow from operating activities scaled by lagged assets.

References

Aggarwal, R., 2002. Strategic IPO underpricing, information momentum, and lockup expiration selling. J. Financ. Econ. 66 (1), 105–137.

Balsam, S., Haw, I., Lilien, S., 1995. Mandated accounting changes and managerial discretion. J. Account. Econ. 20 (1), 3–29.

Barron, O.E., Byard, D., Liang, L., 2013. Analyst pessimism and forecast timing. J. Bus. Finance Account. 40 (5–6), 719–739.

Barron, O.E., Kim, O., Lim, S.C., Stevens, D.E., 1998. Using analysts' forecasts to measure properties of analysts' information. Account. Rev. 73 (4), 421–433.

Becker, C., Defond, M., Jiambalvo, J., 1998. The effect of audit quality on earnings management. Contemp. Account. Res. 15 (1), 1–24.

Beyer, A., 2008. Financial analysts' forecast revisions and managers' reporting behavior. J. Account. Econ. 46, 334–348.

Bowen, R., Lacey, J., Noreen, E., 1981. Determinants of the corporate decision to capitalize interest. J. Account. Econ. 3 (2), 151–179.

Brown, L., 1997. Analyst forecast errors: Additional evidence. Financ. Anal. J. 53 (6), 81–88.

Brown, L.D., 2001. A temporal analysis of earnings surprises: Profits versus losses. J. Account. Res. 39 (2), 221–241.

Brown, L.D., Caylor, M.L., 2005. A temporal analysis of quarterly earnings thresholds: Propensities and valuation consequences. Account. Rev. 80 (2), 423–440.

Burgstahler, D., Dichev, I., 1997. Earnings management to avoid earnings decreases and losses. J. Account. Econ. 24 (1), 99–126.

Burgstahler, D., Eames, M., 2006. Management of earnings and analysts' forecasts to achieve zero and small positive earnings surprises. J. Bus. Finance Account. 33 (5–6), 633–652.

Butler, K.C., Lang, L.H.P., 1991. The forecast accuracy of individual analysts: Evidence of systematic optimism and pessimism. J. Account. Res. 29 (1), 150–156.

Cohen, D.A., Dey, A., Lys, T.Z., 2008. Real and accrual-based earnings management in the pre- and post-sarbanes-oxley periods. Account. Rev. 83 (3), 757–787.

Cowen, A., Groysberg, B., Healy, P., 2006. Which types of analyst firms are more optimistic? J. Account. Econ. 41 (1–2), 119–146.

Daley, L., Vigeland, R., 1983. The effects of debt covenants and political costs on the choice of accounting methods: the case of accounting for R & D costs. J. Account. Econ. 5, 195–211.

Darrough, M., Russell, T., 2002. A positive model of earnings forecasts: Top down versus bottom up. J. Bus. 75 (1), 127–152.

Dechow, P., Hutton, A., Sloan, R., 2000. The relation between analysts' forecasts of long-term earnings growth and stock price performance following equity offerings. Contemp. Account. Res. 17 (1), 1–32.

Defond, M., Subramanyam, K., 1998. Auditor changes and discretionary accruals. J. Account. Econ. 25 (1), 35–67.

Degeorge, F., Patel, J., Zeckhauser, R., 1999. Earnings management to exceed thresholds. J. Bus. 72 (1), 1–33.

Francis, J., Maydew, E., Sparks, H., 1999. The role of big 6 auditors in the credible reporting of accruals. Auditing 18 (2), 17–34.

Francis, J., Newman, S.S., Newton, N.J., 2019. Does tax planning affect analysts' forecast accuracy? Contemp. Account. Res. 36 (4), 2663–2694.

Francis, J., Philbrick, D., 1993. Analysts' decisions as products of a multi-task environment. J. Account. Res. 31 (2), 216–230.

Graham, J.R., Harvey, C.R., Rajgopal, S., 2005. The economic implications of corporate financial reporting. J. Account. Econ. 40 (1–3), 3–73.

Hong, H., Kubik, J., 2003. Analyzing the analysts: career concerns and biased earnings forecasts. J. Finance 58 (1), 313–351.

Hong, H., Kubik, J., Solomon, A., 2000. Security analysts' career concerns and herding of earnings forecasts. RAND J. Econ. 31 (Spring), 121–144.

Iliev, P., 2010. The effect of SOX section 404: Costs, earnings quality, and stock prices. J. Finance 65 (3), 1163–1196.

Jackson, A., 2005. Trade generation, reputation, and sell-side analysts. J. Finace 60 (2), 673–717.

Jiang, J., 2008. Beating earnings benchmarks and the cost of debt. Account. Rev. 83 (2), 377–416.

Johnson, W., Ramanan, R., 1988. Discretionary accounting changes from successful efforts to full cost methods: 1970–76. Account. Rev. 63 (1), 96–110.

Kadous, K., Mercer, M., Thayer, J.M., 2009. Is there safety in numbers? The effects of forecast accuracy and forecast boldness on financial analysts' credibility with investors. Contemp. Account. Res. 26 (3), 933–968.

Kim, J., Chung, R., Firth, M., 2003. Auditor conservatism, asymmetric monitoring, and earnings management. Contemp. Account. Res. 20 (2), 323–359.

Kirschenheiter, M., Melumad, N.D., 2002. Can big bath and earnings smoothing co-exist as equilibrium financial reporting strategies? J. Account. Res. 40 (3), 761–796.

LaBelle, R., 1990. Bond covenants and changes in accounting policy: Canadian evidence. Contemp. Account. Res. 6 (2), 677–698.

Lang, K., 2018. Voluntary disclosure and analyst forecast. Eur. Account. Rev. 27, 23–36.

Lim, T., 2001. Rationality and analysts' forecast bias. J. Finance 56 (1), 369–385.

Lin, H., McNichols, M., 1998. Underwriting relationships, analysts' earnings forecasts and investment recommendations. J. Account. Econ. 25 (1), 101–127.

Malmquist, D., 1990. Efficient contracting and the choice of accounting method in the oil and gas industry. J. Account. Econ. 12 (1–3), 173–205.

Matsumoto, D., 2002. Management's incentives to avoid negative earnings surprises. Account. Rev. 77 (3), 483–514.

Mergenthaler, R., Rajgopal, S., Srinivasan, S., 2012. CEO and CFO Career Penalties to Missing Quarterly Analysts Forecasts. Working paper, Penn State University.

Michaely, R., Womack, K.L., 1999. Conflicts of interest and the credibility of underwriter analyst recommendations. Rev. Account. Stud. 12 (4), 653–686.

Mikhail, M.B., Walther, B.R., Willis, R.H., 1999. Does forecast accuracy matter to security analysts? Account. Rev. 74 (2), 185–200.

Mittendorf, B., Zhang, Y., 2005. The role of biased earnings guidance in creating a healthy tension between managers and analysts. Account. Rev. 80 (4), 1193–1209.

O'Brien, P., 1988. Analysts' forecasts as earnings expectations. J. Account. Econ. 10 (1), 53–83.

O'Brien, P., McNichols, M., Lin, H., 2005. Analyst impartiality and investment banking relationships. J. Account. Res. 43 (4), 623–650.

Rajan, R., Servaes, H., 1997. Analyst following of initial public offerings. J. Finance 52 (2), 507–529.

Richardson, S., Teoh, S.H., Wysocki, P.D., 2004. The walk-down to beatable analyst forecasts: The role of equity issuance and insider trading incentives. Contemp. Account. Res. 21 (4), 886–924.

Simon, A., Curtis, A., 2011. The use of earnings forecasts in stock recommendations: Are accurate analysts more consistent? J. Bus. Finance Account. 38 (1–2), 119–144.

Tan, H., Wang, S., Welker, M., 2011. Analyst following and forecast accuracy after mandated IFRS adoptions. J. Account. Res. 49 (5), 1307–1357.

Xu, L., Tang, A.P., 2012. Internal control material weakness, analysts' accuracy and bias, and brokerage reputation. Rev. Quant. Financ. Account. 39, 27–53.

Zmijewski, M., Hagerman, R., 1981. An income strategy approach to the positive theory of accounting standard setting/choice. J. Account. Econ. 3 (2), 129–149.