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The informativeness of pro forma and street earnings: an examination of information asymmetry around earnings announcements

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Abstract Using adverse-selection cost as a proxy for information asymmetry, we find evidence that non-GAAP earnings numbers issued by management (pro forma earnings) and analysts (street earnings) improve price discovery. First, information asymmetry before an earnings announcement is positively associated with the probability of a non-GAAP earnings number at the forthcoming earnings announcement. Second, the post-announcement reduction in information asymmetry is greater when managers or analysts issue non-GAAP earnings at the earnings announcement and when the magnitude of the non-GAAP earnings adjustment is larger. Our results suggest that earnings adjustments by analysts and managers increase the amount and precision of earnings information and help to narrow information asymmetry between informed and uninformed traders following earnings announcements. Alternatively, the findings may be attributable to characteristics of non-GAAP firms and overall better reporting quality for those firms rather than non-GAAP earnings disclosure per se.

Keywords Information asymmetry · Pro forma earnings · Street earnings · Non-GAAP earnings · Adverse selection · Earnings precision

JEL Classification G10 · G14 · M40 · M41

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1 Introduction

When announcing earnings, management may choose to disclose supplemental pro forma earnings per share (EPS) numbers that differ from EPS under generally accepted accounting principles (GAAP). In addition, the Institutional Brokers' Estimate System (I/B/E/S) frequently issues street EPS numbers that differ from GAAP EPS. These non-GAAP earnings numbers may provide a better representation of sustainable economic performance than GAAP earnings. Alternatively, because non-GAAP earnings are usually larger than GAAP earnings (88 and 77 % for pro forma and street earnings, respectively, in our sample), non-GAAP earnings may represent a bid to boost stock price.

Because scheduled, informative public announcements provide incentives for private information search, informed trading and information asymmetry increase in the days before and decrease in the days after earnings announcements. We exploit this pattern to examine the incremental informativeness of non-GAAP earnings relative to GAAP earnings. Based on an analysis of the level of and change in information asymmetry around earnings announcements, we provide evidence that pro forma and street earnings improve price discovery. These results hold when controlling for the uncertainty in a firm's information environment, potential endogeneity from self-selection, and other firm-specific factors expected to be associated with information asymmetry, including market value, trade size, and trading volume.

As a proxy for information asymmetry, we use the adverse-selection component of the bid-ask spread for firms traded on the NASDAQ exchange. Market makers on that exchange face an information asymmetry problem when they trade with informed investors. Absent this adverse selection, as in the case of pure liquidity-driven buy and sell orders, all trades would occur at fixed bid and ask prices with no change in the bid-ask midpoint. Informed investors, however, will place an order, buy or sell, only when the order is advantageous in light of their private information. Therefore one would expect an increase in the bid-ask midpoint following an informed buy order and a decrease following an informed sell order. The adverse-selection component of the bid-ask spread is a form of protection for market makers against losses from trades with investors who have superior private information.

Three primary findings hold for pro forma earnings provided by managers and street earnings provided by I/B/E/S. First, information asymmetry in the pre-announcement period is positively associated with the probability of non-GAAP earnings at the quarterly earnings announcement. Second, the reduction in information asymmetry after earnings announcements is significantly more pronounced when analysts or managers issue non-GAAP earnings. Third, restricting the analysis to non-GAAP quarters, we find that the post-announcement reduction in information asymmetry is larger when the magnitude of non-GAAP adjustments (i.e., the absolute difference between GAAP earnings and non-GAAP earnings) is larger. Our findings suggest that non-GAAP earnings adjustments improve the precision of earnings information and accelerate price discovery. However, we recognize that our findings may be attributable to characteristics of non-GAAP firms that result in better overall reporting quality for those firms rather than non-GAAP earnings disclosure per se.

Our work contributes directly to the literature assessing how different classes of investors trade on non-GAAP disclosures (Christensen et al. 2014; Elliott 2006; Frederickson and Miller 2004) and especially compliments the work of Allee et al. (2007) and Bhattacharya et al. (2007). Allee et al. (2007) find that abnormal trading by less sophisticated investors in a 3-day earnings-announcement window is higher when managers provide pro forma earnings disclosures at the earnings announcement. Bhattacharya et al. (2007) find that abnormal trading by less informed investors is positively associated with pro forma forecast errors (pro forma EPS minus the I/B/E/S mean forecast). Both studies use intra-day trade-size data to proxy for investor sophistication and conclude that the announcement-window price reaction to pro forma earnings is attributable primarily to trading by less informed investors.

Although not directly comparable to the findings of Allee et al. (2007) and Bhattacharya et al. (2007), our results are consistent with their attribution of announcement-window price reactions to trading by less informed investors in response to pro forma earnings. Unusually high adverse-selection cost in the pre-announcement window, as we find when the probability of non-GAAP reporting is relatively high, is consistent with sophisticated investors trading on private information in the pre-announcement window in anticipation of securing returns in the announcement window. We would expect, then, that trades in the announcement window are initiated, primarily, by less sophisticated traders who lack the resources to engage in private information search in advance of earnings announcements.

In general, we interpret our results in the light of studies relating disclosure quality to information asymmetry. From that perspective, our findings suggest that non-GAAP earnings contribute to, rather than detract from, the quality of a firm's earnings disclosures. Consistent with the increased trading by informed investors before informative disclosures (McNichols and Trueman 1994; Kim and Verrecchia 1997), we find that information asymmetry is higher in the pre-announcement period when non-GAAP earnings are more probable at the earnings announcements. Likewise, consistent with prior research concluding that better disclosure and better earnings quality result in lower information asymmetry between informed and uniformed investors (Bhattacharya et al. 2012; Healy and Palepu 2001), we find that the reduction in information asymmetry following earnings announcements is more pronounced when non-GAAP earnings supplement GAAP earnings disclosures.

Our findings have important implications for managers. First, prior studies (Doyle et al. 2003; Gu and Chen 2004; Landsman et al. 2007; Chen 2010) show that street earnings adjustments have predictive value for future earnings that differs from the predictive value of other earnings components. In this context, our findings suggest that managers can increase the precision of earnings and reduce information asymmetry through the explicit identification of atypical earnings components. This should, in turn, reduce a firm's cost of capital (Botosan et al. 2004).

Second, our findings suggest that management's disclosure of non-GAAP earnings may improve a firm's reputation for providing credible information, consistent with an association between investors' expectation of disclosure quality and managers' threshold level of disclosure (Verrecchia 1983). Thus non-GAAP disclosures may be one way to reduce "information risk," which managers identify as a primary goal of their voluntary disclosure decisions (Graham et al. 2005).

2 Institutional background and prior research

Managers and major forecast vendors, including I/B/E/S, usually justify non-GAAP earnings as a better representation of sustainable corporate performance than GAAP earnings because non-GAAP earnings omit elements of GAAP earnings that are nonrecurring,[1] unimportant, or immaterial in predicting a company's future cash flows. Indeed, pro forma earnings and street earnings often exclude special items found in GAAP earnings (Black and Christensen 2009; Kolev et al. 2008), and earnings response coefficients (ERCs) for forecast errors derived from pro forma and street earnings are significantly larger than ERCs for forecast errors derived from GAAP operating earnings (Bhattacharya et al. 2003). Similarly, Brown and Sivakumar (2003) show that street earnings are more value relevant than GAAP operating earnings.

Another body of literature argues that non-GAAP earnings may support or create unjustifiable stock valuations. Pro forma earnings frequently help firms achieve earnings targets (Black and Christensen 2009; Lougee and Marquardt 2004), and pro forma earnings are more likely after share price declines (Bhattacharya et al. 2004) and when boards of directors are less independent (Frankel and McVay 2011). Strategic timing of earnings announcements is also linked to pro forma disclosures in a way that suggests managerial opportunism (Brown et al. 2012a). Similarly, analysts are more likely to exclude expenses from street earnings for glamour stocks (Baik et al. 2009). Finally, the well-documented finding that ERCs and value relevance are larger for pro forma and street earnings than they are for GAAP earnings (Bhattacharya et al. 2004; Bowen et al. 2005; Bradshaw and Sloan 2002; Brown and Sivakumar 2003; Johnson and Schwartz 2005; Lougee and Marquardt 2004) may reflect investor fixation on non-GAAP earnings rather than their superior informativeness (Abarbanell and Lehavy 2007; Bradshaw and Sloan 2002; Zhang and Zheng 2011).

3 Development of hypotheses

3.1 Information asymmetry

We adopt a market microstructure perspective of information asymmetry, wherein one subset of market participants (informed traders) has private information that is

[1] I/B/E/S (2001, p. 7) states: "There is no 'right' answer as to when a non-extraordinary charge is nonrecurring or non-operating and deserves to be excluded from the earnings basis used to value the company's stock. We believe the 'best' answer is what the majority wants to use, in that the majority basis is likely what is reflected in the stock price." Lambert (2004), however, points out the difficulty surrounding the classification of an item as "nonrecurring."

superior to the information of another subset (uninformed traders). Informed traders are not insiders. Instead, they are individuals or institutions who obtain private information through costly search activities and who expect to benefit when their information becomes public. Information asymmetry between informed and uninformed traders exists even in efficient markets (Lev 1988).

3.2 The informativeness of non-GAAP earnings

We predict that non-GAAP earnings are more informative or precise than GAAP earnings with respect to the value of the firm. We attribute the source of this incremental precision to non-GAAP adjustments that identify components of earnings with unusual implications for future earnings compared to other components of GAAP earnings. For example, assume all firms provide disclosures for the amount of R&D costs but only certain firms (or their analysts) exclude R&D costs from non-GAAP earnings. The incremental informativeness of non-GAAP earnings arises from the explicit indication that R&D costs have different valuation implications than other operating expenses for these non-GAAP firms.

Incremental informativeness for non-GAAP firms assumes that their non-GAAP adjustments reliably indicate differential persistence or predictive value. This assumption is consistent with empirical findings. For example, Doyle et al. (2003) show that one dollar in excluded expense predicts 3.328 dollars of negative cash flow over the next 3 years compared to 7.895 dollars predicted by street earnings. Landsman et al. (2007) find that, while non-GAAP adjustments in street earnings are informative for forecasting future abnormal earnings, the forecasting coefficient for those adjustments is significantly smaller in absolute magnitude than the coefficient for other components of street earnings. Gu and Chen (2004) reach a similar conclusion when comparing core earnings and exclusions by analysts. The common thread in these studies is that non-GAAP exclusions have atypical predictive value compared to other components of net income.

In our example, investors may suspect that R&D costs have differential valuation implications compared to other operating expenses for some subset of GAAP firms. However, investors are likely to be more uncertain about the differential predictive value of R&D costs for GAAP firms than for non-GAAP firms that acknowledge explicitly the atypical nature of R&D costs. Although it is common to argue that non-GAAP exclusions have lower persistence than core earnings, we believe that the only requirement for incremental precision of non-GAAP earnings is that excluded items have persistence or predictive value that differs from other components of net income.

3.3 Pre-announcement period hypothesis

McNichols and Trueman (1994) present a model of private information search by informed traders with finite investment horizons. Informed traders establish equity positions based on their private information before a scheduled public disclosure. Similarly, Kim and Verrecchia (1997) provide a model of informed trading with pre-announcement private information in anticipation of a public disclosure.

Earnings announcements create value for informed traders because, in an efficient market, stock prices fully impound all publicly available information, including any previously private information revealed through earnings announcements.

The incentive to acquire private information before a public disclosure increases as the precision of the upcoming public disclosure increases because information with higher precision causes more belief revisions and more opportunities to profit from private information search (Kim and Verrecchia 1991). Information asymmetry (i.e., adverse selection associated with informed trading) should increase as the precision of forthcoming information increases. If non-GAAP earnings disclosures increase the precision of earnings with respect to the value of the firm, informed trading should reflect the likelihood that non-GAAP earnings disclosures will occur at the earnings announcement. Thus our first hypothesis (prediction) is:

H1 In the pre-announcement period, information asymmetry will be positively associated with the probability of non-GAAP earnings disclosures at the forthcoming quarterly earnings announcement.

3.4 Post-announcement period hypotheses

Our post-announcement tests compare the changes in information asymmetry (post-announcement less pre-announcement) for GAAP and non-GAAP earnings quarters. The post-announcement reduction in information asymmetry should be more pronounced as public disclosures become more informative. At the limit, a perfect or noiseless signal about the value of a firm would eliminate the information advantage of previously better informed investors, albeit only temporarily. All other things equal, a larger reduction in information asymmetry should occur when disclosures are more informative.

Earnings announcements have three information components: publicly anticipated, private, and undiscoverable. Publicly anticipated information should not impact information asymmetry in the pre- or post-announcement periods because informed and uninformed traders are similarly aware of it. Announcements that reveal informed traders' private information should narrow the gap between informed and uninformed (Diamond and Verrecchia 1991; Diamond 1985). At the same time, announcements that reveal previously undiscoverable information may stimulate information processing by, and serve as a source of profits for, traders who can better transform that information into knowledge about a firm's prospects (Kim and Verrecchia 1994), thereby increasing information asymmetry between informed and uninformed traders. However, the precision of that undiscoverable information limits this increase. Holding constant the amount of undiscoverable information, the post-announcement reduction in information asymmetry should be more pronounced when previously undiscoverable information is more precise.

In summary, the post-announcement change in information asymmetry depends on the amount and precision of the pre-disclosure private information and the amount and precision of previously undiscoverable earnings information. If non-GAAP adjustments identify components of GAAP income with atypical persistence and if informed traders have (noisy) estimates of those adjustments in advance of earnings announcements, the disclosure of non-GAAP earnings will transform pre-announcement private information into public knowledge. In addition, if non-GAAP earnings improve the precision or transparency of previously undiscoverable earnings information, the post-announcement information processing advantage of informed traders will be diminished. In both cases, the post-announcement reduction in information asymmetry should be more pronounced in non-GAAP than GAAP quarters. Our second hypothesis (prediction) is:

H2 The reduction in information asymmetry in the post-announcement period (post-announcement less pre-announcement asymmetry) will be more pronounced in non-GAAP than GAAP quarters.

For our third hypothesis, we view the magnitude of the non-GAAP adjustments as a proxy for the incremental precision of earnings information and predict that the post-announcement reduction in information asymmetry will be increasing with the absolute value of the non-GAAP adjustments. For example, if non-GAAP earnings reliably identify earnings components with atypical persistence, then the disclosure of non-GAAP earnings should increase the precision of earnings for valuation purposes and thereby reduce the information-processing advantage of informed traders. Thus our third hypothesis (prediction) is:

H3 For non-GAAP quarters, the post-announcement reduction in information asymmetry will be more pronounced as the absolute value of non-GAAP earnings adjustments increases.

4 Empirical proxies and research design

4.1 Non-GAAP and GAAP firm-quarters

For analysts, we classify a firm-quarter as non-GAAP when EPS, as reported by I/B/E/S in its unadjusted EPS file, differs from Compustat EPS before extraordinary items (Bradshaw and Sloan 2002). When I/B/E/S reports on a diluted (basic) earnings per share basis, we compare I/B/E/S unadjusted EPS to Compustat's *epsfxq* (*epspxq*). For managers, we rely on hand-collected data generously provided to us by Ted Christensen and Erv Black. Following those authors, we classify as non-GAAP any quarter in which management discloses a supplemental EPS number that differs from Compustat's diluted earnings per share (*epsfxq*). In supplemental tests, we use GAAP operating EPS (*oepsxq*) as a benchmark when classifying a quarter as GAAP or non-GAAP (separately for analysts and managers).

4.2 Pre- and post-announcement windows

We expect that informed trading and information asymmetry will increase in advance of a scheduled earnings announcement and that any reduction in information asymmetry will occur soon after earnings are announced. For the pre-announcement window $\langle -12, -3\rangle$, we use the 10 days beginning 12 trading days before the quarterly earnings announcement day ⟨0⟩. For the post-announcement window ⟨+3, +12⟩, we use the 10 days starting 3 days following the earnings announcement. We avoid the 5-day earnings-announcement window because adverse selection is significantly higher in that period than in others (Brooks 1994; Krinsky and Lee 1996; Lee et al. 1993). By excluding the 2 days before and the 2 days after earnings announcements, we reduce noise that would otherwise affect our pre- and post-announcement tests.

4.3 Adverse-selection cost

We use the adverse-selection component of the bid-ask spread as a proxy for the level of information asymmetry. In a pure dealer market, the bid-ask spread is the difference between the bid price at which the market maker is willing to buy and the higher ask price at which the market maker is willing to sell.[2] The spread compensates the market maker for three cost elements: order processing, inventory holding, and adverse selection. Adverse selection occurs when a market maker trades with better informed traders.

Informed traders execute trades after they acquire firm-specific private information that makes the quoted bid or quoted ask price favorable to them. In such cases, the market maker is at an information disadvantage and is likely to incur a loss from the trade. For example, an informed trader's buy order might result in a narrowing of the market maker's realized spread (and profit) if the midpoint between the bid price and the ask price increases after the trade. By observing order flow and order source, a market maker can adjust her quotes to discourage informed trades or to recover potential losses from informed trading. Larger ex ante quoted spreads protect against adverse selection, and quoted spreads increase as the probability of informed trading increases.

We estimate adverse-selection cost for each firm in our sample on a daily basis using the Lin et al. (1995) model. The model provides an estimate (*ADV*) of adverse-selection cost as a proportion of the effective spread. (See Appendix 1.) Because effective (and quoted) spreads have a negative relationship with trading volume (Demestz 1968; Tinic 1972; Stoll 1978; Lin et al. 1995; Van Ness et al. 2001), dollar adverse-selection cost will vary across firms with differential trading volume even when *ADV* is constant across firms. Given the differences in effective spreads across firms and time, we define the daily adverse-selection cost (cents per share) as $ASC_{ij} = ADV_{ij} \times ESPREAD_{ij} \times 100$, where $ESPREAD_{ij}$ is the average effective spread over all N trades for firm i in day j. Specifically, $ESPREAD_{ij} = \sum_{n=1}^{N} \left(|PRICE_{nij} - MIDPOINT_{nij}| \times 2 \right) / N_{ij}$. For each earnings announcement, the pre- and post-announcement estimates of adverse-selection cost, $ASCpre_{it}$ and $ASCpost_{it}$, are the average daily adverse-selection costs over their respective 10-day pre- and post-announcement windows for quarter t.

[2] The NASDAQ saw dramatic changes in the early 2000s because of the growth of electronic communication networks, which enable investors to submit anonymous limit orders and trade directly with each other (Barclay et al. 2003).

4.4 Pre-announcement cross-sectional OLS model

Our first test of H1 uses the following cross-sectional OLS regression model:

$$\begin{aligned} ASCpre_{\mathrm{it}} = {} & \alpha + \beta_0 ASCpre_{\mathrm{it}-1} + \beta_1 ProbNonGAAP_{\mathrm{it}} + \delta_1 C_{\mathrm{it}-1} + \delta_2 D_{it} \\ & + \delta_3 lnMIDPOINT_{\mathrm{it}} + \delta_4 lnTradeSize_{\mathrm{it}} + \delta_5 lnTradeFreq_{\mathrm{it}} + \delta_6 lnMV_{\mathrm{it}} \\ & + \delta_7 ANALYSTS_{\mathrm{it}} + \delta_8 BTM_{\mathrm{it}} + \delta_9 MBECQ_{\mathrm{it}-1} + \delta_{10} LOSS_{\mathrm{it}} + \varepsilon_{\mathrm{i}}. \end{aligned} \tag{1}$$

$ASCpre_{it}$ is the pre-announcement adverse-selection cost for firm *i* in quarter *t*. $ProbNonGAAP_{\mathrm{it}}$ is one of two proxies for the likelihood of non-GAAP earnings ($ProbSTREET_{it}$ and $ProbPROFORMA_{it}$). (See Appendix 3 for detailed descriptions of all variables.) Under H1, we expect adverse-selection cost in the pre-announcement period to be positively associated with the likelihood of non-GAAP earnings ($\beta_1 > 0$). The model used to estimate $ProbSTREET_{it}$ and $ProbPROFORMA_{it}$ is discussed in Sect. 4.5.1. In this section, we discuss our control variables.

The regression model includes the previous quarter's pre-announcement adverse-selection cost ($ASCpre_{\mathrm{it}-1}$) to control for any systematic differences between GAAP and non-GAAP firms. If systematic differences between the composition of firms in GAAP and non-GAAP quarters influence *ASC* in quarter *t*, those differences should similarly affect quarter $t - 1$. Thus the lagged value of the dependent variable should (partially) control for any differences in firm composition.

Our model controls for the uncertainty in firms' information environments because the quality and precision of a firm's information can affect its adverse-selection cost (Bhattacharya et al. 2012), its cost of capital (Botosan et al. 2004), and its trading costs (Sadka and Scherbina 2007). Relying on the Barron et al. (1998) model, we identify two components of the uncertainty in analyst *k*'s earnings forecast for firm *i* in quarter *t*, namely, idiosyncratic uncertainty (D_{it}) unique to analyst *k*'s private information set and common uncertainty (C_{it}) inherent to shared public information about firm *i*. (See Appendix 2.) The uncertainty in analysts' forecasts is distinct from, although clearly related to, the uncertainty about the intrinsic value of firm *i* conditional on investors' information set. Consistent with Barron et al. (2002) and Botosan et al. (2004), we scale D_{it} and C_{it} by the absolute value of the actual I/B/E/S earnings per share. In our regression models, we use the percentile ranks of scaled absolute values of *D* and *C* as control variables. Equation (1) uses the lagged value C_{it-1} because C_{it} is derived, in part, from actual EPS for quarter *t*, which is unknown to investors in the pre-announcement window for quarter *t*. The coefficients for C_{it-1} and D_{it} are expected to be positive.

To control for the nonlinear increase in adverse-selection cost as prices increases (Mayhew 2002), the model includes $lnMIDPOINT_{it}$ (the log of the average daily bid-ask midpoint over the 10-day pre-announcement window). Because larger firms generally have better information availability, fewer opportunities for private information search, and less information asymmetry (Brown et al. 2009), our model includes the log of market value of equity

(*$lnMV_{it}$*). The model includes trading frequency to control for liquidity effects and consequently lower adverse-selection cost for more frequently traded stocks (Lin et al. 1995). The relation between adverse selection and trade size, by contrast, is ambiguous. Although institutional investors are more likely to negotiate large trades inside the spread (Huang and Stoll 1996), larger trades also may indicate an increased likelihood of informed trading. Trade size (*lnTradeSize*) is the natural log of the average daily volume per trade over the pre-announcement window, and trading frequency (*lnTradeFreq*) is the natural log of the average daily buy and sell transactions over the same window.

The model controls for the number of analysts following a stock ($ANALYSTS_{it}$), because the greater the number of analysts following a firm, the fewer the incentives for other forms of private information search. Our model includes the book-to-market ratio (BTM_{it}) because firms with higher growth opportunities are more difficult to value, suggesting that low book-to-market firms provide more incentives for private information search by informed traders (Van Ness et al. 2001). We expect adverse-selection cost to be negatively associated with the number of analysts and the book-to-market ratio.

The variable $MBECQ_{it-1}$ (the number of consecutive quarters that firm *i* met or exceeded analysts' median forecasts) provides an ex ante measure of the likelihood thatn firm *i* will at least meet its earnings forecast for quarter *t*. Brown et al. (2009) show that the probability of informed trading is negatively associated with *MBECQ*, suggesting a negative relation between pre-announcement adverse-selection cost and $MBECQ_{it-1}$. Ng et al. (2009) present evidence that adverse selection is larger for firms reporting a loss. Thus our model controls for expected performance through the indicator variable $LOSS_{it}$, which equals 1 if analysts' median EPS forecast is negative and 0 otherwise.

We also include indicator variables for three important regulatory changes occurring during our sample period: decimalization of bid-ask quotes in 2001 (Bacidore 2001), Regulation FD in 2000, and Regulation G in 2003. We expect adverse-selection cost to decrease after decimalization, given that the effective spread is positively associated with changes in tick size (Bacidore 1997; Bessembinder 1997). Regulation FD forbids publicly traded firms from the selective disclosure of material nonpublic information and is intended to eliminate an information advantage previously enjoyed by favored investors. The regulation should reduce information asymmetry (Eleswarapu et al. 2004). Regulation G, requiring management to reconcile pro forma and GAAP earnings, resulted in a reduction in the frequency and magnitude of the non-GAAP adjustments by I/B/E/S (Entwistle et al. 2006; Heflin and Hsu 2008; Marques 2006) and may have reduced opportunities for private information search. Additionally, we control for year fixed-effects. Any regression model using adverse-selection cost or change in adverse–selection cost as a dependent variable includes our three regulatory indicators and year fixed-effect indicators as controls. We use clustered regression to correct standard errors for within-firm correlation of the error terms (Petersen 2009).

4.5 Treatment effect model

As an alternative to the OLS regression model in Eq. (1), we employ treatment effect models with separate selection and outcome equations. Treatment effect models control for nonrandom treatment assignment and potential coefficient bias in the outcome equation.

4.5.1 Treatment effect model: selection

The selection equation is a probit model, estimated separately for the disclosure choices by analysts and managers. The model relies primarily on a subset of the covariates employed by Lougee and Marquardt (2004) and Brown et al. (2012b). The covariates are intended to capture GAAP earnings informativeness, investor-perception management, regulatory changes, and unspecified factors as reflected in industry membership and prior disclosure choices by I/B/E/S. We recognize that analysts' and managers' incentives to report non-GAAP earnings are unlikely to be identical. For example, it is not clear why analysts would have an interest in misleading investors about firm performance in the same way as managers (Barth et al. 2012). In addition, analysts are less likely than managers to possess information that would allow them to adjust earnings to improve informativeness in the absence of nonrecurring items. On the other hand, managers may exert a strong influence on analysts' exclusion decisions, or analysts' forecasts (GAAP or non-GAAP) may influence managers' disclosure choices. Based on these considerations and for ease of comparability, we use the same selection model for analysts and managers.[3]

Earnings informativeness. Managers or analysts may disclose non-GAAP earnings if GAAP earnings are relatively uninformative about the value of the firm. Lougee and Marquardt (2004) show that pro forma earnings are more likely when a firm has more intangible assets (*INTANGIBLES*), more growth options (*SALESGROWTH* and market-to-book or *MTB*), more leverage (*LEVERAGE*), and higher earnings variability (*STDDEVROA*). Additionally, because special items are mostly nonrecurring, non-GAAP earnings are more likely for firms with special items (*SPECITEMS* = 1) than for firms without them (*SPECITEMS* = 0). We also include total assets (*lnTA*) in our selection model because larger firms are more likely to experience nonrecurring events (Brown et al. 2012b).

Investor-perception management. Managers may report pro forma earnings to influence the investors' perception (Schrand and Walther 2000; Barth et al. 2012), particularly when GAAP earnings miss one or more important benchmarks. Thus we include an indicator for negative forecast error (*negOPFE*) (Lougee and Marquardt 2004) and an indicator for GAAP operating loss (*OPLOSS*) (Brown et al. 2012b) in our selection model.

[3] In robustness checks using a street selection model excluding five variables related solely to earnings informativeness and missed earnings targets (i.e., *INTANGIBLES*, *MTB*, *LEVERAGE*, *negOPFE*, and *OPLOSS*), we find results for analysts (untabulated) very nearly identical to our reported findings.

Regulatory changes. Our selection model also includes an indicator variable to denote quarters ending before or after the effective date of Sarbanes–Oxley Act (*SOX*) in 2002. Prior studies document a downward shift in the frequency of street and pro forma earnings (Marques 2006; Heflin and Hsu 2008) and a change in investor perception toward pro forma earnings (Black et al. 2012) after SOX.[4]

Other unspecified factors. Our models include covariates that capture the history of analysts' disclosure selection. We use two separate variables, one that captures the previous consecutive quarters that I/B/E/S reported GAAP EPS (GQ_{it-1}) and another that captures the previous consecutive quarters that I/B/E/S reported street EPS (NQ_{it-1}). We also control for industry membership because the likelihood of pro forma earnings varies across industries (Brown et al. 2012b). Industry membership and the historical sequence of I/B/E/S actual earnings (GAAP or street) are strong indicators of disclosure selection for analysts and managers in our sample, as we show later.

4.5.2 *Treatment effect model: outcome*

The pre-announcement treatment-effect outcome model is:

$$\begin{aligned} ASCpre_{\mathrm{it}} = {} & \alpha + \beta_0 ASCpre_{\mathrm{it-1}} + \beta_1 NonGAAP_{\mathrm{it}} + \beta_2 IMR_{\mathrm{it}} + \delta_1 C_{\mathrm{it-1}} + \delta_2 D_{\mathrm{it}} \\ & + \delta_3 lnMIDPOINT_{\mathrm{it}} + \delta_4 lnTradeSize_{\mathrm{it}} + \delta_5 lnTradeFreq_{\mathrm{it}} + \delta_6 lnMV_{\mathrm{it}} \\ & + \delta_7 ANALYSTS_{\mathrm{it}} + \delta_8 BTM_{\mathrm{it}} + \delta_9 MBECQ_{\mathrm{it-1}} + \delta_{10} LOSS_{\mathrm{it}} + \varepsilon_{\mathrm{i}}. \end{aligned} \tag{2}$$

For analysts (managers), $NonGAAP_{\mathrm{it}}$ equals 1 if I/B/E/S (managers) issued a street (pro forma) EPS number for firm *i* in quarter *t* and 0 otherwise. Except for the treatment variable (*NonGAAP*), the outcome model is identical for analysts and managers. The pre-announcement outcome model uses the same control variables as the OLS Eq. (1), with the addition of the inverse Mills ratio (*IMR*). *IMR* reflects unobserved factors that affect the selection and the outcome as inferred from the correlation between the error terms from the selection and outcome equations. The treatment effect model aims to eliminate (or reduce) bias in the estimation of the coefficient on the indicator treatment variable in the outcome equation. Under H1, the coefficient on *NonGAAP* is expected to be positive, consistent with a positive treatment effect, that is, higher pre-announcement adverse-selection cost for non-GAAP quarters than for GAAP quarters. We use two-step estimation for all treatment effect models. Results are qualitatively the same with maximum likelihood estimation.

4.6 Post-announcement models

We use treatment effect models exclusively to test H2. Our post-announcement and pre-announcement selection models are identical. However, our post-announcement

[4] In robustness tests, we also included an indicator variable for Regulation G in the selection model. That variable is not significant in any case.

outcome model differs from our pre-announcement outcome model because our second hypothesis predicts differences in post-announcement changes in adverse selection for GAAP and non-GAAP quarters rather than differences in pre-announcement levels of adverse selection. The post-announcement outcome model is:

$$\begin{aligned} chgASC_{\mathrm{it}} = {} & \alpha + \beta_0 ASCpre_{\mathrm{it}-1} + \beta_1 NonGAAP_{\mathrm{it}} + \beta_2 IMR_{\mathrm{it}} + \delta_1 absFEs_{\mathrm{it}} \\ & + \delta_2 chgC_{\mathrm{it}} + \delta_3 chgD_{\mathrm{it}+1} + \delta_4 chglnMIDPOINT_{\mathrm{it}} + \delta_5 chglnTradeSize_{\mathrm{it}} \\ & + \delta_6 chglnTradeFreq_{\mathrm{it}} + \delta_7 LOSS2_{\mathrm{it}} + \varepsilon_{\mathrm{i}}. \end{aligned} \quad (3)$$

In Eq. (3), *chgASC* is the change in the adverse-selection cost; *NonGAAP* is the previously defined indicator variable; *absFEs* is the absolute value of the forecast error scaled by end-of-quarter stock price; *chglnMIDPOINT* is the change in the log of the midpoint; *chglnTradeSize* is the change in the log of trade size; and *chglnTradeFreq* is the change in the log of the number of trades. We calculate changes in *ASC*, midpoint, trade size, and trade frequency as the post-announcement-window level minus the pre-announcement-window level. Thus a positive (negative) value for those change variables indicates an increase (decrease) in the level of the variable in the post-announcement period relative to the pre-announcement period.[5] H2 predicts that non-GAAP earnings (and the associated non-GAAP earnings adjustments) reduce information asymmetry more than GAAP earnings alone and that, as a result, the reduction in adverse-selection cost will be more pronounced when a manager reports pro forma earnings or I/B/E/S reports street earnings. Thus, under H2, we expect β_1 to be less than zero.

The variable $chgC_{it}$ ($=C_{it} - C_{it-1}$) is the change in the uncertainty of public earnings information as revealed at the earnings announcement for quarter t compared to quarter $t - 1$. The variable $chgD_{it+1}$ ($=D_{it+1} - D_{it}$) captures the change in the uncertainty in analysts' private information following the quarter t earnings announcement, under the assumption that the pre-announcement forecast dispersion for quarter $t + 1$ best reflects the level of uncertainty in analysts' private information following the announcement of earnings for quarter t. As $chgC_{it}$ and $chgD_{t+1}$ increase, we expect the level of and change in post-announcement adverse selection to be larger (i.e., $\delta_2 > 0$ and $\delta_3 > 0$). *LOSS2* is an indicator variable equal to 1 if actual earnings (as reported by analysts or managers, as appropriate) is negative and 0 otherwise. The sign for the loss variable is difficult to predict because of the high correlation between forecasted and actual losses and because *ASCpre* reflects the forecasted sign of earnings.

Our post-announcement model for H3 is restricted to non-GAAP (street and pro forma) firm-quarters and examines the association between the change in adverse-

[5] Equation (3) does not include changes in *lnMV*, *ANALYSTS*, and *BTM* because size, number of analysts, and book-to-market for any firm-quarter are essentially fixed. Additionally, *ASCpre* in Eq. (3) already reflects size, number of analysts, and book to market. Omitting size, however, may be a special concern because small firms typically have more informative earnings announcements than large firms. We reran the model including size (*lnMV*). Size is not significant, and its inclusion does not affect any inferences.

selection cost and the magnitude of the non-GAAP earnings adjustments made by analysts and managers. Separately for analysts and managers, we estimate the following OLS model:

$$\begin{aligned} chgASC_{it} = {} & \alpha + \beta_0 ASCpre_{it} + \beta_1 RANKabsEXs_{it} + \delta_1 absFEs_{it} + \delta_2 chgC_{it} \\ & + \delta_3 chgD_{it+1} + \delta_4 chglnMIDPOINT_{it} + \delta_5 chglnTradeSize_{it} \\ & + \delta_6 chglnTradeFreq_{it} + \delta_7 LOSS2_{it} + \varepsilon_i . \end{aligned} \quad (4)$$

In Eq. (4), *RANKabsEXs* is the rank of *absEXs*, where *absEXs* is the absolute value of the difference between street (pro forma) EPS and GAAP EPS, scaled by share price, for analysts (managers). Other variables are defined previously. H3 predicts that the reduction in information asymmetry will be increasingly pronounced as the non-GAAP earnings adjustment increases. If H3 is correct, the change in adverse-selection cost should be negatively associated with *RANKabsEXs*. H3 predicts that $\beta_1 < 0$.

5 Sample and descriptive statistics

We obtain data for adverse-selection cost from NASTRAQ intra-day trade and quote data. We adopt the procedures used in several studies (Barclay and Hendershott 2004; Chung et al. 2006; Huang and Stoll 1996) when cleaning the data and matching trades and quotes. (Details are available upon request.) Forecasted EPS, street EPS, and the number of analysts making forecasts are obtained from the unadjusted I/B/E/S database. We obtain earnings announcement dates, basic and diluted quarterly earnings per share before extraordinary items, and other accounting data from Compustat. Stock return data are from CRSP. Ted Christensen and Erv Black shared their hand-collected manager pro forma data for this study.

Our analysis centers on quarterly earnings announcements from Compustat with available NASTRAQ data[6] (from 1999 to 2006 in the WRDS database). We first calculate adverse-selection cost on a daily basis, dropping any day with fewer than 30 trades for a stock (Lin et al. 1995). Then, for each quarterly earnings announcement, we find the mean daily adverse-selection cost over the pre- and post-announcement windows, separately.

The NASTRAQ database comprises 10,843 different firms represented at least once. Of those, 4878 firms appear at least once in Compustat and I/B/E/S. We restrict the study to firm-quarters with all data necessary to test our three hypotheses, including adverse-selection data, I/B/E/S forecasts and actual earnings

[6] We choose NASTRAQ intra-day data over TAQ data for three reasons. First, NASTRAQ permits accurate matching of trade and quote data because actual trade execution times are known; TAQ stamps a trade based on when it is reported rather than when it is executed. Second, unlike TAQ, NASTRAQ does not round transaction sizes and prices.

data, CRSP return data, and Compustat data. We further require that all firm-quarters in the sample have at least three analyst forecasts in the pre- and post-announcement periods, at least five daily returns on CRSP in the pre- and post-announcement periods, and at least five valid observations on daily adverse-selection cost in each estimation window. We merge manager pro forma data to our dataset using Compustat GVKEY and CRSP PERMNO. The final sample is 21,327 firm-quarters and 2279 unique firms. Of those firms, 809 report pro forma earnings for at least one quarter, and 1702 have an I/B/E/S street earnings for at least one quarter.

Table 1 Panel A reports the number of observations (firm-quarters) by fiscal year. Over the entire sample period, analysts (managers) issue non-GAAP earnings in 45.57 (14.83) % of all firm-quarters. From 1999 to 2001, street and pro forma earnings increase as a percentage of the total earnings disclosures in a given year. Beginning in 2002, pro forma and street earnings become less popular until 2006. Panel B reports the number of firm-quarters by industry using an industry classification scheme similar to the classification in Barth et al. (1998). Street and pro forma earnings, as a proportion of the industry total, varies considerably across industries. For analysts and managers, the proportion of non-GAAP earnings is above the sample average for three industry groups (food; manufacturing: electrical equipment; and computers). The variability of non-GAAP earnings across industries justifies industry membership as a covariate in our selection model.

Table 2 Panel A reports descriptive statistics for variables related (primarily) to forecasted and actual quarterly earnings, classified by street vs. GAAP quarters for analysts and by pro forma vs. GAAP quarters for managers. On average, the market value of common equity and the number of analysts following a firm are larger for non-GAAP than GAAP quarters. Also, the average book-to-market ratio is higher for non-GAAP than GAAP quarters. We control for these three variables in the regression models that explain adverse-selection cost.

As expected, analysts' street EPS ($0.140 median) is higher than the median EPS reported by Compustat ($0.070 primary and diluted). Similarly, managers' median pro forma EPS ($0.130) is higher than the median EPS reported by Compustat ($0.060 primary and diluted). The mean absolute earnings adjustment, as a percentage of stock price, is 1.675 % for street earnings and 1.096 % for pro forma earnings. Forecast errors, based on earnings numbers reported by analysts and managers, are generally more favorable when non-GAAP earnings are reported. For example, when managers issue pro forma (GAAP) earnings, approximately 67.9 (58.1) % of firms beat the I/B/E/S forecast and 22.3 (25.5) % miss the forecast.

Table 2 Panel B reports mean and median statistics for information uncertainty, intra-day trading measures, and adverse-selection cost. Based on mean values, the Barron et al. (1998) measures of information uncertainty are higher in non-GAAP than GAAP quarters for analysts; however, the opposite is true for managers. For analysts and managers, median trade sizes and median trading frequencies are larger in non-GAAP than in GAAP quarters. The substantially greater market liquidity for non-GAAP quarters is a primary reason why, on average, effective spread and adverse-selection cost are lower in non-GAAP than GAAP quarters. These liquidity differences illustrate the importance of controlling for trading frequency. As

Table 1 Sample distribution

Panel A: Year distribution

Year	Sample total	Analysts			Managers		
		GAAP	Street		GAAP	Pro forma	
	N	N	N	Percent	N	N	Percent
1999	1784	1049	735	41.20	1646	138	7.74
2000	1972	1019	953	48.33	1658	314	15.92
2001	2410	1074	1336	55.44	1899	511	21.20
2002	2493	1276	1217	48.82	2082	411	16.49
2003	2573	1459	1114	43.30	2204	369	14.34
2004	3109	1753	1356	43.62	2639	470	15.12
2005	3609	2071	1538	42.62	3181	428	11.86
2006	3377	1908	1469	43.50	2855	522	15.46
Total	21,327	11,609	9718	45.57	18,164	3163	14.83

Panel B: Industry distribution

Industry (SIC range)	Total	Analysts			Managers		
		GAAP	Street		GAAP	Pro forma	
	N	N	N	%	N	N	%
Not assigned	55	25	30	54.5	46	9	16.5
Mining/construction (1000–1099)	59	44	15	25.4	56	3	5.1
Food (2000–2111)	111	59	52	46.9	91	20	18.0
Textiles/print/publish (2200–2780)	393	273	120	30.5	376	17	4.3
Chemicals (2800–2824, 2840–2899)	104	71	33	31.7	99	5	4.8
Pharmaceuticals (2830–2836)	1865	1303	562	30.1	1680	185	9.9

Table 1 continued

Panel B: Industry distribution

Industry (SIC range)	Total	Analysts			Managers		
		GAAP	Street		GAAP	Pro forma	
	N	N	N	%	N	N	%
Extractive (1300–1399, 2900–2999)	224	135	89	39.7	211	13	5.8
Manuf: rubber/glass/etc. (3000–3299)	101	71	30	29.7	99	2	2.0
Manuf: metal (3300–3499)	196	95	101	51.5	184	12	6.1
Manuf: machinery (3500–3599)	645	350	295	45.7	571	74	11.5
Manuf: electrical equipment (3600–3699)	1082	470	612	56.6	836	246	22.7
Manuf: transportation equipment (3700–3799)	132	101	31	23.5	122	10	7.6
Manuf: instruments (3800–3899)	1541	889	652	42.3	1333	208	13.5
Manuf: miscellaneous (3900–3999)	84	49	35	41.7	81	3	3.6
Computers (3570–3579, 3670–3679,7370–7379)	6325	2291	4034	63.8	4646	1679	26.5
Transportation (4000–4899)	1502	933	569	37.9	1429	73	4.9
Utilities (4900–4999)	95	60	35	36.8	85	10	10.5
Retail: wholesale (5000–5199)	428	257	171	39.9	383	45	10.5
Retail: miscellaneous (5200–5999)	1364	951	413	30.3	1267	97	7.1
Retail: restaurant (5800–5899)	402	280	122	30.3	372	30	7.5
Financial (6000–6411)	2690	1815	875	32.5	2484	206	7.7
Insurance/real estate (6500–6999)	132	56	76	57.6	127	5	3.8
Services (7000–8999)	1797	1031	766	42.6	1586	211	11.7
Total	21,327	11,609	9718	45.6	18,164	3163	14.8

The total sample consists of 21,327 firm-quarter observations. For analysts, we classify firm-quarters by whether I/B/E/S issued GAAP EPS or street (non-GAAP) EPS. For managers, we classify firm-quarters by whether management issued GAAP EPS alone or pro forma (non-GAAP) EPS as a supplement to GAAP earnings. See Appendix 3 for details

Table 2 Descriptive statistics

Variable[a]	Acronym	Analysts (n = 21,327)				Managers (n = 21,327)					
		GAAP (n = 11,609)		Street (n = 9718)		GAAP (n = 18,164)		Pro forma (3163)		T-statistic diff. in means: GAAP minus non-GAAP	
		Mean	Med	Mean	Med	Mean	Med	Mean	Med	Analysts	Managers
Panel A: Forecast and earnings variables											
Number of analysts	ANALYSTS	6.750	5.000	8.140	6.000	7.150	6.000	8.720	7.000	−20.73***	−16.77***
Market value ($ millions)	MV	1708	657	2385	754	1890	680	2739	793	−12.52***	−11.20***
Book-to-market	BTM	0.384	0.335	0.467	0.389	0.418	0.353	0.449	0.370	−18.52***	−5.037***
Analyst median forecast EPS < 0	LOSS	0.240	0.000	0.263	0.000	0.254	0.000	0.230	0.000	−3.74***	2.90***
Analyst (manager) actual EPS < 0	LOSS2	0.243	0.000	0.269	0.000	0.293	0.000	0.219	0.000	−4.31***	8.54***
GAAP EPS diluted		0.164	0.200	0.014	0.070	0.112	0.160	−0.001	0.060	23.13***	12.30***
GAAP EPS primary		0.173	0.200	0.022	0.070	0.121	0.160	0.006	0.060	22.81***	12.32***
Analyst/manager EPS		0.168	0.200	0.141	0.140	0.114	0.160	0.159	0.130	5.33***	−5.27***
Absolute analyst/manager earnings adjustment											
Dollar per share	absEX	0.000	0.000	0.183	0.070	0.000	0.000	0.142	0.080	−64.18***	−120.00***
Percentage of share price	absEXs	0.000	0.000	1.675	0.374	0.000	0.000	1.096	0.398	−43.21***	−96.90***
Analyst/manager forecast error											
Dollar per share	FE	0.009	0.010	0.009	0.010	0.009	0.010	0.017	0.010	−0.50	−5.47***
Dollar per share (absolute value)	absFE	0.045	0.020	0.050	0.020	0.050	0.020	0.042	0.020	−4.45***	4.88***
Percentage of share price (abs. value)	absFEs	0.332	0.100	0.423	0.118	0.386	0.111	0.360	0.116	−6.89***	1.35
Direction of analyst/manager forecast error											
Meet estimate	MEET	0.171	0.000	0.159	0.000	0.165	0.000	0.097	0.000	2.32**	9.64***
Beat estimate	BEAT	0.578	1.000	0.597	1.000	0.581	1.000	0.679	1.000	−2.81***	−10.48***
Miss estimate	MISS	0.251	0.000	0.244	0.000	0.255	0.000	0.223	0.000	1.21	3.83***
Consecutive quarter of MBE at $t-1$	MBECQ	4.356	3.000	4.530	3.000	4.296	3.000	5.236	4.000	−2.01**	−7.75***
Probability of Street/Pro forma at t[b]	ProbNonGAAP	0.265	0.202	0.673	0.719	0.112	0.073	0.246	0.222	−130.0***	−56.0***

Table 2 continued

Variable[a]	Acronym	Analysts (n = 21,327)				Managers (n = 21,327)					
		GAAP (n = 11,609)		Street (n = 9718)		GAAP (n = 18,164)		Pro forma (3163)		T-statistic diff. in means: GAAP minus non-GAAP	
		Mean	Med	Mean	Med	Mean	Med	Mean	Med	Analysts	Managers
Panel B: Barron et al. (1998) and ASC-related variables											
Barron et al. (1998) information uncertainty (scaled by absolute value of I/B/E/S-issued EPS)											
Total uncertainty	V	0.034	0.004	0.044	0.006	0.040	0.005	0.030	0.005	−6.45***	4.135***
Private uncertainty	D	0.009	0.001	0.012	0.001	0.010	0.001	0.009	0.001	−6.27***	1.59
Common uncertainty	C	0.023	0.002	0.030	0.002	0.027	0.002	0.020	0.002	−5.51***	3.979***
Average trade size	TradeSize										
Pre-announcement		452	354	502	414	471	372	494	423	−11.97***	−3.83***
Post-announcement		465	360	515	421	485	379	503	429	−11.17***	−2.95***
Change: post minus pre		13	3	13	30	13	3	10	2	0.08	0.95
Average daily trading frequency	TradeFreq										
Pre-announcement		1168	454	1941	688	1374	516	2354	797	−20.49***	−18.50***
Post-announcement		1212	496	1989	744	1419	554	2409	870	−20.52***	−18.64***
Change: post minus pre		68	16	99	15	72	15	145	20	−3.01***	−5.11***
Mean effective spread (cents per share)	ESPREAD										
Pre-announcement		7.847	5.389	6.743	4.261	7.528	5.009	6.289	4.088	11.07***	8.85***
Earnings announcement		7.989	5.615	6.791	4.480	7.630	5.228	6.368	4.196	12.16***	9.14***
Post-announcement		7.409	5.127	6.303	4.050	7.081	4.760	5.896	3.884	12.04***	9.20***
Adverse selection (proportion of spread)	ADV										
Pre-announcement		0.268	0.257	0.268	0.252	0.268	0.255	0.269	0.253	−0.42	−0.37
Earnings announcement		0.274	0.258	0.275	0.252	0.274	0.256	0.275	0.250	−0.79	−0.05
Post-announcement		0.275	0.258	0.275	0.252	0.274	0.256	0.276	0.253	−0.00	−0.51

Table 2 continued

Variable[a]	Acronym	Analysts (n = 21,327)				Managers (n = 21,327)					
		GAAP (n = 11,609)		Street (n = 9718)		GAAP (n = 18,164)		Pro forma (3163)		T-statistic diff. in means: GAAP minus non-GAAP	
		Mean	Med	Mean	Med	Mean	Med	Mean	Med	Analysts	Managers
Panel B: Barron et al. (1998) and ASC-related variables											
Adverse-selection cost (cents per share)	ASC										
Pre-announcement		1.722	1.374	1.459	1.112	1.640	1.292	1.382	1.053	15.72***	10.98***
Earnings announcement		1.784	1.432	1.509	1.174	1.700	1.359	1.425	1.116	16.42***	11.42***
Post-announcement		1.664	1.332	1.400	1.082	1.582	1.255	1.326	1.027	16.68***	11.48***

Variable[a]	Acronym	Analysts (n = 21,327)				Managers (n = 21,327)					
		GAAP (n = 11,609)		Street (n = 9718)		GAAP (n = 18,164)		Pro forma (3163)		T-statistic diff. in means: GAAP minus non-GAAP	
		Mean	Med	Mean	Med	Mean	Med	Mean	Med	Analysts	Managers
Panel C: Selection models variables											
Sales growth	SALESGROWTH	0.359	0.174	0.320	0.153	0.339	0.165	0.356	0.166	3.45***	−1.06
Earnings variability	STDDEVROA	0.027	0.013	0.040	0.019	0.031	0.014	0.041	0.021	−15.83***	−8.97***
Special items indicator	SPECITEMS	0.176	0.000	0.544	1.000	0.307	0.000	0.556	1.000	−60.95***	−27.79***
Log of total assets	lnTA	6.249	6.038	6.458	6.284	6.337	6.146	6.386	6.197	−10.67***	−1.80*
SOX indicator	SOX	0.671	1.000	0.626	1.000	0.655	1.000	0.624	1.000	6.85***	3.360***
Consecutive qtrs. I/B/E/S Street EPS[c]	NQ_{t_1}	0.517	0.000	3.363	2.000	1.454	0.000	3.880	3.000	−88.29***	−48.41***
Consecutive qtrs. I/B/E/S GAAP EPS[c]	GQ_{t_1}	3.686	3.000	0.877	0.000	2.688	1.000	0.788	0.000	77.94***	34.71***
Intangibles intensity	INTANGIBLES	0.024	0.000	0.039	0.001	0.028	0.000	0.047	0.007	−15.99***	−13.71***
Market value to book value	MTB	0.138	0.087	0.098	0.055	0.124	0.074	0.096	0.056	16.41***	8.24***

Table 2 continued

Variable[a]	Acronym	Analysts (n = 21,327)				Managers (n = 21,327)				T-statistic diff. in means: GAAP minus non-GAAP	
		GAAP (n = 11,609)		Street (n = 9718)		GAAP (n = 18,164)		Pro forma (3163)			
		Mean	Med	Mean	Med	Mean	Med	Mean	Med	Analysts	Managers
Panel C: Selection models variables											
Leverage	LEVERAGE	2.180	0.585	1.353	0.519	1.906	0.582	1.211	0.432	16.63***	9.95***
Negative op. income forecast error indicator	negOPFE	0.250	0.000	0.571	1.000	0.357	0.000	0.621	1.000	−50.57***	−28.59***
Operating loss indicator	OPLOSS	0.241	0.000	0.338	0.000	0.276	0.000	0.336	0.000	−15.78***	−6.83***

[a] A variable with the prefix 'ln' denotes the natural logarithm of the variable. All continuous variables, except those that are log transformations, are winsorized at the top and bottom 1 percentile. Appendix 3 defines all variables

[b] The estimated probabilities of street earnings and pro forma earnings at quarter *t* are based on logistic models using covariates described in Sect. 4.5.1. In this table and for the OLS model in Table 4, the probabilities of street and pro forma earnings are from models estimated over all firm-quarters (n = 43,505) with data within the sample date range (1999–2006). We estimate the models separately for analysts' and managers' reporting selections, with the percent concordant 85.4 and 78.9, respectively

[c] We use consecutive quarters of I/B/E/S-reported street and I/B/E/S-reported EPS in the selection models for both analysts and managers because we do not have data on the history of manager-reported pro forma EPS

expected, the mean and median effective spreads (cents per share) and adverse-selection cost (cents per share) decline in the post-announcement period relative to the pre-announcement period, consistent with a decrease in information asymmetry following earnings announcements.

Table 2 Panel C reports means and medians for variables in our selection model. As expected, the volatility of return on assets (*STDDEVROA*) and the frequency of special items (*SPECITEMS*) are larger, on average, in non-GAAP than in GAAP quarters for analysts and managers. Also as expected, non-GAAP quarters have more intangible assets (*INTANGIBLES*), a higher frequency of negative forecast errors for operating earnings (*negOPFE*), and a higher frequency of negative operating earnings (*OPLOSS*) than GAAP quarters. And non-GAAP quarters exhibit larger firm size (*lnTA*) and are less likely after SOX. However, contrary to expectations, market-to-book (*MTB*), and leverage (*LEVERAGE*) are higher in GAAP than in non-GAAP quarters.

Table 3 classifies the sample by the number of consecutive quarters that I/B/E/S issued GAAP or street earnings as of quarter $t-1$. For each classification, Table 3 reports the mean probability of street and pro forma earnings for quarter t from our selection model and the actual frequency of GAAP and non-GAAP earnings reported in quarter t by analysts and managers. For example, in 849 cases, I/B/E/S issued a GAAP earnings number for exactly five consecutive quarters as of $t-1$. For those 849 cases, the actual frequency of street (pro forma) earnings in quarter t is 139 (45), and the relative frequency of street (pro forma) earnings is 16.37 (5.30) %. By contrast, for the 602 cases where I/B/E/S reported street earnings for exactly five consecutive quarters at $t-1$, the actual frequency of street (pro forma) earnings in quarter t is 487 (177), and the relative frequency is 80.90 (29.40) %. On average, the estimated probabilities of street and pro forma earnings in quarter t from our selection models increase monotonically as the consecutive quarters of I/B/E/S-issued GAAP (street) earnings as of quarter $t-1$ decreases (increases). The results in Table 3 illustrate that the reporting choices by analysts and managers are not statistically independent, an issue we return to below.

Figure 1 plots median daily adverse-selection measures from 20 days prior through 20 days after earnings announcements for street and GAAP quarters. (The plots for pro forma versus GAAP quarters resemble those in Fig. 1.) In Panel A, the median effective spread (*ES*) spikes upward just before and on the day of the earnings announcements and plummets immediately thereafter. Panel B reports a similar pattern for adverse-selection cost per share (*ASC*). At each point in event time, effective spread in Panel A and *ASC* in Panel B are lower for the street portfolio than the GAAP portfolio. The lower adverse-selection cost for the street portfolio reflects the generally larger size and greater liquidity of firms in the street portfolio compared to the GAAP portfolio. Panels A and B illustrate the importance of controlling for size and other factors that affect the levels of and the changes in adverse-selection cost.

Figure 1 Panel C plots the deviation of the daily median *ASC* from each portfolio's 41-day median. Street quarters have a smaller spike than GAAP quarters on the day of the earnings announcements, consistent with earlier price discovery for street than GAAP quarters. Post-announcement period *ASC* is noticeably lower

Table 3 Analysis of consecutive quarters of GAAP and street earnings at t − 1 and the likelihood of non-GAAP street and pro forma earnings in quarter t

I/B/E/S-issued EPS[a]		Analysts: GAAP and street earnings at quarter t				Managers: GAAP and pro forma earnings at quarter t			
		GAAP	Street			GAAP	Pro forma		
	Total at t − 1	N	N	Actual relative frequency (%)	Estimated mean logit probability[b] (%)	N	N	Actual relative frequency (%)	Estimated mean logit probability[b] (%)
Consecutive GAAP earnings at t − 1									
≥8	3131	2744	387	12.36	9.88	3011	120	3.83	2.26
7	573	472	101	17.63	18.59	550	23	4.01	4.50
6	688	592	96	13.95	20.54	657	31	4.51	5.02
5	849	710	139	16.37	22.47	804	45	5.30	5.56
4	1038	831	207	19.94	25.53	984	54	5.20	6.45
3	1269	973	296	23.33	30.20	1181	88	6.93	7.67
2	1700	1291	409	24.06	32.89	1595	105	6.18	8.61
1	2524	1612	912	36.13	38.28	2254	270	10.70	10.40
Consecutive street earnings at t − 1									
1	2642	1266	1376	52.08	48.57	2285	357	13.51	13.10
2	1383	374	1009	72.96	58.52	1085	298	21.55	15.89
3	941	178	763	81.08	65.84	720	221	23.49	17.71
4	770	139	631	81.95	71.54	577	193	25.06	18.87
5	602	115	487	80.90	77.30	425	177	29.40	21.06
6	489	65	424	86.71	82.02	332	157	32.11	22.73
7	396	45	351	88.64	85.91	261	135	34.09	24.85

Table 3 continued

I/B/E/S-issued EPS[a]		Analysts: GAAP and street earnings at quarter t				Managers: GAAP and pro forma earnings at quarter t			
		GAAP	Street			GAAP	Pro forma		
	Total at t − 1	N	N	Actual relative frequency (%)	Estimated mean logit probability[b] (%)	N	N	Actual relative frequency (%)	Estimated mean logit probability[b] (%)
≥8	2332	202	2130	91.34	95.37	1443	889	38.12	36.32
Total	21,327	11,609	9718	45.57	45.08	18,164	3163	14.83	13.19

[a] We use I/B/E/S EPS because we have a long history of I/B/E/S data but no manager EPS data before 1999

[b] The estimated probability of street earnings and pro forma earnings at quarter *t* are based on logistic models using covariates described in Sect. 4.5.1. In this table and for the OLS model in Table 4 Panel A, the probabilities of street and pro forma earnings are from models estimated over all firm-quarters (n = 43,505) with data within the sample date range (1999–2006). We estimate the model separately for analysts' and managers' reporting selection, with a percent concordant of 85.4 and 78.9, respectively. When we restrict the model estimation to firm-quarters with all data necessary for our full sample in Table 4 Panel A (n = 21,327), the percent concordant is 86.1 for analysts and 78.6 for managers

for both portfolios than their respective pre-announcement period *ASC*, consistent with earnings disclosures that reveal informed traders' pre-announcement private information. Panel D plots the difference between the daily median *ASC* for the two groups (street minus GAAP). The dip in the plot series on the earnings announcement day is due to the larger increase in *ASC* for the GAAP portfolio compared to the street portfolio. Panel D does not clearly show whether the post-announcement decline in *ASC* differs between the street and GAAP portfolios.

6 Regression results

6.1 Results for H1 using OLS models

Our first set of tests, using the OLS model described in Sect. 4.4, examines whether adverse-selection cost in the pre-announcement period is positively associated with the probability of street and pro forma earnings as predicted by H1. In Table 4 Panel A, columns (a) and (b) report results for the full sample, separately for analysts and managers; columns (c) and (d) report the results for quarters when the disclosure choice changed from GAAP to non-GAAP or vice versa. We first discuss the full sample results in Table 4 Panel A and then turn to the restricted sample findings.

For analysts (managers), $ProbNonGAAP_{it}$ is the probability that I/B/E/S (managers) will issue street (pro forma) earnings for firm *i* at the quarter *t* earnings release. For analysts in column (a) and managers in column (b), the coefficient on *ProbNonGAAP* is positive and significant ($p < 0.001$), indicating that adverse-selection cost in the pre-announcement period is increasing as the probability of non-GAAP earnings (street or pro forma) increases. As expected, pre-announcement adverse-selection cost, $ASCpre_t$, is positively associated with $ASCpre_{t-1}$. This is consistent with firm-level effects that evolve slowly. Pre-announcement adverse-selection cost is also positively associated ($p < 0.001$) with the uncertainty of a firm's public information (*RankC*), suggesting that information asymmetry is increasing with the underlying uncertainty intrinsic to a firm's information environment.

For the full sample, adverse-selection cost is positively associated with stock price (*lnMIDPOINT*), as expected, and negatively associated with trading frequency (*lnTradeFreq*) and trade size (*lnTradeSize*). The negative coefficient for trading frequency ($p < 0.001$) is consistent with lower information asymmetry as market liquidity increases. However, the negative coefficient for trade size ($p < 0.01$) is inconsistent with larger trades as an indicator of a higher likelihood of informed trades. This outcome may not be entirely surprising because trade size may be a poor indicator for trades by sophisticated investors (Cready et al. 2014). We do find, as expected, that adverse-selection cost is negatively associated with market value of equity (*lnMV*) and book-to-market ratio (*BTM*), consistent with better information availability and less information asymmetry for larger firms and lower growth firms. The coefficients for *ANALYSTS* in columns (a) and (b) are, unexpectedly,

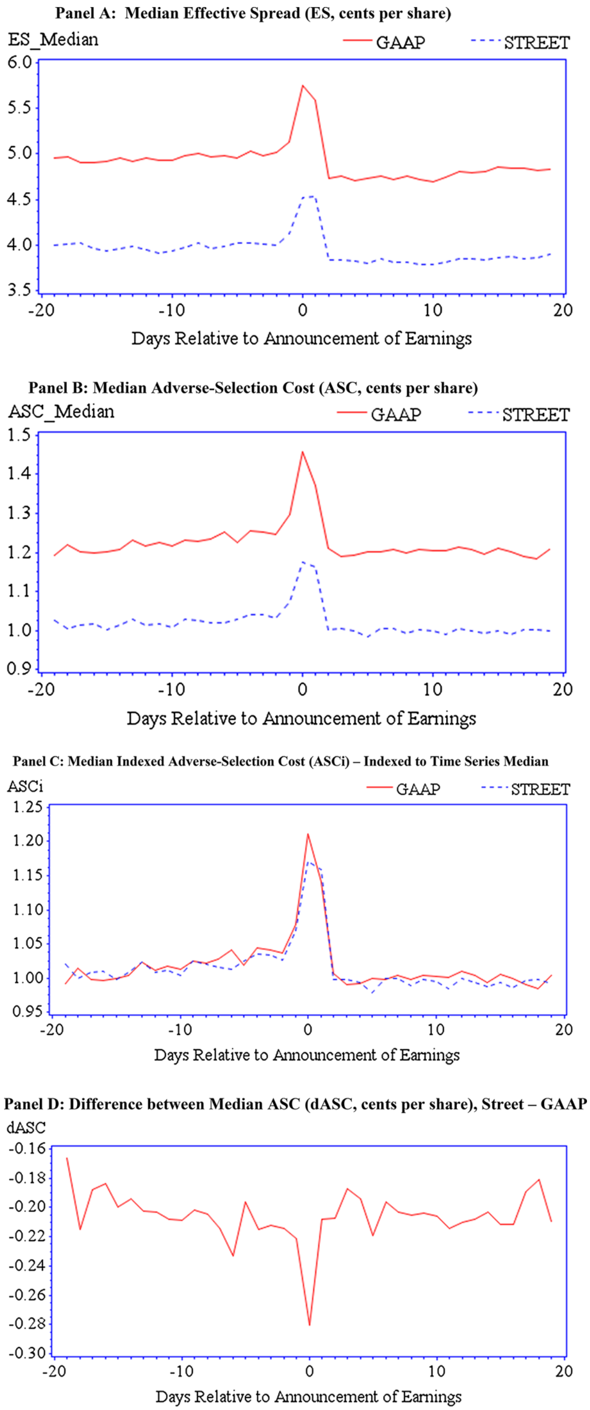

Fig. 1 Effective Spread and Adverse-Selection Cost in Days Surrounding Earnings Announcements

positive ($p \leq 0.02$)[7] and $MBECQ_{t-1}$ is insignificant. Finally, firms with a forecasted loss (*LOSS*) have higher pre-announcement adverse-selection cost, as expected.

One concern with the full sample results is that the differences in the composition of firms in GAAP and non-GAAP quarters may influence the observed difference in adverse-selection cost (*ASC*). We partially address this issue by including lagged *ASC* as an independent variable. As an additional remedy, we restrict the analysis to firm-quarters where the disclosure choice for firm *i* in quarter *t* differs from the choice in quarter $t - 1$. These samples, identified separately for analysts (n = 4931) and managers (n = 2564), allow us to capture within-firm variation of *ASC* related to disclosure choice, per se, and reduce the concern that cross-sectional differences in *ASC* are driven by firm characteristics that lead some firms (or, their analysts) to typically report non-GAAP and other firms to typically report GAAP earnings. As reported in Table 4 Panel A, results for the restricted samples (columns (c) and (d)), show that the coefficient on the probability of non-GAAP earnings is not significant for analysts ($p = 0.120$) but is significant for managers ($p = 0.002$). The findings for managers are robust to our subsample test.

6.2 Results for H1 using treatment effect models

As an additional test of H1, we employ Heckman-type treatment effect models. The treatment effect models control for selection bias and capture the difference in pre-announcement adverse-selection cost between GAAP and non-GAAP quarters through the indicator variable $NonGAAP_{it}$ in the outcome equation. Because the actual disclosure choice ($NonGAAP_{it}$) is included in the outcome equation in Table 4 Panel B, our pre-announcement treatment effect models embody a perfect foresight assumption with respect to selection. All treatment effect models, including models in Table 5, exhibit a significant correlation between the error terms from the selection and outcome equations (Wald Chi square *p* values <0.001, untabulated), which suggests the potential for coefficient bias without control for self-selection.

We first discuss our selection model results. We find that the likelihood of non-GAAP earnings is positively and highly significantly associated with special items (*SPECITEMS*, $p \leq 0.001$), with the log of total assets (*lnTA*, $p \leq 0.001$) for analysts, and with sales growth (*SALESGROWTH*, $p \leq 0.001$) for managers. These results, broadly speaking, are consistent with a greater likelihood of non-GAAP earnings when nonrecurring items are more likely. Earnings volatility (*STDEVROA*) is not significant. There is a highly significant decrease in the likelihood of non-GAAP disclosures following Sarbanes–Oxley (*SOX*, $p \leq 0.001$) for analysts but not managers. Consistent with Table 3, the likelihood of street and pro forma earnings at quarter *t* increases with the consecutive quarters of I/B/E/S street earnings at $t - 1$ (NQ_{t-1}, $p \leq 0.001$) and decreases with the consecutive quarters of I/B/E/S GAAP earnings at $t - 1$ (GQ_{t-1}, $p \leq 0.001$) for all samples.

[7] When we drop firm size (*lnMV*) from the regression model, we find a negative coefficient on *ANALYSTS* ($p \leq 0.001$) in all regressions (not tabulated), consistent with lower adverse-selection cost as analyst coverage increases.

Table 4 Summary statistics for regression of pre-announcement adverse-selection cost (ASCpre)

Panel A: OLS regressions

Variables[a]	Full sample				Quarters with changes in disclosure choice[d]			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	t[c]	Coeff	t	Coeff	t	Coeff	t
$ASCpre_{t-1}$	0.390	30.30***	0.388	30.25***	0.395	18.20***	0.437	12.40***
$ProbNonGAAP_t^e$	0.116	5.54***	0.398	7.28***	0.070	1.55	0.294	3.15***
$RankC_{t-1}$	0.093	4.86***	0.094	4.94***	0.097	2.68***	0.037	0.80
$RankD_t$	−0.005	−0.21	0.005	0.20	0.044	0.95	−0.026	−0.43
$lnMIDPOINT_{pre}$	0.605	25.34***	0.615	25.60***	0.557	15.03***	0.520	11.63***
$lnTradeSize_{pre}$	−0.063	−2.79***	−0.060	−2.67***	−0.153	−3.86***	−0.082	−1.62
$lnTradeFreq_{pre}$	−0.200	−20.75***	−0.206	−21.39***	−0.209	−11.27***	−0.212	−8.96***
lnMV	−0.124	−8.40***	−0.125	−8.53***	−0.107	−4.96***	−0.056	−2.44**
ANALYSTS	0.485	2.64***	0.428	2.33**	0.308	1.10	0.762	2.42**
BTM	−0.166	−7.78***	−0.169	−8.09***	−0.206	−5.46***	−0.145	−3.53***
$MBECQ_{t-1}$	−0.111	−1.10	−0.159	−1.57	0.027	0.14	−0.123	−0.55
LOSS	0.147	9.09***	0.157	9.49***	0.147	5.17***	0.218	5.08***
Intercept	2.476	13.00***	2.479	13.00***	3.054	10.38***	2.592	6.64***
Year controls	Yes		Yes		Yes		Yes	
Reg. controls[f]	Yes		Yes		Yes		Yes	
N	21,327		21,327		4931		2564	
R-squared	0.684		0.684		0.687		0.720	

Table 4 continued

Panel B: Treatment effect models

	Full sample				Restricted sample[h]			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	z[g]	Coeff	z	Coeff	z	Coeff	z
Outcome model[a]								
$ASCpre_{t-1}$	0.389	29.68***	0.388	28.49***	0.384	30.01***	0.408	17.11***
$NonGAAP_t$	0.114	5.16***	0.335	7.98***	0.108	5.06***	0.330	3.65***
IMR[i]	−0.066	−4.72***	−0.187	−7.76***	−0.062	−4.87***	−0.194	−3.44***
$RankC_{t-1}$	0.093	5.23***	0.093	6.61***	0.107	6.41***	0.077	3.02***
$RankD_t$	−0.005	−0.23	0.004	0.16	−0.009	−0.37	−0.018	−0.54
$lnMIDPOINT_{pre}$	0.605	25.03***	0.611	32.08***	0.615	25.02***	0.529	16.78***
$lnTradeSize_{pre}$	−0.063	−2.57**	−0.059	−2.51**	−0.076	−2.74***	−0.047	−1.49
$lnTradeFreq_{pre}$	−0.201	−23.76***	−0.206	−19.30***	−0.202	−18.81***	−0.202	−14.84***
lnMV	−0.123	−8.68***	−0.120	−8.95***	−0.134	−8.51***	−0.061	−4.30***
ANALYSTS	0.486	2.67***	0.450	1.98**	0.356	1.91*	0.268	1.11
BTM	−0.165	−8.46***	−0.162	−8.61***	−0.183	−8.49***	−0.122	−5.49***
$MBECQ_{t-1}$	−0.111	−1.05	−0.145	−1.52	−0.149	−1.30	−0.188	−1.58
LOSS	0.148	9.73***	0.154	12.43***	0.135	8.20***	0.158	6.71***
Intercept	2.144	9.82***	2.112	9.81***	2.322	10.61***	1.784	6.16***
Year controls	Yes		Yes		Yes		Yes	
Reg. controls[f]	Yes		Yes		Yes		Yes	
Selection model[a]								
SALESGROWTH	0.032	2.50**	0.078	3.96***	0.017	1.14	0.086	3.99***
STDDEVROA	0.149	0.48	−0.221	−0.83	0.170	0.50	−0.388	−0.99
SPECITEMS	0.862	31.42***	0.346	10.34***	0.816	22.24***	0.163	3.88***

Table 4 continued

Panel B: Treatment effect models

	Full sample				Restricted sample[h]			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	z[g]	Coeff	z	Coeff	z	Coeff	z
lnTA	0.065	4.22***	−0.005	−0.20	0.073	4.84***	−0.043	−1.81*
SOX	−0.105	−4.62***	−0.055	−1.40	−0.109	−4.22***	−0.087	−1.71*
NQ_{t-1}	0.183	30.68***	0.077	9.71***	0.178	28.40***	0.048	6.29***
GQ_{t-1}	−0.119	−28.32***	−0.067	−6.90***	−0.114	−19.82***	−0.026	−2.87***
INTANGIBLES	0.327	1.71*	0.966	4.14***	0.207	0.99	0.936	3.84***
MTB	0.236	3.39***	−0.122	−0.99	0.248	2.83***	−0.245	−1.52
LEVERAGE	−0.032	−5.20***	0.009	1.08	−0.030	−5.02***	0.004	0.35
negOPFE	0.659	27.35***	0.352	11.99***	0.605	22.31***	0.195	5.82***
OPLOSS	−0.005	−0.17	−0.146	−3.47***	0.021	0.63	−0.156	−2.90***
Intercept	−1.030	−9.74***	−1.462	−7.87***	−1.130	−9.94***	−0.712	−4.18***
Industry controls	Yes		Yes		Yes		Yes	
N	21,327		21,327		18,164		9718	

Panel C: Cross-classification of manager and analyst disclosure selections

Analysts	*Managers*		
	GAAP	Pro forma	Total
GAAP	11,261	348	11,609
	(0.789)	(0.843)	(0.793)
Street	6903	2815	9718

Table 4 continued

Panel C: Cross-classification of manager and analyst disclosure selections

Analysts	*Managers*		
	GAAP	Pro forma	Total
	(0.717)	(0.720)	(0.729)
Total	18,164	3163	21,327
	(0.789)	(0.756)	(0.805)

[a] A variable with the prefix 'ln' denotes the natural logarithm of the variable. Appendix 3 defines all variables

[b] The coefficients reported for NonGAAP, RankC, RankD, ANALYSTS, and MBECQ are equal to the actual regression coefficients multiplied by a factor of 100

[c] The symbols, *, **, and *** indicate two-tailed significance at p value of 0.10, 0.05 and 0.01, respectively. All standard errors are corrected for clustering (firm level)

[d] For analysts, the sample is restricted to firm-quarters where the disclosure choice by analysts (GAAP or street) for firm i in quarter t differs from the disclosure choice by analysts for firm i in quarter $t-1$. Likewise, for managers, the sample is restricted to firm-quarters where the disclosure choice by management (GAAP or pro forma) for firm i in quarter t differs from the disclosure choice by management for firm i in quarter $t-1$

[e] The estimated probabilities of street earnings and pro forma earnings at quarter t are based on logistic models using covariates described in Sect. 4.5.1. In this panel, the probabilities of street and pro forma earnings are from models estimated over all firm-quarters (n = 43,505) with data within the sample date range (1999–2006). We estimate the models separately for analysts' and managers' reporting selections, with a percent concordant of 85.4 and 78.9, respectively. When we restrict the estimation to firm-quarters with all data necessary for our full sample in this panel (n = 21,327), the percent concordant is 86.1 for analysts and 78.6 for managers

[f] Reg. controls are indicator variables that control for three important regulatory changes that occur in our sample period: decimalization of price quotes, Reg FD, and Reg G. See text for discussion

[g] The symbols, *, **, and *** indicate two-tailed significance at p value of 0.10, 0.05 and 0.01, respectively. All standard errors are corrected for clustering (firm level) based on bootstrap estimation. Results are virtually the same with MLE estimation and clustered standard errors. The Wald Chi Square statistics are highly significant for all models, rejecting the null that the error terms in the selection and outcome equations are independent

[h] The restrictions are different for analysts and managers. For analysts, the sample is restricted to those quarters where managers did *not* report pro forma earnings. For managers, the sample is restricted to those quarters where analysts *did* report street earnings

[i] Inverse Mills ratio

Panel C reports the two-way classification of the full sample (n = 21,327 firm-quarters) by the disclosure choice for analysts and managers. For example, analysts reported GAAP (street) earnings in 11,609 (9718) of the 21,327 firm-quarters, while managers reported GAAP (pro forma) earnings in 18,164 (3163) over the same firm-quarters. In parentheses for each cross-section, we report the Pearson correlation between the probability of street earnings by analysts and the probability of pro forma earnings by managers, as estimated by our logit models separately for analysts and managers

We find mixed evidence for the use of non-GAAP earnings to influence investor perception of firm performance. The likelihood of non-GAAP earnings is significantly higher for firms with negative forecast errors (*negOPFE*, $p \leq 0.001$). At the same time, non-GAAP earnings is negatively associated with GAAP operating losses (*OPLOSS*, $p < 0.004$) for managers and insignificantly associated with GAAP operating losses for analysts. The evidence is also mixed with respect to whether non-GAAP disclosures are more likely when earnings have low informativeness. Intangible intensity (*INTANGIBLES*) is highly significant ($p \leq 0.001$) for managers but not analysts, and market-to-book (*MTB*) and leverage (*LEVERAGE*) are significant ($p \leq 0.001$) for analysts but not managers. The findings suggest that the selection decisions by managers and analysts differ.

We turn next to the results for our outcome models. The results for the control variables resemble those in our OLS models. The new and important results relate to the treatment effect variable, *NonGAAP*, and the inverse Mills ratio (*IMR*). In column (a), after controlling for selection bias, we observe higher adverse-selection cost in the pre-announcement period when I/B/E/S subsequently issues street EPS rather than unadjusted GAAP EPS ($p \leq 0.001$). Similarly, in column (b), we observe higher adverse-selection cost when managers issue pro forma earnings rather than GAAP-only earnings ($p \leq 0.001$). These findings are consistent with H1.

The coefficient on *IMR* is negative and significant ($p < 0.001$). Our interpretation of this finding relies on Li and Prabhala (2007), who argue that managers' unobservable inside information influences their selection decisions and the related outcomes. In our case, this means that managers' inside information affects their decision to provide non-GAAP earnings and also affects the pre-announcement adverse-selection cost. Under this interpretation, the negative coefficient on the inverse Mills ratio reflects the association between management's inside information and pre-announcement adverse-selection cost, suggesting that higher levels of inside information are associated with lower levels of information acquisition by informed traders in the pre-announcement period. This result is reasonable if the precision of public information is diminishing as the amount of inside information increases. To clarify, let the total quantity of information (i.e., the sum of inside information and public information about a firm) be the best indicator of firm value. As the amount or precision of inside information increases, the relative precision of forthcoming public information with respect to firm value decreases. Because informed traders can profit most from public disclosures that most precisely reveal firm value, we would expect the existence of inside information to lower the incentive for informed traders to acquire private information in the pre-announcement period. A similar interpretation for *IMR* applies to street earnings, provided that analysts also hold "inside" information. We do not speculate on whether analysts' private information resembles or differs from that held by management.[8]

[8] The negative coefficient on *IMR* indicates that the error terms in the selection (*e*) and outcome (*u*) equations are negatively correlated ($\sigma_{e,u} < 0$), suggesting that common unobservable factors that are positively associated with the likelihood of non-GAAP earnings are also negatively associated with the pre-announcement adverse-selection cost. Because adverse selection is negatively associated with *IMR* and positively associated with the selection of non-GAAP earnings, the coefficient on the treatment variable (*NonGAAP*) would be biased toward zero if *IMR* were omitted from the outcome equation. In

A limitation of the full sample results in columns (a) and (b) is that street and pro forma disclosure choices are positively correlated, which confounds the attribution of the differences in adverse selection between GAAP and non-GAAP quarters uniquely to street or pro forma earnings. This issue was raised earlier in Table 3. To further illustrate the problem, consider the two-way classification of manager and analyst disclosure selections in Table 4 Panel C. The two-way classification reports the number of observations and, in parentheses, the Pearson correlation between $ProbSTREET_t$ and $ProbPROFORMA_t$ (for each cell) from our selection models for analysts and managers, respectively. The two-way classification clearly shows that the selection of GAAP or street earnings by analysts is not (statistically) independent of the selection of GAAP or pro forma earnings by managers. The high Pearson correlations between the probability of street earnings and the probability of pro forma earnings for all cells in the two-way classification reflect this dependence.

Table 4 Panel B addresses the issue of statistical dependence through two restricted samples. In column (c), we restrict the analyst regression to the 18,164 firm-quarters when management did *not* report pro forma earnings. In those quarters, I/B/E/S issued GAAP (street) earnings 11,261 (6903) times. In column (d), we restrict the manager regression to the 9718 firm-quarters when I/B/E/S *did* issue street earnings. In those quarters, managers issued GAAP (pro forma) earnings 6903 (2815) times.

In Table 4 Panel B column (c), we again find that adverse selection in the pre-announcement period is higher when I/B/E/S issues street earnings rather than GAAP earnings ($p \leq 0.001$). These findings isolate the incremental adverse-selection cost attributable to the (anticipated) disclosure by analysts of street earnings instead of GAAP earnings for a sample of firm-quarters where management reports GAAP earnings only. Similarly, in column (d), we find that adverse selection is higher in the pre-announcement period when management issues pro forma earnings rather than GAAP earnings only ($p \leq 0.001$) for a sample of firm-quarters where analysts report street earnings. Thus, even in cases where analysts report street earnings, we can attribute significantly higher adverse-selection cost to the (anticipated) supplemental disclosure of pro forma earnings by managers.

6.3 Post-announcement period

Despite our efforts, the differences in information asymmetry between GAAP and non-GAAP quarters in Table 4 may result from a failure to control adequately for important systematic differences between the typical GAAP and non-GAAP firm. Under that view, empirical support for the first hypothesis may not reflect the market's perception of the informativeness of non-GAAP earnings but rather other fundamental differences between the typical GAAP and non-GAAP firm. Our

Footnote 8 continued
other words, the incremental adverse-selection cost associated with non-GAAP earnings (treatment effect) would be *understated* without an adjustment for self-selection.

second set of tests largely avoids this criticism by using changes in adverse selection as the dependent variable, in effect making a firm its own control through a difference-in-differences approach. Additionally, we continue to employ treatment effect models to control for selection bias.

6.3.1 Results for H2

Table 5 examines whether the post-announcement change in information asymmetry (*ASCpost* less *ASCpre*) differs between GAAP and non-GAAP quarters. As discussed earlier, if non-GAAP earnings numbers reveal more pre-announcement private information and facilitate a faster resolution of undiscoverable information than GAAP earnings alone, we would expect a larger post-announcement reduction in adverse-selection cost in non-GAAP than GAAP earnings quarters. H2 predicts that the post-announcement reduction in adverse-selection cost will be more pronounced for non-GAAP than GAAP quarters.

Tables 4 and 5 use the same selection model and the selection model results are similar for the two tables. Consequently, we do not revisit the selection model results. In Table 5, as in Table 4, the inverse Mills ratio from each selection model is a covariate in its respective outcome equation. Thus, in Table 5, the outcome equations control for changes in adverse-selection cost associated with unobserved factors that affect both the decision to issue non-GAAP earnings and changes in adverse-selection cost, allowing a better identification of the extent to which post-announcement changes in information asymmetry depend on analyst and manager disclosure choices per se.

In our outcome models, the coefficient on *ASCpre* is -0.251 ($p \leq 0.001$) in columns (a) and (b). This finding indicates that, after controlling for other factors affecting the change in adverse-selection cost, there is a 25 % reduction in adverse-selection cost on average from the pre- to the post-announcement period. This outcome is expected if scheduled disclosures through financial statements stimulate private information search in advance of those disclosures and if information asymmetry is resolved following the public dissemination of financial statements.

In Table 5, the difference between the change in adverse-selection cost for GAAP and non-GAAP quarters is modeled as a fixed constant as measured by the coefficient on the variable, $NonGAAP_t$. For analysts and managers, the coefficient on $NonGAAP_t$ is negative and significant ($p < 0.001$) indicating that, on average, the post-announcement reduction in adverse-selection cost is significantly more pronounced when analysts (managers) issue street (pro forma) earnings at the earnings announcement than when they do not. We interpret non-GAAP disclosures as a mechanism for disclosing price-relevant private information, consistent with a significantly greater reduction in information asymmetry in non-GAAP than GAAP quarters.

We find a positive and significant ($p < 0.001$) coefficient on *IMR*. Again, we interpret the coefficient on the inverse Mills ratio as the effect of *undisclosed* inside management information on the post-announcement change in adverse selection. Higher levels of inside information would be expected to reduce the precision of accounting information with respect to the value of the firm and thus temper the

Table 5 Summary statistics for regression of post-announcement change in adverse-selection cost (chgASC) on disclosure choice—treatment effect models

	Full sample				Restricted sample[d]			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	z[c]	Coeff	z	Coeff	z	Coeff	z
Outcome model[a]								
$ASCpre_t$	−0.251	−25.67***	−0.251	−29.66***	−0.251	−23.12***	−0.265	−17.07***
$NonGAAP_t$	−0.116	−6.94***	−0.243	−7.68***	−0.121	−6.81***	−0.209	−3.66***
IMR[e]	0.059	4.83***	0.128	6.63***	0.062	5.71***	0.121	3.64***
absFEs	−0.020	−7.30***	−0.022	−9.04***	−0.019	−6.40***	−0.016	−4.26***
$chgRankC_{t-1}$	−0.010	−0.84	−0.010	−0.77	−0.008	−0.65	−0.017	−1.06
$chgRankD_t$	−0.004	−0.22	−0.002	−0.16	−0.006	−0.39	−0.021	−0.97
chglnMIDPOINT	0.611	16.40***	0.615	18.02***	0.639	17.69***	0.550	13.42***
chglnTradeSize	−0.288	−12.36***	−0.288	−21.35***	−0.310	−14.95***	−0.232	−11.29***
chglnTradeFreq	−0.095	−7.67***	−0.094	−7.78***	−0.100	−7.30***	−0.090	−5.19***
LOSS2	−0.027	−2.54**	−0.030	−2.66***	−0.025	−2.05**	−0.039	−2.37**
Intercept	0.704	18.52***	0.688	18.97***	0.707	17.80***	0.697	10.87***
Year controls	Yes		Yes		Yes		Yes	
Reg. controls[f]	Yes		Yes		Yes		Yes	
Selection model[a]								
SALESGROWTH	0.032	1.95*	0.078	3.74***	0.017	0.93	0.086	3.89***
STDDEVROA	0.149	0.50	−0.221	−0.69	0.170	0.55	−0.388	−1.03
SPECITEMS	0.862	27.57***	0.346	9.37***	0.816	25.34***	0.163	4.25***
lnTA	0.065	5.27***	−0.005	−0.25	0.073	4.63***	−0.043	−1.80*
SOX	−0.105	−5.37***	−0.055	−1.39	−0.109	−4.23***	−0.087	−2.13**
NQ_{t-1}	0.183	31.56***	0.077	13.49***	0.178	29.18***	0.048	5.31***

Table 5 continued

	Full sample				Restricted sample[d]			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	z[c]	Coeff	z	Coeff	z	Coeff	z
GQ_{t-1}	−0.119	−21.34***	−0.067	−8.86***	−0.114	−22.30***	−0.026	−2.80***
INTANGIBLES	0.327	1.83*	0.966	4.12***	0.207	0.98	0.936	3.07***
MTB	0.236	3.28***	−0.122	−0.95	0.248	2.66***	−0.245	−1.86*
LEVERAGE	−0.032	−5.26***	0.009	0.99	−0.030	−4.16***	0.004	0.36
negOPFE	0.659	23.38***	0.352	12.17***	0.605	21.63***	0.195	5.33***
OPLOSS	−0.005	−0.17	−0.146	−3.87***	0.021	0.57	−0.155	−3.13***
Intercept	−1.030	−10.81***	−1.462	−10.14***	−1.130	−9.81***	−0.712	−5.05***
Industry controls	Yes		Yes		Yes		Yes	
N	21,327		21,327		18,164		9718	

[a] A variable with the prefix 'ln' denotes the natural logarithm of the variable. Appendix 3 defines all variables

[b] The coefficients reported for NonGAAP, RankC, RankD, ANALYSTS, and MBECQ are equal to the actual regression coefficients multiplied by a factor of 100

[c] The symbols, *, **, and *** indicate two-tailed significance at *p* value of 0.10, 0.05 and 0.01, respectively. All standard errors are corrected for clustering (firm level) based on bootstrap estimation. Results are virtually the same with MLE estimation and clustered standard errors. The Wald Chi square statistics are highly significant for all models, rejecting the null that the error terms in the selection and outcome equations are independent

[d] The restrictions differ for analysts and managers. For analysts, the sample is restricted to those quarters where managers did *not* report pro forma earnings. For managers, the sample is restricted to those quarters where analysts *did* report street earnings

[e] Inverse Mills ratio

[f] Reg. controls are indicator variables that control for three important regulatory changes that occur in our sample period: decimalization of price quotes, Reg FD, and Reg G. See text for discussion

overall reduction in post-announcement information asymmetry. The positive coefficient on *IMR* is consistent with this inside information interpretation.[9]

We also report restricted sample tests in Table 5, where the restrictions are the same as those in Table 4 Panel B. Consistent with the full sample results in Table 5, the coefficient on the treatment variable, *NonGAAP*, is negative and significant ($p < 0.001$). The result for the manager sample, which is restricted to firm-quarters where analysts reported street earnings, is particularly interesting. The negative coefficient for *NonGAAP* for that sample suggests that, when managers disclose pro forma earnings rather than GAAP earnings, there is a reduction in information asymmetry that is incremental to the reduction in information asymmetry that occurs when analysts report street earnings. Additionally, in an untabulated analysis for the full sample, we find that the reduction in adverse-selection cost is larger for pro forma disclosures than street earnings disclosures. Specifically, the 95 % confidence interval for the coefficient on $NonGAAP_t$ for pro forma earnings (−0.305 to −0.181) is smaller than the same confidence interval for street earnings (−0.148 to −0.083). Collectively, our results suggest that pro forma earnings are incrementally informative to I/B/E/S street earnings. Under the view that pro forma disclosures communicate a subset of managers' previously private information and that street earnings similarly communicate a subset of analysts' previously private information, our results suggest that, with respect to firm valuation, managers' private information is more informative than analysts'.

Next, we consider our control variables in our outcome models in Table 5. Results are similar across models and samples. As expected, the reduction in adverse-selection cost is more pronounced ($p \leq 0.001$) as the absolute forecast error (*absFEs*) increases. This finding is reasonable because forecast errors represent earnings information not in analysts' forecasts. As the absolute forecast error increases, the earnings announcement communicates increasing levels of previously nonpublic information and reduces information asymmetry.

The change in adverse-selection cost is negatively associated with the changes in trade frequency and positively associated with the change in price (*chglnMIDPOINT*). These results are consistent with expectations because post-announcement increases in trade frequency and decreases in price suggest more liquidity and lower adverse-selection cost. However, the negative association between change in adverse-selection and trade size is unexpected because the result suggests that adverse selection cost decreases as trade size increases. This anomalous finding for trade size resembles the anomalous finding for trade size in Table 4, indicating that trade size is a poor proxy for informed trading. We find that loss firms show a steeper decline in adverse selection than profit firms ($p \leq 0.011$), consistent with the

[9] The positive coefficient on *IMR* indicates that error terms in the selection (e) and outcome (u) equations are positively correlated ($\sigma_{e,u} > 0$), suggesting that common unobservable factors that are positively associated with the selection of non-GAAP earnings are also positively associated with the post-announcement change in adverse selection cost. Because the change in adverse selection is positively associated with *IMR* and negatively associated with the selection of non-GAAP earnings, the coefficient on the treatment variable (*Non-GAAP*) would be biased toward zero if the inverse Mills ratio were omitted from the outcome equation. In other words, our estimates of the magnitude of the reduction in adverse-selection cost due to non-GAAP earnings would be *understated* without an adjustment for self-selection bias.

strong correlation between predicted and actual losses and the relatively high pre-announcement adverse selection for firms with forecasted losses. Finally, there is an insignificant association between the change in adverse-selection cost and the change in information uncertainty (*chgRankC*$_t$ and *chgRankD*$_{t+1}$).

6.3.2 Results for H3

H3 predicts that the post-announcement reduction in adverse-selection cost will be larger when the absolute value of non-GAAP earnings exclusions is larger. Table 6 is restricted to street quarters for analysts and pro forma quarters for managers. The table reports findings for non-GAAP earnings exclusions (*EX* or *EX′*) based on two different benchmarks for non-GAAP earnings. In panel A, exclusions (*EX*) are found as non-GAAP EPS minus GAAP EPS before extraordinary items. *EX* may be comprised of special items or line items included in operating income. In Panel B, exclusions (*EX′*) are found as non-GAAP EPS minus GAAP operating EPS (*oepsxq*) (Black and Christensen 2009). Under the assumption that special items are always excluded from street and pro forma earnings, *EX′* is limited to revenues and expenses that are part of GAAP operating income. For street and pro forma earnings, separately, we substitute integer ranks (0–99) for the absolute-value of price-scaled nonzero earnings adjustments, such that a one-point increase in the ranking variable, *RANKabsEXs*, represents a one-percentile increase in the magnitude of the per-share non-GAAP earnings adjustments (*EX* or *EX′*) scaled by stock price. We use ranked values to allow simpler interpretation of the economic significance of non-GAAP exclusions and to avoid the influence that outliers might otherwise have on the results.

In Table 6, Panel A, columns (a) and (b), the coefficients on *ASCpre* indicate that adverse-selection cost decreases, on average, by approximately 26 % from the pre-announcement level for analysts and managers, after controlling for other factors. This finding is comparable to the 25 % reduction reported in Table 5 for the full sample. The coefficient on *RANKabsEXs* for street (pro forma) earnings indicates that post-announcement adverse-selection cost per share decreases, on average, by about 3.4 (3.2) % when the non-GAAP earnings adjustment (*EX*) as a proportion of market value increases from the 25th to the 75th percentile.[10] As a sense of the size of the non-GAAP adjustments in economic terms, the 25th percentile for the absolute value of the street EPS adjustment as percentage of share price is 0.13 %, and the 75th percentile is 1.17 %. Thus, for the street earnings, when the absolute

[10] The coefficients reported in Table 6 for any variable with *RANKabsEXs* are the actual coefficients multiplied by 100. The actual coefficients for *RANKabsEXs* for columns (a) and (b) are 0.000,992 and 0.000871, respectively. For street quarters, an increase in absolute exclusion from the 25th to the 75th percentile would decrease adverse-selection cost by 0.0496 cents per share (=50 × −0.000992), or 3.4 % of the mean level *ASC* per share (−0.0496/1.459 = −0.03399). For pro forma quarters, an increase in the absolute exclusion from the 25th to the 75th percentile would decrease adverse-selection cost by 0.04355 cents per share (=50 × −0.000871), or 3.2 % of the mean level *ASC* per share (−0.04355/1.382 = −0.03151).

Table 6 Summary statistics for OLS regressions of post-announcement change in adverse-selection cost (chgASC) on the rank of the absolute value of earnings adjustments for analyst street earnings and manager pro forma earnings

Panel A: Using GAAP EPS (before extraordinary items) as a benchmark for calculating the absolute exclusion								
Variables[a]	Model 1: Rank of abs. exclusions				Model 2: Pos. vs. neg. exclusions			
	(a)		(b)		(c)		(d)	
	Analysts		Managers		Analysts		Managers	
	Coeff[b]	t[c]	Coeff	T	Coeff	t	Coeff	t
ASCpre	−0.265	−18.08***	−0.256	−9.18***	−0.265	−18.06***	−0.256	−9.17***
RANKabsEXs	−0.099	−4.23***	−0.087	−2.39**				
RANKabsEXs (negative)[d]					−0.058	−1.71*	−0.090	−1.71*
RANKabsEXs (positive)					−0.107	−4.55***	−0.087	−2.36**
absFEs	−0.009	−2.39**	−0.018	−2.39**	−0.010	−2.58**	−0.018	−2.34**
$chgRankC_t$	−0.016	−0.94	−0.025	−0.96	−0.016	−0.90	−0.025	−0.96
$chgRankD_{t+1}$	−0.025	−1.22	0.001	0.05	−0.024	−1.18	0.001	0.04
chglnMIDPOINT	0.557	12.70***	0.506	7.45***	0.556	12.68***	0.507	7.45***
chglnTradeSize	−0.231	−10.05***	−0.165	−5.03***	−0.231	−10.05***	−0.165	−5.03***
chglnTradeFreq	−0.091	−5.52***	−0.059	−2.53**	−0.091	−5.54***	−0.059	−2.53**
LOSS2	−0.020	−1.39	−0.022	−0.90	−0.019	−1.30	−0.022	−0.91
Intercept	0.643	8.21***	0.747	4.66***	0.640	8.17***	0.747	4.66***
Year controls	Yes		Yes		Yes		Yes	
Reg. controls[e]	Yes		Yes		Yes		Yes	
N	9718		3163		9718		3163	
R-squared	0.238		0.242		0.238		0.242	

Table 6 continued

Panel B: Using GAAP operating income as a benchmark for calculating the absolute exclusion

Variables[a]	Model 1: Rank of abs. exclusions				Model 2: Pos. vs. neg. exclusions			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	t[c]	Coeff	T	Coeff	t	Coeff	t
ASCpre	−0.266	16.18***	−0.262	−8.48***	−0.267	−16.17***	−0.262	−8.47***
RANKabsEXs	−0.103	−4.04***	−0.072	−1.65*				
RANKabsEXs (negative)[d]					−0.058	−1.66*	−0.047	−0.81
RANKabsEXs (positive)					−0.113	−4.41***	−0.074	−1.68*
absFEs	−0.008	−1.94*	−0.019	−2.31**	−0.010	−2.35**	−0.020	−2.42**
$chgRankC_t$	−0.004	−0.21	−0.016	−0.55	−0.004	−0.19	−0.015	−0.55
$chgRankD_{t+1}$	−0.041	−1.90*	0.001	0.02	−0.040	−1.84*	0.001	0.02
chglnMIDPOINT	0.600	12.81***	0.512	7.18***	0.601	12.82***	0.512	7.18***
chglnTradeSize	−0.199	−8.06***	−0.137	−3.88***	−0.199	−8.04***	−0.137	−3.87***
chglnTradeFreq	−0.087	−4.91***	−0.053	−2.10**	−0.088	−4.92***	−0.053	−2.11**
LOSS2	−0.015	−0.95	−0.016	−0.61	−0.014	−0.87	−0.015	−0.59
Intercept	0.641	7.15***	0.722	4.32***	0.640	7.14***	0.724	4.33***
Year controls	Yes		Yes		Yes		Yes	
Reg. controls[e]	Yes		Yes		Yes		Yes	
N	8357		2812		8357		2812	
R-squared	0.241		0.248		0.242		0.248	

Table 6 continued

Panel C: Opportunism tests: exclusion flips the forecast error from miss to meet or beat

Variables[a]	Model 1: GAAP income as benchmark for exclusion calculation				Model 2: Operating income as benchmark for exclusion calculation			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	t[c]	Coeff	t	Coeff	t	Coeff	t
ASCpre	−0.268	−14.72***	−0.254	−7.81***	−0.266	−12.52***	−0.252	−7.08***
FE_FLIPS	0.016	0.62	0.029	0.74	−0.004	−0.12	−0.003	−0.08
RANKabsEXs[g]	−0.094	−2.70***	−0.092	−1.67*	−0.117	−2.98***	−0.102	−1.55
FE_FLIPS × RANKabsEXs	−0.025	−0.59	−0.026	−0.40	0.013	0.27	0.033	0.44
absFEs	−0.008	−1.81**	−0.013	−1.18	−0.009	−1.76*	−0.020	−1.92**
$chgRankC_t$	−0.030	−1.64	−0.050	−1.74*	−0.011	−0.54	−0.014	−0.47
$chgRankD_{t+1}$	−0.018	−0.76	0.003	0.09	−0.034	−1.32	−0.008	−0.24
chglnMIDPOINT	0.556	11.42***	0.506	6.90***	0.578	10.86***	0.469	5.98***
chglnTradeSize	−0.208	−8.45***	−0.161	−4.50***	−0.184	−6.73***	−0.132	−3.51***
chglnTradeFreq	−0.086	−4.79***	−0.050	−1.90*	−0.083	−4.14***	−0.049	−1.71**
LOSS2	−0.035	−2.23**	−0.019	−0.73	−0.034	−1.90*	−0.025	−0.93
Intercept	0.662	7.17***	0.701	4.08***	0.651	6.03***	0.648	3.58***
Year controls	Yes		Yes		Yes		Yes	
Reg. controls[e]	Yes		Yes		Yes		Yes	
N[f]	7558		2777		6357		2462	

Table 6 continued

Panel C: Opportunism tests: exclusion flips the forecast error from miss to meet or beat

Variables[a]	Model 1: GAAP income as benchmark for exclusion calculation				Model 2: Operating income as benchmark for exclusion calculation			
	(a) Analysts		(b) Managers		(c) Analysts		(d) Managers	
	Coeff[b]	t[c]	Coeff	t	Coeff	t	Coeff	t
R-square	0.245		0.229		0.241		0.225	

[a] A variable with the prefix 'ln' denotes the natural logarithm of the variable. Appendix 3 defines all variables

[b] The coefficients reported for RANKabsEXs, RankC, and RankD equal the actual regression coefficients multiplied by a factor of 100

[c] The symbols, *, **, and *** indicate two-tailed significance at p value of 0.10, 0.05 and 0. 0 1, respectively. All standard errors are corrected for clustering (firm level)

[d] RANKabsEXs (negative) refers to the ranked absolute value of exclusions when the exclusion was income-decreasing, and RANKabsEXs (positive) refers to the ranked absolute value of exclusions when the exclusion was income-increasing. The amount of the street (pro forma) exclusion is found as street (pro forma) EPS minus GAAP operating income per share, with all EPS numbers scaled by quarter-end stock price

[e] Reg. controls are indicator variables that control for three important regulatory changes that occur in our sample period: decimalization of price quotes, Reg FD, and Reg G. See text for discussion

[f] The sample for Model 1 is larger than the sample for Model 2. Model 1 is restricted to cases where total exclusions $EX > 0$, where $EX = \text{non-GAAP EPS} - \text{GAAP EPS}$ before extraordinary items. Model 2 is restricted to cases where $EX > 0$ and $EX' > 0$, where $EX' = \text{non-GAAP EPS} - \text{GAAP operating EPS}$. In some cases, total exclusions (EX) are income increasing but operating income exclusions (EX') are income-decreasing for those instances

[g] RANKabsEXs refers to the ranked absolute value of exclusions. The amount of the street (pro forma) exclusion is found as street (pro forma) EPS minus GAAP earnings, defined as GAAP income before extraordinary items in columns (a) and (b) and as GAAP operating income in columns (c) and (d). Exclusions and earnings are scaled by quarter-end share price

value of the pro forma adjustment increases by 1.04 percentage points of share price, adverse-selection cost decreases by 3.4 %.[11]

The informativeness of non-GAAP earnings may be sensitive to whether earnings adjustments increase or decrease earnings (Abarbanell and Lehavy 2007). Thus we conduct another test that separately analyses income-decreasing adjustments (where EX = non-GAAP EPS − GAAP EPS < 0) and income-increasing adjustments (where EX = non-GAAP EPS − GAAP EPS > 0). For street earnings in column (c), the coefficient for *RANKabsEXs* is negative for income-decreasing (coefficient = −0.058, $p = 0.087$) and income-increasing earnings adjustments (coefficient = −0.107, $p \leq 0.001$). The coefficient for positive (income-increasing) adjustments is smaller than the coefficient for negative (income-decreasing) adjustments ($p = 0.053$, not tabulated). In other words, the reduction in post-announcement adverse-selection cost for street earnings is significantly more pronounced for income-increasing than for comparable income-decreasing adjustments.

For pro forma earnings in column (d), the coefficient for *RANKabsEXs* is again negative for income-decreasing adjustments (coefficient = −0.090, $p = 0.089$) and income-increasing earnings adjustments (coefficient = −0.087, $p = 0.019$). The reduction in post-announcement adverse-selection cost is statistically indistinguishable ($p = 0.986$, not tabulated) for comparable income-increasing and income-decreasing pro forma adjustments. Overall, the results in Table 6 Panel A suggest that realistically observable cross-sectional differences in the dollar amount of non-GAAP adjustments are associated with economically significant and statistically distinguishable effects on the extent of the post-announcement reduction in information asymmetry.

Results in Panel B for operating income exclusions (EX') resemble those in Panel A for total exclusions (EX). In Panel B columns (a) and (b), there is a negative association between the change in post-announcement adverse-selection cost and the rank of the absolute operating income exclusion for analysts ($p < 0.001$) and managers ($p = 0.099$). These results indicate that, for analysts, the reduction in information asymmetry is increasingly pronounced as the absolute value of the exclusion increases when exclusions are restricted to revenues and expenses classified as part of operating income. When we further split operating income exclusions into income-decreasing and income-increasing for analysts, the coefficient for *RANKabsEXs* is negative for both (income-decreasing: $p = 0.097$; income-increasing: $p \leq 0.001$), and the coefficient for income-increasing or positive adjustments is smaller than the coefficient for income-decreasing or negative adjustments ($p = 0.041$, not tabulated). In short, for analysts, the results restricted to operating income exclusions in Panel B resemble those for total income exclusions in Panel A.

[11] We reran Model 1 for street earnings restricted to cases where managers did not report pro forma earnings (n = 6903); the coefficient on *RankEX* is negative (−0.1008) and significant ($p \leq 0.001$). Thus results for the restricted sample are nearly identical to the full sample results. We also reran Model 1 for pro forma earnings restricted to cases where I/B/E/S did not report street earnings (n = 348); the coefficient on *RankEX* is negative (−0.3360) and significant ($p = 0.046$).

In Panel B for managers, we find negative coefficients for income-decreasing ($p = 0.429$) and income-increasing exclusions ($p = 0.093$). Considering the insignificant coefficient for income-decreasing operating-income exclusions in Panel B and the (marginally) significant coefficient for the corresponding analysis in Panel A, we conclude that special items may be responsible for Panel A's findings for income-decreasing total exclusions for managers.

In Table 6, Panel C, we examine whether the post-announcement reduction in adverse selection is sensitive to the effect that income-increasing exclusions have on the sign of the forecast error. Specifically, we examine whether the association between the change in adverse selection and the magnitude of income-increasing exclusions differs when the total exclusion flips the sign of the forecast error, from "miss" to "meet-or-beat," compared to total exclusions that leave the sign of the forecast error unchanged. The rationale behind this additional test is that income-increasing exclusions that flip the sign of the forecast error may be driven primarily by incentives or pressures to meet or beat earnings forecasts rather than incentives to improve the informativeness of earnings disclosures.

To examine whether an opportunism effect is present, we restrict the analysis to non-GAAP (street and pro forma) quarters with income-increasing total exclusions ($EX > 0$). We then form an indicator variable, *FE_FLIPS*, equal to 1 if the exclusion flips the forecast error from miss to meet or beat. Specifically, when GAAP earnings are less than forecasted earnings (miss) and non-GAAP earnings are greater than or equal to forecasted earnings (meet or beat), then *FE_FLIPS* is equal to 1.[12] Of the 9718 street quarters, 7558 firm-quarters have income-increasing total exclusions ($EX > 0$). Of those, 3124 do not flip the forecast error ($FE\_FLIP = 0$), and 4434 do flip the forecast error ($FE\_FLIP = 1$). Of the 3163 pro forma quarters, 2777 have income-increasing total exclusions. Of those, 1139 flip and 1638 do not flip the forecast error.

In Panel C, the coefficient on the interaction term, $FE\_FLIPS \times RANKabsEXs$ captures whether the association between post-announcement changes in adverse-selection cost and the magnitude of the non-GAAP exclusions differs when income-increasing exclusions flip the forecast error (from miss to meet or beat) compared to cases when exclusions do not change the sign of the forecast error. In Model 1, *RANKabsEXs* is the rank of total exclusions (i.e., ranks of *EX* where $EX > 0$). For Model 2, *RANKabsEXs* is the rank of operating exclusions (EX') for the subset of non-GAAP quarters where $EX > 0$ and $EX' > 0$. Model 2 examines whether the association between changes in adverse selection and the magnitude of GAAP operating expense exclusions differs when operating expense exclusions contribute to flipping the forecast error. In all four columns, the coefficient on the interaction term is insignificant ($p \geq 0.553$), showing no evidence of opportunism effects for total exclusions or for operating expense exclusions.

[12] Formally, let *FE* (forecast error) = non-GAAP EPS − I/B/E/S median forecast EPS, and let *EX* (total exclusion) = non-GAAP EPS − GAAP EPS before extraordinary items. We select all cases with $EX > 0$ and then form an indicator variable, *FE_FLIPS*, where *FE_FLIPS* equals 1 if $FE - EX < 0$ and $FE \geq 0$ and 0 otherwise.

7 Conclusion

We examine whether the level of information asymmetry before earnings announcements and the change in information asymmetry after earnings announcements differ in quarters where analysts and managers issue street earnings or pro forma earnings, respectively, compared to quarters when they refrain from reporting a non-GAAP EPS number. In the pre-announcement period, we find that the adverse-selection component of the bid-ask spread is significantly and positively associated with the probability that I/B/E/S will issue a street earnings number or that managers will issue a pro forma earnings number. These findings are consistent with an increase in private information searching and heightened trading on private information when sophisticated investors (informed traders) expect non-GAAP earnings at the earnings announcement. The findings are consistent with the prospect of higher earnings precision at the earnings announcement when street or pro forma earnings are more likely.

Additionally, we find that the post-announcement reduction in adverse-selection cost is more pronounced in street and pro forma quarters than in GAAP-only quarters. We also find that the post-announcement reduction in adverse-selection cost is larger when the magnitude of the non-GAAP earnings adjustment (the absolute difference between GAAP and non-GAAP earnings) is larger. The latter result holds for street and pro forma earnings and for income-increasing and income-decreasing earnings adjustments. The findings suggest that street and pro forma earnings adjustments help to narrow the information gap between informed and uninformed traders. One avenue for additional research is whether non-GAAP disclosures are associated with capital market effects such as the cost of capital or post earnings-announcement drift.

Our study is subject to certain limitations. While we find evidence that the reduction in information asymmetry is more pronounced when managers or analysts choose to report non-GAAP earnings and that the reduction in information asymmetry is increasing with the magnitude of non-GAAP earnings adjustments, we do not identify why those associations occur. It may be that non-GAAP earnings adjustments identify elements of earnings that have different relevance or persistence with respect to firm value, as we propose. However, it may also be that overall reporting quality is better when analysts or managers disclose non-GAAP earnings and that our findings reflect a difference in the overall quality of disclosures rather than a difference specifically related to non-GAAP disclosures. Also, we have not considered whether non-GAAP adjustments are identified in the footnotes to the financial statements. Adjustments that are typically disclosed in the footnotes may be less informative than adjustments that are less commonly disclosed.

Our interpretation of our results assumes that markets are (reasonably) efficient. In an efficient market, information with higher precision with respect to firm value commands a higher price. Thus, under the assumption of an efficient market, our results suggest that the expectation of street or pro forma earnings increases private information search because non-GAAP earnings more precisely reflect a firm's underlying value. However, markets may be consistently inefficient. In that case, private information search might focus on non-GAAP earnings simply because naïve investors may view non-GAAP earnings as more value relevant than GAAP earnings. Thus sophisticated investors might earn positive returns to private information search, independent of the relevance of non-GAAP earnings to a firm's intrinsic value.

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Appendix 1: Lin et al. (1995) Model

Lin et al.'s (1995) and Masson's (1993) models show how quote revisions following stock trades can be used to estimate the adverse-selection component of the bid-ask spread. In response to a sell (buy) order that reveals possible private information, the market maker adjusts the bid-ask midpoint downward (upward). In the Lin et al.'s model,[13] bid-quote and ask-quote revisions ($B_{k+1} - B_k$, and $A_{k+1} - A_k$, respectively) for a trade at time k are related to adverse selection expressed as a proportion (λ_k) of the signed one-half effective spread (Z_k), as shown in (5), (6), and (7).

$$B_{k+1} - B_k = \lambda_k Z_k \tag{5}$$

$$A_{k+1} - A_k = \lambda_k Z_k \tag{6}$$

$$Z_k = (P_k - MP_k) \tag{7}$$

where B is the bid quote, A is the ask quote, P is the transaction price, MP is the quote midpoint, Z is the signed one-half effective spread that takes a negative value for sell orders and a positive value for buy orders, and λ is the adverse-selection component as a fraction of Z, where $0 < \lambda < 1$. In this model, the midpoint revision and the effective spread[14] relate to the adverse-selection component λ as follows:

$$MP_{k+1} - MP_k = \lambda_k Z_k \tag{8}$$

[13] The Lin et al. (1995) model is used widely in market microstructure studies to measure the adverse-selection component of the bid-ask spread. Prior studies that use this model include Chung et al. (2006), Barclay and Hendershott (2004), Van Ness et al. (2005), and Chung and Li (2003). Barclay and Hendershott (2004) suggest that the model does not rely on inventory-induced trade reversals and also does not require a constant effective spread. The model follows Huang and Stoll (1994) and permits a separate estimate of fixed and dealer profit components. We thank David Dubofsky for bringing many of these points to our attention.

[14] The use of the effective spread in the Lin et al. (1995) model allows for trades that are executed inside or outside the quoted spread. The Masson (1993) model uses only those trades at bid quote or ask quote. Using a sample of 313 stocks traded on NASDAQ between September 27, 1996, and September 29, 1997, Ellis et al. (2000) find that 20.4 and 4.93 % of the trades in their sample occur inside and outside the quoted spread, respectively. For an inside (outside) trade, the effective spread is smaller (larger) than the quoted spread.

We begin by estimating the adverse-selection component (λ) of the effective spread on a daily basis using all N trades for a firm *i* during day *j*. We use ordinary least squares regression to estimate λ_{ij} as follows:

$$ln\left(MP_{ijn}^{k+1}\right) - ln(MP_{ijn}^{k}) = ADV_{ij} lnZ_{ijn} + \varepsilon_{ijn}, \quad (9)$$

where *ln(MP)* is the natural log of the quoted midpoint of the bid-ask spread, calculated as (bid + ask)/2; *ADV* is the regression estimate of λ, *lnZ* is the effective half spread, calculated as the natural log of price minus the natural log of quoted midpoint; and ε is the normally distributed random error term. From an economic perspective, ADV_{ij} is the adverse-selection cost as a proportion of the effective spread for firm *i* for day *j*.

We find the daily adverse-selection cost (cents per share) as $ASC_{ij} = ADV_{ij} \times ESPREAD_{ij} \times 100$, where $ESPREAD_{ij}$ is the average effective spread over all N trades for firm i in day j. Specifically, $ESPREAD_{ij} = \sum_{n=1}^{N} \left(|PRICE_{nij} - MIDPOINT_{nij}| \times 2\right)/N_{ij}$. For each earnings announcement, the pre- and post-announcement estimates of adverse-selection cost, $ASCpre_{it}$ and $ASCpost_{it}$, are daily adverse-selection cost averaged over the respective 10-day pre- and post-announcement windows for quarter *t*.

Appendix 2: Barron et al. (1998) model

To control for the uncertainty of a firm's information environment, we rely on the Barron et al. (1998) model. In this model, the uncertainty in analyst *k*'s forecast for firm *i* in quarter *t* (V_{itk}) has two components: information uncertainty that is unique to analyst *k*'s private information set with respect to firm *i*'s earnings (D_{itk} or idiosyncratic uncertainty) and information uncertainty that is inherent to shared public information about firm *i* (C_{it} or common uncertainty). V_{itk} is an ex ante concept that represents analyst *k*'s assessment of the expected variance of EPS_{it}, conditional on the uncertainty of public information (an expectation shared by all analysts) and the uncertainty of private information (an expectation unique to analyst *k*).

On an ex post basis, we derive unbiased estimates of the expected values for *D*, *C*, and *V* for firm *i* in quarter *t* from three observable variables: analyst earnings per share forecasts (F_{ikt}), actual earnings per share (EPS_{it}), and the number of forecasts (N_{it}). The estimating equations are:

$$D_{it} = \sum_{k=1}^{N_{it}} \left[\left(F_{itk} - \overline{F_{it}}\right)^2/(N_{it} - 1)\right] \quad (10)$$

$$C_{it} = \left(EPS_{it} - \overline{F_{it}}\right)^2 - (D_{it}/N_{it}) \quad (11)$$

$$V_{it} = D_{it} + C_{it} = \sum_{k=1}^{N_{it}} (EPS_{it} - F_{itk})^2/N_{it} \quad (12)$$

where D_{it} is the dispersion in forecasts that depends on analysts' reliance on noisy private information, C_{it} is the common forecast error that depends on analysts' reliance on noisy public information, and V_{it} is the total information uncertainty about earnings. V_{it} represents private and public information uncertainty averaged across all N_{it} analysts. V_{it} is distinct from, although clearly related to, uncertainty about the intrinsic value of firm *i* conditional on investors' information set. The inverse of V_{it} represents the precision of earnings information.

Appendix 3: Variable definitions

Variable used in pre- or post-announcement OLS models or treatment-effect outcome models[a]	
ASC[b]	Adverse-selection cost in cents per share, found as ADV × ESPREAD × 100.
ESPREAD[b]	Mean daily effective spread measured as the absolute difference between quoted midpoint and transaction prices.
ADV [b]	Mean daily adverse-selection component of the bid-ask spread, using the model in Lin et al. (1995).
$STREET_t$	An indicator variable equal to 1 when I/B/E/S reports street earnings and 0 otherwise. Street earnings is indicated when I/B/E/S actual EPS (*VALUE*) differs from GAAP EPS. For analysts, GAAP EPS is diluted EPS (*epsfxq*) or basic EPS (*epspxq*), consistent with the I/B/E/S variable *FDI*. We obtain I/B/E/S data from its unadjusted earnings per share files to avoid potential problems that stem from rounding effects that compromise the accuracy of the I/B/E/S split-adjusted EPS files (Payne and Thomas 2003; Philbrick and Ricks 1991). We correct I/B/E/S unadjusted data when a stock-split date occurs after the date of a forecast and before earnings are released (Glushkov and Robinson 2006), such that I/B/E/S EPS data (forecast and actual) reflect the actual number of shares outstanding as of the end of the fiscal quarter, consistent with Compustat.
$PROFORMA_t$	An indicator variable equal to 1 when the firm reports pro forma earnings and 0 otherwise. Pro forma earnings is indicated when management reports an earnings number that differs from GAAP EPS. For the manager, GAAP EPS is Compustat's diluted EPS (*epsfxq*).
$NonGAAP_t$	An indicator variable equal to $STREET_t$ for the analysis of analysts' reporting choices and $PROFORMA_t$ for managers' reporting choices.
$ProbNonGAAP_t$	Probability of street earnings for analysts ($ProbSTREET_t$) and the probability of pro forma earnings for managers ($ProbPROFORMA_t$), estimated separately for analysts and managers, using a logistic regression model with the covariates discussed in Sect. 4.5.1.
D_t	Dispersion in analyst earnings forecasts, representing the uncertainty in analysts' private information in the Barron et al. (1998) model. Forecast dispersion is estimated using the last earnings forecast for quarter *t* by each of N analysts as reported in the I/B/E/S detailed earnings forecast database. We require at least three analysts for firm *i* in quarter *t*.
C_t	Forecast error, representing the uncertainty in public information about earnings in the Barron et al. (1998) model. C_t uses the same earnings forecasts as D_t and the corresponding I/B/E/S actual EPS. We require at least three analysts for firm *i* in quarter *t*.
V_t	Total forecast uncertainty over all N analysts, representing private and public uncertainty with respect to earnings information in the Barron et al. (1998) model.

Variable used in pre- or post-announcement OLS models or treatment-effect outcome models[a]	
MIDPOINT[b]	Average daily midpoint of bid-ask spread.
TradeSize[b]	Average trade size (number of shares) per transaction.
TradeFreq[b]	Average number of daily transactions.
MV	Market value of equity (*prccq* × *cshoq*) at the end of quarter t.
ANALYSTS	Number of analysts providing earnings forecasts (I/B/E/S item, *NUMEST*).
BTM	Book-to-market ratio (*ceqq*/MV) at the end of quarter t.
MBE	An indicator variable equal to 1 if I/B/E/S (manager) actual EPS met or exceed analysts' median forecast and 0 otherwise.
BEAT	An indicator variable equal to 1 if I/B/E/S (manager) FE is positive and 0 otherwise.
MISS	An indicator variable equal to 1 if I/B/E/S (manager) FE is negative and 0 otherwise.
$MBECQ^{c}_{t-1}$	The number of consecutive quarters a firm met or beat (failed to meet) analysts' median estimate based on I/B/E/S actual EPS (*VALUE)* less the median estimate (*MEDEST*). See footnote to this table for details.
LOSS	Indicator variable equal to 1 if I/B/E/S median earnings estimate is negative.
DEC	Indicator variable equal to 0 for any quarter when the earnings announcement date (*rdq*) occurred before the midpoint (March 31, 2001) of the March 21 to April 9, 2001, phase-in of decimalization of NASDAQ quotes and 1 otherwise.
REGFD	Indicator variable equal to 0 for any quarter where the earnings announcement date (*rdq*) occurred before the compliance date (October 24, 2000) of Regulation FD and 1 otherwise.
REGG	Indicator variable equal to 0 for any quarter when the earnings announcement date (*rdq*) occurred before the compliance date (March 29, 2003) of Regulation G and 1 otherwise.
Variables used exclusively in post-announcement OLS models or treatment-effect outcome models	
EX	Street (pro forma) EPS for the analysts (managers) minus GAAP EPS. EX is in dollars per share and is equal to 0 when STREET (PROFORMA) is equal to 0.
absFE	The absolute value of FE.
absFEs	absFE as a percentage of end-of-quarter share price; absFEs = (absFE/*prccq*) × 100.
LOSS2	An indicator variable equal to 1 if actual earnings reported by I/B/E/S (manager) is negative for analysts (managers).
absEX	The absolute value of EX.
absEXs	absEX as a percentage of end of quarter share price (*prccq*); absEXs = (absEX/*prccq*) × 100.
RANKabsEXs	Ranked values of absEXs. Firms are grouped into percentiles to form rankings from 0 to 99, separately for the analysts and managers.
FE	The forecast error is found as I/B/E/S actual EPS less the median estimate (FE = *VALUE* − *MEDEST*) for analysts and managers, unless PROFORMA = 1. Then, for managers only, FE = manager reported pro forma earnings – *MEDEST*.
FE_FLIPS	An indicator variable equal to 1 if the FE > 0 and FE − EX < 0 and zero otherwise. FE_FLIPS is found separately for analysts and managers. FE_FLIPS is equal to 1 when income-increasing exclusions flipped the sign of the forecast error from miss to meet or beat analysts' median estimate.

Variable used exclusively in probit/selection models[a]	
SALESGROWTH[e]	Sales growth for quarter *t*, found as $(saleq_t/saleq_{t-4}) - 1$.
STDDEVROA[e]	Standard deviation of return on assets (roa = *niq/atq)* over the previous eight quarters.
SPECITEMS	Indicator variable equal to 1 if firm reports a nonzero special item (*spiq*) and 0 otherwise.
lnTA	Log of total assets (*at*) at the end of quarter *t*.
SOX	Indicator variable equal to 1 for all calendar quarters ending after the second calendar quarter of 2002 and 0 otherwise.
NQ_t^d	The number of consecutive quarters that I/B/E/S reported an earnings number that differs from GAAP earnings.
GQ_t^d	The number of consecutive quarters that I/B/E/S reported an earnings that is the same as GAAP earnings.
INTANGIBLES[e]	End-of-quarter intangible assets (*intanoq*) divided by total assets (*atq*).
MTB[e]	End-of-quarter market value (*prccq* × *cshoq*) divided by book value of common equity (*ceqq*).
LEVERAGE[e]	End-of-quarter total liabilities (*ltq*) divided by total common equity (*ceqq*).
negOPFE	Indicator variable equal to1 if operating EPS (*oepsxq*) is less than the median I/B/E/S forecast and 0 otherwise.
OPLOSS	Indicator variable equal to 1 if firm has an operating loss (oepsxq < 0) and 0 otherwise.

[a] I/B/E/S (Compustat) mnemonics are displayed in upper (lower) case and italicized

[b] These variables are measured over the three intervals—the pre-announcement window (−12,−3), the earnings announcement window (−2,+2), and the post-announcement window (+3,+12). When necessary to prevent ambiguity, the variables have a suffix indicating whether the variable is the average over the pre-announcement window (pre), earnings announcement window (ern), or post-announcement window (post). For example, *ASCpre* is the average daily *ASC* over the (−12,−3) window. Changes in these variables are denoted with the prefix "chg." Changes are expressed as post-announcement window averages less pre-announcement window averages. For example, *chgASC* = *ASCpost* − *ASCpre*. A variable expressed in natural logarithm form has the prefix "ln." For example, *lnTradeSize* is the natural log of *TradeSize*

[c] Following Brown et al. (2009), we let I/B/E/S MBE_{it} equal to 1 when I/B/E/S actual EPS is greater than or equal to I/B/E/S median forecast EPS for quarter *t* and 0 otherwise. If, over 12 quarters, firm *i* had the series $MBE_{it} = (0,0,0,1,1,1,0,0,1,1,0,0)$, then the corresponding values of $MBECQ_{it} = (-1,-2,-3,+1,+2,+3,-1,-2,+1,+2,-1,-2)$

[d] To illustrate our sequence variables, let the indicator variable $STREET_t$ be equal to 1 (0) if I/B/E/S earnings and GAAP earnings differ (the same) for quarter *t*. Then, if a (newly listed) firm has the $STREET_t$ series (0,0,0,1,1,1,0,0) over its first eight quarters, the corresponding values of NQ_t would be (0,0,0,1,2,3,0,0), and the corresponding values of GQ_t would be (1,2,3,0,0,0,1,2). Thus GQ_{it} and NQ_{it} are the number of consecutive quarters that I/B/E/S reported GAAP and non-GAAP earnings, respectively, for firm *i* as of the end of quarter *t*. We restrict the range of these variables to no more than +8. Note that we measure NQ_t and GQ_t using the full history of I/B/E/S earnings starting with the first calendar quarter of 1995 and ending with quarter *t*. Before 1995 I/B/E/S actual EPS is unreliable. We thank Ted Christensen for bringing this point to our attention

[e] We use the same definitions as Lougee and Marquardt (2004) for intangible intensity, sales growth, market-to-book, leverage, and earnings variability

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