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The Effect of Algorithmic Trading on Management Guidance

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ABSTRACT: I investigate whether algorithmic trading (AT) affects the provision of management guidance. Existing research finds that AT decreases fundamental information acquisition before earnings announcements and consequently reduces the informativeness of prices. To compensate for reduced information acquisition, I predict and find that managers at firms with more AT activity increase the quantity and quality of guidance issued at earnings announcements. Evidence is consistent with managers responding to reduced information acquisition, as opposed to changes in liquidity, and results suggest guidance in response to AT is effective at reducing information asymmetry. These findings identify a new channel through which AT affects stock price informativeness by documenting a link to managers' disclosure decisions.

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I. INTRODUCTION

Algorithmic trading (AT) uses computer programs to automate the submission and cancelation of orders in financial markets (Hendershott, Jones, and Menkveld 2011). Already comprising more than 50 percent of trading volume and with new investments in artificial intelligence expected to delegate more trading decisions to computers in the coming years (Goldstein, Kumar, and Graves 2014; Market Makers 2023), AT is fundamentally changing the acquisition, processing, and pricing of information in equity markets (Brogaard, Hendershott, and Riordan 2014; Weller 2018). By changing what information is acquired and priced, AT potentially alters managers' incentives to *disclose* information to the capital markets. In this study, I explore whether managers respond to AT activity with changes in their voluntary disclosures.

Specifically, I examine whether AT in the quarter before an earnings announcement influences the voluntary guidance issued by managers around the announcement, finding managers increase guidance following pre-announcement AT. In light of evidence that AT leaves prices less informative by deterring investors from acquiring information before earnings announcements (Weller 2018; Lee and Watts 2021), identifying managers' voluntary disclosure responses to AT is important for understanding whether firms can effectively address this information gap and provides crucial evidence on the broader question of how AT affects the informativeness of stock prices and quality of equity markets.

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Any errors are my own.

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I focus on management guidance as a disclosure response because it directly affects price informativeness and is increasingly bundled with earnings announcements, making it a natural disclosure to address pre-announcement AT activity (Han and Wild 1991; Rogers and Van Buskirk 2013). Moreover, as one of firms' most informative disclosures, changes in guidance could make up for (or even surpass) the effects of AT on price informativeness through other channels (Beyer, Cohen, Lys, and Walther 2010).

Pre-announcement AT could influence management guidance issued with earnings announcements (hereafter, "announcement guidance") through three channels. The first channel operates through the information acquired by investors (hereafter, the "information acquisition channel"). Evidence suggests that AT reduces investor information acquisition by competing for liquidity with informed traders (Weller 2018; Korajczyk and Murphy 2019). If managers observe a less informed market, they could issue more guidance to substitute for information lost from other sources (Balakrishnan, Billings, Kelly, and Ljungqvist 2014). Alternatively, if decreased information acquisition makes managerial learning from prices less effective, managers could face reduced incentives to issue disclosures that elicit market feedback (Jayaraman and Wu 2020).

The second channel operates through liquidity (hereafter, the "liquidity channel"). On average, AT narrows spreads and enhances liquidity (Hendershott et al. 2011). Because managers reduce disclosure following exogenous increases in liquidity (Hagenberg, Miller, Sharma, and Yohn 2021), managers may decrease guidance in response to pre-announcement AT. However, although AT improves liquidity on average, it may harm liquidity for large or informed traders by competing for liquidity (Korajczyk and Murphy 2019). If managers care about liquidity for this particular group of traders, they may increase guidance in response.

The third channel operates through market responses to firm disclosures (hereafter, the "market response channel"). Evidence shows that AT helps price fundamental information in firms' disclosures (Bhattacharya, Chakrabarty, and Wang 2020; Chakrabarty, Moulton, and Wang 2022). If managers anticipate that the market will price their disclosures more efficiently when AT is high, they may issue more guidance (Fishman and Hagerty 2003; Suijs 2007). Considering credible arguments for both increases and decreases in management guidance, it is an empirical question of how pre-announcement AT influences guidance around earnings announcements.

Using a sample of earnings announcements between 2012 and 2021, I find that pre-announcement AT is positively associated with both the likelihood of issuing guidance and the quantity of guidance issued in the three-day window centered on the earnings announcement. AT is calculated as the first principal component of the cancelation-to-trade ratio, the trade-to-order ratio, the odd-lot-volume ratio, and trade size measured over the period beginning five days following the prior earnings announcement to two days before the current earnings announcement (hereafter, the "pre-announcement window") (Weller 2018). The results are robust to the addition of firm fixed effects, controls for price liquidity and historical guidance, and alternative measures of AT. The association is similar across both core (e.g., EPS and revenue) and noncore (e.g., capital expenditures and other) guidance measures, consistent with managers making substantial and pervasive changes to guidance (Abramova, Core, and Sutherland 2020).

Beyond the quantity of guidance issued, managers increase the informativeness of voluntary disclosures more broadly in response to pre-announcement AT. When managers issue guidance, pre-announcement AT is associated with more accurate and precise guidance. Exploring other voluntary disclosure channels, pre-announcement AT is positively associated with the likelihood of holding a conference call but not associated with voluntary 8-Ks or non-GAAP metrics. This result suggests managers add a rich disclosure channel instead of lean channels to better convey complex information in response to pre-announcement AT (Skinner 2024).

Next, I investigate the three channels through which AT can influence disclosure using cross-sectional tests and a path analysis approach. Cross-sectional tests are generally consistent with the information acquisition channel. Specifically, the association between pre-announcement AT and guidance is weakest when information intermediaries can substitute for firm disclosures following decreased information acquisition. Likewise, the association is strongest for firms with investors who regularly engage in information acquisition activities and when managers hold negative news about future earnings, consistent with guidance filling a specific information gap to decrease litigation risk and walk down analyst expectations (Skinner 1994; Cotter, Tuna, and Wysocki 2006). To provide more direct evidence, I use a path analysis with proxies for the information acquisition, liquidity, and market response channels. The evidence is strongest for a path from AT to decreased information acquisition, followed by more disclosure, although there is moderate evidence of a path through reduced liquidity.

Given the potential endogeneity between AT and firm disclosure, such that AT may be more active in firms with richer information environments and disclosure patterns, I utilize an instrumental variables analysis and two natural experiments to strengthen a causal interpretation of my results. First, following Weller (2018), I instrument for AT using the firm's lagged stock price in a two-staged least squares regression and find a positive association between the instrumented AT and guidance. Second, I utilize the Tick Size Pilot (TSP) program as a plausibly exogenous decrease in AT

and find that treated firms decrease guidance more than control firms post-treatment. Examining the information acquisition, liquidity, and market response channels in the TSP setting, I find evidence generally consistent with the information acquisition channel, although evidence is mixed on whether the TSP affects disclosure through changes in AT. Third, I utilize a technological upgrade at the Nasdaq Stock Exchange in 2010 that increased order processing and trade speed (Chordia and Miao 2020). Nasdaq firms, which experience a plausibly exogenous increase in AT, issue relatively more guidance than NYSE-listed firms after the upgrade. All three identification settings corroborate the conclusions of my pooled regression design, providing support for a causal relation between AT and announcement guidance.

My final set of analyses examines whether disclosure compensates for decreased information acquisition by investors. Guidance following high pre-announcement AT is associated with improved liquidity and returns that reflect relatively less information from external sources (i.e., market-wide and private information) over the post-announcement quarter (Brogaard, Nguyen, Putnins, and Wu 2022). These tests suggest that guidance effectively levels the playing field by enriching the public information environment following pre-announcement AT.

My study contributes to the literature in three ways. First, I contribute to the voluntary disclosure literature by documenting a positive association between pre-announcement AT and management guidance issued at earnings announcements. This evidence extends research examining how firms' investors affect voluntary disclosure decisions by showing that an important characteristic of firms' active *traders*, AT, affects the voluntary provision of guidance (Boone and White 2015; Li and Zhang 2015; Abramova et al. 2020). Because a substantial literature finds guidance has meaningful consequences for price informativeness, liquidity, and the cost of capital (see Beyer et al. 2010, for a review), evidence of managers' voluntary disclosure responses to pre-announcement AT has implications for our understanding of how AT affects the quality of capital markets more broadly. Moreover, by documenting that guidance has a stronger association with market quality following high pre-announcement AT, my study suggests that guidance in response to AT, in particular, is informative to investors and has significant capital market consequences.

Second, I fill a gap in the AT literature by documenting that AT can affect price informativeness through a relation with managers' voluntary disclosure decisions. Regulators, academics, and investors are concerned about whether the overwhelming presence of AT in equity markets has increased or decreased the informativeness of stock prices. Prior studies find that AT improves pricing efficiency for publicly available information (Brogaard et al. 2014; Bhattacharya et al. 2020; Chordia and Miao 2020) but reduces the acquisition of new information and results in less informative stock prices before earnings announcements (Weller 2018; Lee and Watts 2021). Although Ahmed, Li, and Xu (2020) document a negative association between AT and mandatory reporting quality, AT's effect on managers' *voluntary* disclosures remains unexplored. My results showing a positive association between AT and the provision of management guidance contrast those of Ahmed et al. (2020). Because guidance is highly informative to prices (e.g., Beyer et al. 2010 find that management guidance accounts for 55.2 percent of accounting-related information incorporated into stock prices), our understanding of the broader relation between AT and price informativeness is incomplete without considering the effects of AT on voluntary guidance.

Third, I provide evidence that AT influences management guidance through a decrease in information acquisition. This finding contrasts and extends inferences drawn in prior studies. Specifically, using the TSP setting, Hope and Liu (2022) argue that increased tick sizes reduce liquidity and weaken market reactions to firm disclosures, prompting firms to issue less guidance. Because Lee and Watts (2021) provide strong evidence that the TSP decreased AT for treated firms, I reexamine the TSP results through the information acquisition, liquidity, and market response channels, finding evidence consistent with the information acquisition channel. My study extends Chen, Ng, Ofosu, and Yang's (2023) TSP analysis on voluntary disclosure by using a more direct measure of AT and multiple settings to improve identification. Although the TSP is restricted to small firms, my analyses using Market Information Data Analytics System (MIDAS) data to proxy for AT show that the association between AT and voluntary disclosure also extends to larger firms. Further, by documenting consistent results across multiple settings other than the TSP, my tests reduce the risk of false positives when natural experiments are re-used (Heath, Ringgenberg, Samadi, and Werner 2023). These new analyses suggest AT influences disclosure by altering investors' information acquisition activities.

II. BACKGROUND AND EMPIRICAL PREDICTIONS

Management Guidance

Management guidance consists of forecasts about future performance provided by firms to investors, analysts, and other stakeholders. Beyer et al. (2010) summarize the literature on why managers disclose voluntarily. I highlight three stylized facts from that review. First, although the goal of voluntary disclosure is to reduce information asymmetries, the individual incentives that influence disclosure are numerous; managers will alter disclosure decisions when their

compensation is tied to stock prices (Noe 1999), to avoid litigation (Skinner 1994), to walk down analyst expectations (Cotter et al. 2006), to improve liquidity (Balakrishnan et al. 2014), in addition to others. I discuss specific disclosure incentives below as they relate to AT. Second, managers have incentives to release guidance containing both positive and negative news. For EPS guidance in my sample, about 58 percent (42 percent) of EPS forecasts are below (at or above) current expectations. It is an empirical question whether AT more strongly affects guidance containing positive or negative news. Third, managers increasingly release guidance bundled with earnings announcements, including over 80 percent of the guidance in my sample period (Rogers and Van Buskirk 2013). I focus on guidance around earnings announcements because it reflects when the preponderance of management guidance is issued and when guidance is most responsive to changes in investor demands (Abramova et al. 2020). In the following subsections, I describe three channels through which pre-announcement AT may influence the decision to issue guidance around an earnings announcement.

AT and Management Guidance

Information Acquisition Channel

Whether executed by standalone algorithms or market makers to avoid adverse selection, theoretical studies predict that order anticipation strategies increase the cost of informed by predicting and competing with incoming order flow (Hoffmann 2014; Menkveld and Zoican 2017; Yang and Zhu 2020). Empirically, when large parent orders are split up into a series of smaller orders to improve execution, AT initially provides liquidity. After detecting the presence of a latent parent order, the AT strategy turns and competes for liquidity with the incoming orders (Korajczyk and Murphy 2019; Van Kervel and Menkveld 2019; Hirschey 2021). Consequently, Weller (2018) and Lee and Watts (2021) find empirical evidence consistent with AT decreasing information acquisition prior to earnings announcements, leaving pre-announcement prices less informative.

It is not evident whether a decrease in pre-announcement information acquisition will increase or decrease announcement guidance. The expectations-adjustment hypothesis states that managers disclose to align market expectations with the manager's private information; when the misalignment between managers and the market is greater, the benefits of disclosing increase, and managers are more likely to do so (Ajinkya and Gift 1984; Verrecchia 1990). Empirical studies support that managers disclose more when stock prices reflect less fundamental information (Sletten 2012; Balakrishnan et al. 2014; Billings, Jennings, and Lev 2015).[1] Thus, pre-announcement AT may increase guidance by decreasing information acquisition.

However, a stream of literature documents that managers issue forecasts to elicit market feedback and adjust their forecasts in response to what they learn from prices (Zuo 2016; Jayaraman and Wu 2020). If decreased information acquisition in response to AT makes prices less informative and managerial learning less effective, managers may issue fewer disclosures designed to elicit market feedback (Ye, Zheng, and Zhu 2023). Moreover, this literature highlights that investors' and managers' information sets do not fully overlap. If the information gap created when investors reduce information acquisition cannot be filled by managers' private information, managers may not increase disclosures to "fill the gap." As a result, pre-announcement AT may decrease (or have no effect on) guidance by reducing information acquisition.

Liquidity Channel

The association between AT and liquidity is complex. Many studies find that AT improves traditional liquidity measures (e.g., spreads, price impact, etc.) (Hendershott et al. 2011; Conrad, Wahal, and Xiang 2015). However, recent studies have explored the dynamics of liquidity to reveal that AT competes for liquidity with informed traders when they break up large parent orders into a series of smaller orders to improve execution (Korajczyk and Murphy 2019; Van Kervel and Menkveld 2019; Hirschey 2021). These results imply that, although AT narrows bid-ask spreads and improves liquidity on average, realized liquidity depends on the liquidity taker's specific needs, e.g., how much volume they need to trade and how much time they have to trade it.[2]

[1] Using the TSP as an exogenous decrease in AT, Ahmed et al. (2020) find that treated firms exhibit improved financial reporting quality for mandatory disclosures. The negative association between AT and financial reporting quality may not apply to management guidance because the incentives and costs of voluntary disclosure differ from mandatory disclosure. Management guidance involves commitments by managers to meet specific benchmarks and carries significant costs, often establishing a disclosure "policy" that is challenging to halt without repercussions. The voluntary disclosure incentives discussed in Section II do not necessarily apply to mandatory reporting.

[2] The proposition that AT increases the cost of informed trading may appear at odds with prior studies suggesting AT improves liquidity. However, these studies are more consistent than they appear. Hendershott et al. (2011, 3) state that "The narrower spreads are a result of a sharp decline in adverse selection, or equivalently a decrease in the amount of price discovery associated with trades." Adverse selection is simultaneously a cost to market makers and a profit to informed traders. If AT reduces adverse selection and trade-related price discovery, inside quotes should improve, but information acquisition should decrease due to lower profits when trading on private information.

The literature suggests that managers disclose to reduce information asymmetries and improve liquidity and that these disclosures are effective at doing so (Diamond and Verrecchia 1991; Coller and Yohn 1997; Balakrishnan et al. 2014; Schoenfeld 2017). However, identifying whether liquidity shapes disclosure causally is a more recent inquiry. Balakrishnan et al. (2014) find that managers increase voluntary disclosures when analyst coverage and liquidity decline due to exogenous factors. Similarly, Hagenberg et al. (2021) show that an exogenous liquidity increase leads to reduced voluntary disclosure.[3] Thus, if AT improves liquidity on average, I expect a negative association between pre-announcement AT and management guidance at the earnings announcement. If managers are concerned with liquidity declines for large or informed traders due to AT, I may observe a positive association between pre-announcement AT and guidance.

Market Response Channel

The prior literature consistently finds that AT improves the efficiency with which public information is priced. AT trades in response to the direction of insider trades (Rogers, Skinner, and Zechman 2017), earnings surprises (Bhattacharya et al. 2020), and macroeconomic news (Hu, Pan, and Wang 2017). More importantly, AT improves the *efficiency* with which the information event is priced. In the short term, AT trades in the direction of permanent price changes and opposite transitory changes, resulting in prices that more closely resemble a random walk (Brogaard et al. 2014). Over the longer term, AT facilitates the pricing of earnings news and reduces post-announcement drift (Chordia and Miao 2020; Chakrabarty et al. 2022).

Theoretical studies suggest that when managers are more certain about the market response to their disclosures, they are more likely to disclose (Fishman and Hagerty 2003; Suijs 2007). Although not a direct test of these theories, Abramova et al. (2020) find that when institutional investors are inattentive, potentially increasing uncertainty about how the market will price firm news, managers issue less management guidance. If AT increases the efficiency and predictability of the market response to management guidance, I expect managers will issue more guidance at earnings announcements.

To summarize, I identify three channels through which pre-announcement AT could influence management guidance at earnings announcements: the information acquisition channel, the liquidity channel, and the market response channel. These channels are not mutually exclusive and do not offer an obvious directional prediction on the relation between pre-announcement AT and announcement guidance. Therefore, it is an empirical question whether pre-announcement AT is positively or negatively associated with guidance at earnings announcements.

Guidance Characteristics and Other Voluntary Disclosures

In this subsection, I consider the broader menu of voluntary disclosure responses available to managers following pre-announcement AT. On the intensive margin, managers can change the characteristics of guidance issued in addition to the quantity of guidance. If a manager intends to disclose more (less) information following pre-announcement AT, then I should observe more (less) accurate and precise forecasts and relatively longer (shorter) horizon forecasts (Li and Zhang 2015; Chen, Cheng, Luo, and Yue 2020). Managers can also change the specific measures they forecast. Abramova et al. (2020) define core guidance as earnings and revenue forecasts and secondary guidance as other forecasts. They find that managers respond to institutional distraction with changes in guidance for "secondary instead of core items." Changes to core guidance would be consistent with managers altering especially informative disclosures when pre-announcement AT is high. Alternatively, changes in guidance restricted to secondary measures suggest that guidance issued in response to pre-announcement AT will have limited effects on price informativeness and market quality.

Although guidance is an informative voluntary disclosure, it is not the only option available to managers. If pre-announcement AT induces managers to provide more (less) informative guidance, I expect similar effects in other disclosure channels. Changes in voluntary 8-Ks, non-GAAP metrics, and conference calls could reveal the nature of the information managers convey in response to pre-announcement AT. Skinner (2024) finds that firms choose rich channels (e.g., conference calls) for complex information and lean channels (e.g., press releases) for less complex information. Because management guidance is forward-looking and may require additional context, I expect contemporaneous changes in rich disclosure channels instead of lean channels.

[3] Using the TSP, Hope and Liu (2022) find that treated firms, whose liquidity declines, decrease disclosure. These results contrast with Balakrishnan et al. (2014) and Hagenberg et al. (2021), who find that declines (improvements) in liquidity lead to greater (reduced) voluntary disclosure. A critical difference between these studies is that the TSP setting prevents voluntary disclosure from improving liquidity (i.e., treated firms in the TSP have a minimum tick size that cannot be improved by increased disclosure). This feature, unique to the TSP setting, removes one of managers' primary disclosure incentives. In more generalized settings, I expect the associations in Balakrishnan et al. (2014) and Hagenberg et al. (2021) to hold.

Cross-Sectional Analyses

This section discusses cross-sectional factors that moderate the relation between pre-announcement AT and guidance to provide evidence on the channel through which AT influences disclosure. I expect information intermediaries, such as analysts, to weaken the association between pre-announcement AT and disclosure. By providing novel information to investors, analysts can substitute for firm disclosures when information acquisition declines in response to AT (Balakrishnan et al. 2014; Bradley, Clarke, Lee, and Ornthanalai 2014). Additionally, by reducing information asymmetry, improving liquidity, and increasing the efficiency with which news is priced, analysts can substitute for AT in the liquidity and market response channels and weaken the association between AT and disclosure (Zhang 2008; Schoenfeld 2017).

The firm's investor base could also moderate the association between pre-announcement AT and guidance. If AT operates through the information acquisition channel, institutional ownership should strengthen the association between pre-announcement AT and guidance because institutional owners are more likely to acquire private information (Drake, Johnson, Roulstone, and Thornock 2020). As a result, AT will reduce information acquisition more when institutional ownership is high. If AT operates through the market response channel, institutional ownership should weaken the association between AT and guidance because institutional owners help price news more efficiently, substituting for the pricing benefits of AT (Ke and Ramalingegowda 2005).

Whether the manager possesses good or bad news guidance may affect the association between pre-announcement AT and announcement guidance. If AT operates through the market response channel, I expect a stronger relation between pre-announcement AT and guidance when the manager holds good news. Voluntarily disclosing good news benefits the manager when their stock compensation is tied to prices (e.g., Noe 1999), and therefore the benefit only materializes if the information is incorporated into prices. However, disclosing bad news benefits the manager by reducing litigation risk and walking down analyst expectations (Skinner 1994; Cotter et al. 2006). Although the manager may still care about efficient pricing for bad news, these additional, nonpricing incentives tilt the relative benefits of efficient pricing more toward good news than bad news. If AT operates through the liquidity channel, I do not expect the sign of the news to change the association between AT and guidance because the information asymmetry and liquidity improvements are symmetric for good and bad news. Lastly, if AT operates through the information acquisition channel by widening the information gap between investors and managers, it should strengthen whatever incentives the manager already holds. Because bad news guidance is moderately more common, I may observe a stronger association with bad news.

III. DATA AND RESEARCH DESIGN

Sample

I construct a sample of all earnings announcements listed on I/B/E/S between February 1, 2012, and July 31, 2021.[4] I merge these announcements with CRSP and Compustat, requiring a stock price greater than $5 and a market capitalization greater than $10 million. I remove observations if the I/B/E/S earnings announcement date differs from the Compustat date by more than one calendar day. I require the prior (subsequent) earnings announcement date to be between 20 and 126 trading days before (following) the current earnings announcement for the AT measurement window to be sufficiently long. I retain 76,988 firm-quarter observations (3,587 firms) over my sample period with available data.

Measuring AT

The SEC's MIDAS dataset provides summary data for 13 equity exchanges in the US including volume, orders, trades, and cancelations by firm and day. Using these data, I define four proxies for AT identified by the prior literature (Weller 2018). The odd-lot volume ratio (*OddLotVolumeRatio*) is the volume of trades executed in odd-lot sizes divided by the total volume traded, where greater odd-lot trades are associated with more AT (O'Hara, Yao, and Ye 2014). The trade-to-order ratio (*TradeToOrderRatio*) is the total volume traded divided by the total volume of orders placed. The trade-to-order ratio is negatively correlated with AT because algorithms place and cancel high volumes of orders when executing trades (Hendershott et al. 2011). The cancelations-to-trades ratio (*CancelToTradeRatio*) is the number of orders canceled divided by the number of trades executed and is positively correlated with AT

[4] The SEC MIDAS data are available beginning January 1, 2012. Eliminating earnings announcements before February 1, 2012, allows at least 31 days of measurement for the AT proxies. The end date of the sample includes data available at the time of collection. Data can be found at http://www.sec.gov/marketstructure/data

(Hasbrouck and Saar 2013). Trade size (*TradeSize*) is calculated as the total volume traded divided by the number of trades. Trade size is negatively correlated with AT, as algorithms execute more small orders for a given volume (O'Hara 2015).

The proxies are measured daily by firm, averaged over the period beginning five days following the prior earnings announcement to two days before the current announcement ("pre-announcement window," see Appendix A), and logged. Because AT decreases information acquisition during this timeframe, it should be salient for managers when choosing whether to issue guidance at the announcement (Lee and Watts 2021). The means for each measure, presented in Table 1, are consistent with prior literature (Weller 2018). The AT proxy (*AT*) is the first principal component of the *OddLotVolumeRatio*, *TradeToOrderRatio*, *CancelToTradeRatio*, and *TradeSize*, with an eigenvalue of 2.28. In Table 2, *AT* is positively correlated with *OddLotVolumeRatio* and *CancelToTradeRatio* (0.86 and 0.58, respectively) and negatively correlated with *TradeToOrderRatio* and *TradeSize* (−0.76 and −0.72, respectively) as expected.

Research Design

I use the following base model to test the effect of AT on voluntary disclosure:

$$\begin{aligned} Guidance_{i,t} = {} & \alpha + \beta_1 AT_{i,t} + \beta_2 UE_{i,t} + \beta_3 PosUE_{i,t} + \beta_4 NegUE_{i,t} + \beta_5 PPUE_{i,t} + \beta_6 Loss_{i,t} \\ & + \beta_7 SalesGrowth_{i,t} + \beta_8 Q4_{i,t} + \beta_9 LnCAR\_PreAnn_{i,t} + \beta_{10} NewsEvents_{i,t} + \beta_{11} InsiderSales_{i,t} \\ & + \beta_{12} Dispersion_{i,t} + \beta_{13} LnMktCap_{i,t} + \beta_{14} AnalystFollowing_{i,t} + \beta_{15} IO_{i,t} + \beta_{16} Turnover_{i,t} \\ & + \beta_{17} ESpread_{i,t} + + \beta_{18} iVol_{i,t} + \beta_{19} Illiquidity_{i,t} + \beta TimeFE + \beta FirmFE + \varepsilon_{i,t} \end{aligned} \quad (1)$$

$Guidance_{i,t}$ represents the voluntary disclosure for firm i released in the [−1,+1] trading day window around the earnings announcement ("announcement window," see Appendix A) in quarter t. I measure guidance as the logarithm of 1 plus the count of guidance issued (*LnGuideCount*) and an indicator equal to 1 if the firm issues any guidance in the announcement window (*Guider*).[5] Firms issue announcement window guidance in 67 percent of firm-quarters (see Table 1), and the mean (median) of *LnGuideCount* is 0.874 (1.099), commensurate with a raw guidance count of 1.4 (2).

$AT_{i,t}$ is the proxy for AT as defined previously. The remaining covariates follow the voluntary disclosure models in Rogers and Van Buskirk (2013) and Billings et al. (2015). Variable definitions are provided in Appendix B. I control for earnings news using unexpected earnings ($UE_{i,t}$), positive and negative earnings surprise indicators ($PosUE_{i,t}$ and $NegUE_{i,t}$, respectively), the proportion of historical positive earnings surprises ($PPUE_{i,t}$), a loss indicator ($Loss_{i,t}$), and sales growth ($SalesGrowth_{i,t}$). To account for news and performance in the pre-announcement window, I control for abnormal returns ($LnCAR\_PreAnn_{i,t}$), the number of unique news events ($NewsEvents_{i,t}$), and net insider sales ($InsiderSales_{i,t}$). I control for the firm's information environment with analyst forecast dispersion ($Dispersion_{i,t}$), firm size ($LnMktCap_{i,t}$), analyst following ($AnalystFollowing_{i,t}$), and institutional ownership ($IO_{i,t}$). I also include controls for market quality that may influence disclosure. I calculate share turnover ($Turnover_{i,t}$), intraday effective spreads ($ESpread_{i,t}$), intraday price volatility ($iVol_{i,t}$), and open-to-close Amihud illiquidity ($Illiquidity_{i,t}$) (Amihud 2002; Barardehi, Bernhardt, Ruchti, and Weidenmier 2021). AT likely causes changes in turnover, spreads, volatility, and liquidity, and therefore I calculate these controls over the [−126,+5] trading day period around the *prior* quarter's earnings announcement ("market control window," see Appendix A), strictly before the measurement of AT. Last, time (quarterly) and firm fixed effects are included to account for changes in disclosure levels over time or unobservable firm-level factors that may be correlated with AT.

I present summary statistics for the above variables in Table 1. A total of 61 percent of firms have positive earnings surprises, whereas 27 percent report a loss. The median analyst coverage for my sample is nine analysts. Median sales growth is 6 percent, and median returns in the quarter before an announcement are slightly negative. These descriptive statistics are generally consistent with the prior literature. In the regression analyses, the independent variables are normalized with a mean of 0 and a standard deviation of 1 for a more straightforward interpretation of coefficient estimates. Continuous variables are Winsorized at 1 percent to reduce the influence of outliers.

[5] Guidance is obtained from the I/B/E/S Guidance dataset, which records firm forecasts for earnings per share (EPS), sales, earnings before income taxes, depreciation, and amortization (EBITDA), EBITDA per share, capital expenditures, dividends per share, funds from operations, fully reported EPS, gross margin, net income, operating profit, pretax income, ROA, and ROE. In untabulated analyses, I find 803 firms (8,928 observations) never issue guidance in the announcement window, 585 firms (14,359 observations) always issue guidance, and the remaining 2,199 firms (53,701 observations) issue at least one forecast in one quarter and zero forecasts in at least one quarter. Of the 803 firms that never issue guidance around earnings announcements, only 50 (1,130 observations) issue management guidance between earnings announcements at least once across the sample period.

TABLE 1

Summary Statistics

	n	Mean	Std. Dev.	P25	Median	P75
AT Proxies						
AT	76,988	−0.323	1.357	−1.196	−0.315	0.566
OddLotVolumeRatio	76,988	−1.870	0.622	−2.258	−1.815	−1.425
TradeToOrderRatio	76,988	−3.644	0.485	−3.939	−3.593	−3.298
CancelToTradeRatio	76,988	3.192	0.495	2.851	3.130	3.447
TradeSize	76,988	4.542	0.426	4.283	4.558	4.842
Disclosure Variables						
Guider	76,988	0.670	0.470	0.000	1.000	1.000
LnGuideCount	76,988	0.874	0.722	0.000	1.099	1.386
Accuracy	33,873	−0.015	0.127	−0.005	−0.002	−0.001
Precision	30,616	0.004	0.018	0.001	0.002	0.004
Specificity	37,902	2.078	0.312	2.000	2.000	2.000
Horizon	37,875	4.786	0.738	4.127	4.382	5.505
$LnGuideCount_{EPS}$	76,988	0.321	0.422	0.000	0.000	0.693
$LnGuideCount_{REV}$	76,988	0.338	0.423	0.000	0.000	0.693
$LnGuideCount_{CAPEX}$	76,988	0.245	0.353	0.000	0.000	0.693
$LnGuideCount_{OTHER}$	76,988	0.355	0.506	0.000	0.000	0.693
Ln8Ks	76,980	0.720	0.238	0.693	0.693	0.693
NonGAAP	57,238	0.578	0.494	0.000	1.000	1.000
ConfCall	76,988	0.882	0.323	1.000	1.000	1.000
LnConfCall_Seconds	67,907	7.978	0.317	7.789	8.038	8.206
Control Variables						
UE	76,988	0.000	0.016	−0.001	0.001	0.002
PosUE	76,988	0.610	0.488	0.000	1.000	1.000
NegUE	76,988	0.333	0.471	0.000	0.000	1.000
PPUE	76,988	0.636	0.306	0.500	0.750	1.000
Loss	76,988	0.273	0.445	0.000	0.000	1.000
SalesGrowth	76,988	0.131	0.488	−0.027	0.058	0.175
Q4	76,988	0.258	0.437	0.000	0.000	1.000
LnCAR_PreAnn	76,988	−0.027	0.206	−0.110	−0.008	0.086
NewsEvents	76,988	14.315	17.056	0.000	11.000	21.000
InsiderSales	76,988	0.001	0.003	0.000	0.000	0.000
Dispersion	76,988	0.102	0.232	0.020	0.041	0.090
LnMktCap	76,988	21.459	1.632	20.280	21.327	22.500
AnalystFollowing	76,988	10.869	7.462	5.000	9.000	15.000
IO	76,988	0.764	0.243	0.678	0.841	0.937
Turnover	76,988	0.010	0.009	0.005	0.008	0.012
ESpread	76,988	15.927	23.473	4.622	9.018	17.049
iVol	76,988	0.034	0.133	0.001	0.004	0.015
Illiquidity	76,988	0.010	0.041	0.000	0.001	0.004

Table 1 presents summary statistics for select variables used in the empirical tests.
See Appendix B for variable definitions.

IV. MAIN RESULTS

Pooled Regression Results

Table 3 presents regressions of announcement window guidance (*LnGuideCount* and *Guider*) on pre-announcement AT (*AT*). Columns (1) and (2) present results without control variables, columns (3) and (4) with the control variables in

TABLE 2

Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	*AT*	1.00											
(2)	*OddLotVolumeRatio*	0.86*	1.00										
(3)	*TradeToOrderRatio*	−0.76*	−0.36*	1.00									
(4)	*CancelToTradeRatio*	0.58*	0.16*	−0.79*	1.00								
(5)	*TradeSize*	−0.72*	−0.87*	0.15*	0.06*	1.00							
(6)	*Guider*	0.01	−0.02*	−0.05*	−0.02*	0.00	1.00						
(7)	*LnGuideCount*	0.01*	0.00	−0.03*	−0.04*	−0.03*	0.85*	1.00					
(8)	*UE*	0.06*	0.06*	−0.04*	0.00	−0.06*	0.04*	0.05*	1.00				
(9)	*PosUE*	0.05*	0.07*	−0.02*	−0.04*	−0.08*	0.09*	0.12*	0.38*	1.00			
(10)	*NegUE*	−0.07*	−0.09*	0.03*	0.03*	0.10*	−0.12*	−0.16*	−0.40*	−0.88*	1.00		
(11)	*PPUE*	0.08*	0.11*	−0.04*	−0.05*	−0.12*	0.16*	0.22*	0.13*	0.25*	−0.28*	1.00	
(12)	*Loss*	−0.21*	−0.13*	0.24*	−0.17*	0.08*	−0.16*	−0.13*	−0.16*	−0.16*	0.20*	−0.20*	1.00
(13)	*SalesGrowth*	−0.05*	−0.00	0.09*	−0.07*	−0.02*	−0.09*	−0.07*	0.06*	0.05*	−0.05*	−0.01	0.05*
(14)	*Q4*	−0.01	−0.00	0.01	−0.00	0.00	0.02*	0.02*	−0.01	−0.01*	0.01*	0.00	0.02*
(15)	*LnCAR_PreAnn*	−0.01	−0.03*	−0.02*	0.03*	0.04*	0.04*	0.03*	0.03*	0.03*	−0.03*	−0.03*	−0.05*
(16)	*NewsEvents*	−0.03*	0.01*	0.04*	−0.14*	−0.04*	0.09*	0.08*	0.03*	0.05*	−0.09*	0.13*	−0.12*
(17)	*InsiderSales*	0.03*	0.05*	0.00	−0.02*	−0.06*	−0.02*	0.01	0.02*	0.03*	−0.03*	0.06*	0.03*
(18)	*Dispersion*	−0.03*	−0.01*	0.04*	−0.06*	−0.02*	−0.13*	−0.15*	−0.19*	−0.08*	0.11*	−0.13*	0.17*
(19)	*LnMktCap*	−0.02*	0.03*	0.00	−0.24*	−0.08*	0.21*	0.18*	0.06*	0.10*	−0.17*	0.24*	−0.29*
(20)	*AnalystFollowing*	−0.23*	−0.21*	0.12*	−0.23*	0.14*	0.20*	0.18*	0.02*	0.05*	−0.11*	0.16*	−0.09*
(21)	*IO*	0.14*	0.18*	−0.07*	−0.09*	−0.21*	0.20*	0.20*	0.06*	0.06*	−0.08*	0.12*	−0.10*
(22)	*Turnover*	−0.31*	−0.25*	0.24*	−0.28*	0.15*	0.01	0.01	−0.00	0.01	0.01	−0.01	0.18*
(23)	*ESpread*	0.09*	0.05*	−0.02*	0.32*	0.04*	−0.26*	−0.24*	−0.06*	−0.08*	0.11*	−0.18*	0.21*
(24)	*iVol*	0.08*	0.05*	−0.02*	0.26*	0.04*	−0.18*	−0.17*	−0.04*	−0.06*	0.07*	−0.12*	0.14*
(25)	*Illiquidity*	0.02*	−0.02*	0.00	0.28*	0.12*	−0.16*	−0.15*	−0.05*	−0.06*	0.08*	−0.13*	0.13*

		(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
(1)	*AT*													
(2)	*OddLotVolumeRatio*													
(3)	*TradeToOrderRatio*													
(4)	*CancelToTradeRatio*													
(5)	*TradeSize*													
(6)	*Guider*													
(7)	*LnGuideCount*													
(8)	*UE*													

(continued on next page)

TABLE 2 (continued)

		(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
(9)	*PosUE*													
(10)	*NegUE*													
(11)	*PPUE*													
(12)	*Loss*													
(13)	*SalesGrowth*	1.00												
(14)	*Q4*	0.01*	1.00											
(15)	*LnCAR_PreAnn*	−0.04*	0.02*	1.00										
(16)	*NewsEvents*	−0.01	0.09*	0.01*	1.00									
(17)	*InsiderSales*	0.07*	0.11*	−0.05*	0.05*	1.00								
(18)	*Dispersion*	0.05*	0.01*	−0.03*	−0.03*	−0.03*	1.00							
(19)	*LnMktCap*	−0.05*	−0.01	0.04*	0.51*	−0.05*	−0.03*	1.00						
(20)	*AnalystFollowing*	−0.01*	0.01	0.04*	0.37*	−0.02*	0.02*	0.66*	1.00					
(21)	*IO*	−0.06*	−0.00	0.02*	0.11*	0.02*	−0.08*	0.21*	0.17*	1.00				
(22)	*Turnover*	0.09*	−0.00	−0.05*	0.04*	0.07*	0.15*	−0.00	0.26*	0.12*	1.00			
(23)	*ESpread*	0.07*	−0.01	−0.04*	−0.22*	0.01*	0.07*	−0.58*	−0.39*	−0.36*	−0.18*	1.00		
(24)	*iVol*	0.04*	−0.00	−0.03*	−0.11*	−0.01	0.06*	−0.35*	−0.22*	−0.27*	−0.15*	0.88*	1.00	
(25)	*Illiquidity*	0.02*	0.00	−0.01	−0.12*	−0.02*	0.04*	−0.38*	−0.22*	−0.28*	−0.16*	0.85*	0.84*	1.00

* Indicates statistical significance at the 1 percent level.
Table 2 presents the correlation matrix.
See Appendix B for variable definitions.

TABLE 3

Guidance Frequency and Likelihood

Panel A: Pooled Regression Analyses

	No Controls		Controls		Firm Fixed Effects	
Dep. Var. =	***LnGuideCount*** **(1)**	***Guider*** **(2)**	***LnGuideCount*** **(3)**	***Guider*** **(4)**	***LnGuideCount*** **(5)**	***Guider*** **(6)**
AT	**0.031****	**0.019****	**0.027****	**0.019*****	**0.033*****	**0.024*****
	(2.53)	**(2.50)**	**(2.46)**	**(2.82)**	**(4.59)**	**(4.89)**
UE			−0.060***	−0.022***	−0.005	0.002
			(−6.85)	(−4.42)	(−0.91)	(0.57)
PosUE			0.038*	0.023**	0.015*	0.011*
			(1.95)	(2.30)	(1.94)	(1.78)
NegUE			−0.191***	−0.069***	−0.019*	−0.001
			(−8.49)	(−5.74)	(−1.78)	(−0.16)
PPUE			0.103***	0.036***	0.011***	0.004*
			(17.66)	(10.66)	(3.38)	(1.75)
Loss			−0.012	−0.043***	−0.020**	−0.013*
			(−0.73)	(−4.31)	(−2.11)	(−2.00)
SalesGrowth			−0.032***	−0.029***	0.004**	0.002
			(−6.43)	(−8.32)	(2.11)	(1.00)
Q4			0.029*	0.013	0.032***	0.013**
			(1.88)	(1.34)	(4.35)	(2.36)
LnCAR_PreAnn			0.008*	0.004	0.001	0.000
			(1.89)	(1.23)	(0.27)	(0.04)
NewsEvents			0.002	0.003	0.006	0.001
			(0.19)	(0.35)	(0.84)	(0.30)
InsiderSales			0.001	−0.007**	0.001	0.001
			(0.19)	(−2.05)	(0.60)	(0.57)
Dispersion			−0.063***	−0.033***	−0.026***	−0.016***
			(−8.73)	(−6.15)	(−4.93)	(−4.31)
LnMktCap			−0.074***	−0.035***	0.056***	0.024**
			(−4.38)	(−3.22)	(3.31)	(2.08)
AnalystFollowing			0.081***	0.053***	0.090***	0.063***
			(5.91)	(6.75)	(6.43)	(6.99)
IO			0.077***	0.047***	0.042***	0.023***
			(6.85)	(6.35)	(5.54)	(4.64)
Turnover			−0.016*	−0.009*	−0.014**	−0.009**
			(−1.82)	(−1.81)	(−2.24)	(−2.07)
ESpread			−0.264***	−0.185***	−0.080***	−0.054***
			(−11.27)	(−10.77)	(−6.33)	(−5.98)
iVol			0.074***	0.050***	0.026***	0.014**
			(5.66)	(5.27)	(3.60)	(2.36)
Illiquidity			0.087***	0.061***	0.024***	0.018***
			(7.76)	(7.08)	(3.85)	(3.82)
Firm FE	No	No	No	No	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
n	76,988	76,988	76,988	76,988	76,988	76,988
R^2	0.01	0.02	0.15	0.15	0.70	0.61

(continued on next page)

TABLE 3 (continued)

Panel B: Robustness Tests

	Contemporaneous Market Controls		Past Guidance	
Dep. Var. =	***LnGuideCount***	***Guider***	***LnGuideCount***	***Guider***
	(1)	**(2)**	**(3)**	**(4)**
AT	**0.028*****	**0.019*****	**0.037*****	**0.026*****
	(3.54)	**(3.52)**	**(7.66)**	**(7.26)**
Turnover	−0.018***	−0.013***		
	(−3.19)	(−3.08)		
ESpread	−0.044***	−0.031***		
	(−3.81)	(−4.08)		
iVol	0.018***	0.011**		
	(3.17)	(2.56)		
Illiquidity	0.007	0.006		
	(1.45)	(1.54)		
LnGuideCount_PreAnn			0.031***	0.020***
			(5.50)	(4.75)
LnGuideCount_EALag1			0.357***	0.201***
			(18.90)	(18.16)
LnGuideCount_EALag2			0.108***	0.056***
			(11.13)	(8.29)
LnGuideCount_EALag3			0.012	0.007
			(0.98)	(1.00)
LnGuideCount_EALag4			0.099***	0.046***
			(7.20)	(6.13)
Firm and Quarter FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
n	76,988	76,988	64,436	64,436
R^2	0.70	0.61	0.76	0.65

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.
Table 3 presents regressions of announcement window guidance on pre-announcement AT. Panel A presents the primary analyses, where columns (1) and (2) present results with no controls, columns (3) and (4) with controls, and columns (5) and (6) with controls and firm fixed effects. Panel B presents models that include contemporaneous market controls and historical guidance. In columns (1) and (2) of Panel B, *Turnover*, *ESpread*, *iVol*, and *Illiquidity* are measured over the pre-announcement window, contemporaneously with AT. In columns (3) and (4) of Panel B, regressions include controls of historical guidance, including the guidance count measured over the pre-announcement window (*LnGuideCount_PreAnn*) and each of the four prior earnings announcement windows (*LnGuideCount_EALag1* through *LnGuideCount_EALag4*). Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm.
See Appendix B for variable definitions.

Equation (1), and columns (5) and (6) include firm fixed effects.[6] *AT* is positively associated with *LnGuideCount* and *Guider* in all models (p-values < 0.05 in columns (1)–(3) and p-values < 0.01 in columns (4)–(6)). A one-standard-deviation increase in *AT* is associated with a 3.3 percent increase in the count of guidance issued and a 2.4 percentage point (3.6 percent of the sample mean) increase in the likelihood of issuing guidance (coefficients of 0.033 and 0.024 on *AT* in columns (5) and (6), respectively). Given that guidance is often a persistent disclosure, these estimates align with the magnitudes of other factors influencing disclosure (e.g., the coefficient estimates on institutional ownership, *IO*, are 0.042 and 0.023 in the same regression).[7]

[6] All models use OLS estimation. For models with binary dependent variables, I use OLS rather than probit or logit estimation because the specification includes extensive fixed effects, and OLS does not suffer from the incidental parameter problem that is well-known for probit and logit models with fixed effects (Greene 2012, 721). The main results are robust to using a logit model for binary dependent variables.

[7] I perform multiple robustness tests (untabulated) on the fixed effects model in Table 3, Panel A. First, I use the individual AT proxies instead of the principal component, finding they are individually associated with disclosure as predicted. Second, I execute a first differences model and find consistent results. Third, my result is robust over both the first and second halves of my sample period, suggesting the association is unrelated to a singular event or period. Fourth, I drop always-guiding and never-guiding firms and find no changes in the results. Fifth, results are robust to using non-Winsorized measures.

In Table 3, Panel B, I address the risk of reverse causality. Specifically, high disclosure quality (such as management guidance) could improve liquidity, consequently attracting AT (Schoenfeld 2017). In columns (1) and (2), I recalculate the market quality variables (*Turnover*, *ESpread*, *iVol*, and *Illiquidity*) contemporaneously with *AT* over the pre-announcement window. In columns (3) and (4), I include controls for guidance issued over the pre-announcement window (*LnGuideCount_PreAnn*) and the four prior earnings announcements (*LnGuideCount_EALag1* through *LnGuideCount_EALag4*). The coefficient estimates on *AT* are similar in magnitude to those in Panel A, suggesting that, if these variables are correlated with unobservable liquidity and disclosure quality, these constructs are unlikely to be the cause of my results (Oster 2019).[8,9]

Characteristics of Guidance and Other Voluntary Disclosures

Table 4 examines whether the characteristics of guidance and other voluntary disclosures change in response to pre-announcement AT. Panel A tests whether guidance characteristics change in response to pre-announcement AT. The sample contains all EPS forecasts issued in the announcement window, where each observation is an individual forecast. *Accuracy* is the absolute value of the difference between forecasted and actual EPS, scaled by stock price and multiplied by −1. *AbsFrcstRange* is the absolute difference between the upper and lower bounds forecasted by managers, scaled by stock price (measured for closed-range forecasts only). *Specificity* equals 1 if the forecast is an open range (above or below a given value), 2 if it is a closed range, and 3 if it is a point forecast. *Horizon* is the logarithm of the days between the guidance release date and the forecasted quarter-end date. The average forecast is a closed range (median of *Specificity* is 2.00, see Table 1) and the mean horizon is about 120 days (mean of *Horizon* is 4.786). I find that pre-announcement AT is positively associated with forecast accuracy (column (1), p-value < 0.05) and negatively associated with the absolute value of forecast range (column (2), p-value < 0.01). Pre-announcement AT is not significantly associated with forecast specificity or horizon (columns (3) and (4), respectively). This evidence suggests that managers provide more informative guidance to investors when pre-announcement AT is high, consistent with the increased quantity disclosed. The evidence is inconsistent with managers learning less from prices when AT reduces investor information acquisition and suggests overlap exists between the information investors stop acquiring and private information held by managers (Zuo 2016).

Table 4, Panel B examines which measures of announcement guidance are associated with pre-announcement AT. I measure *LnGuideCount* for core items (EPS and revenue forecasts) in columns (1) and (2), respectively, capital expenditure (CapEx) forecasts in column (3), and all other forecasts in column (4). Capital expenditure forecasts are the least likely and all other forecasts the most likely to be disclosed (see Table 1). I find pre-announcement AT is positively associated with EPS (p-value < 0.01), revenue (p-value < 0.01), capital expenditure (p-value < 0.10), and other guidance (p-value < 0.05). The consistent association across guidance measures suggests that managers adjust both core and secondary measures in response to AT and forecast both performance and investment. Moreover, the loss in managerial learning from stock prices does not deter managers from issuing more capital expenditure forecasts (Ye et al. 2023).[10]

Table 4, Panel C examines other voluntary disclosure choices available to managers. I measure the logarithm of the number of voluntary 8-Ks issued in the announcement window (*Ln8Ks*) and an indicator for whether the firm issues a non-GAAP EPS disclosure bundled with the earnings announcement (*NonGAAP*) (B. Segal and D. Segal 2016;

[8] In robustness tests (untabulated), I find there is no significant association between pre-announcement AT and guidance issued in the post-announcement window. I also examine whether pre-announcement AT is associated with pre-announcement guidance (i.e., guidance and AT are measured contemporaneously). The coefficients on AT are negative and significant for both *LnGuideCount* and *Guider*. Because the contemporaneous measurement of AT and guidance raises concerns about reverse causality, I examine pre-announcement guidance using my causal inference settings (discussed in Section V). I test *LnGuideCount* and *Guider* across the stock price instrumental variables analysis, the TSP experimental setting, and Nasdaq technological upgrade. The coefficients of interest are not statistically significant in five of the six regressions.

[9] Chordia and Miao (2020) raise concerns that the *CancelToTradeRatio* (*TradeToOrderRatio*) is positively (negatively) correlated with bid-ask spreads and negatively (positively) correlated with their measure of low-latency trading (LLT), both of which are unexpected given results in the prior literature. A critical difference between the LLT measure in Chordia and Miao (2020) and the AT proxies used here is that Chordia and Miao's measure is unscaled—it counts the number of high-frequency order placement-cancellation runs. The MIDAS AT proxies measure cancellations relative to executions (e.g., the denominator in the *CancelToTradeRatio* is the number of orders executed). The unexpected correlation with bid-ask spreads is potentially due to large bid-ask spreads decreasing trading volume proportionally more than cancellation volume, which increases (decreases) the *CancelToTradeRatio* (*TradeToOrderRatio*). If so, the controls for contemporaneous spreads in Table 3, Panel B should leave the remaining variation in the MIDAS proxy to capture differences in *AT* based on the prior literature discussed in Section III. To alleviate these concerns further, I use multiple identification strategies that provide quasi-exogenous variation in AT (see Section V). The positive association between AT and announcement guidance persists across three natural experiments and one instrumental variables analysis. In untabulated robustness tests, I also use alternative measures of AT that more closely align with Chordia and Miao's (2020) LLT measure. Using the log of the number and volume of cancellations, without scaling by trading activity, I find both are *negatively* correlated with spreads, as expected. Moreover, both are positively associated with announcement guidance, similar to my pooled regression results in Table 3. The results persist after controlling for the contemporaneous number of trades or volume executed.

[10] Tables 4 and 5 present results using *LnGuideCount* for brevity. Results using *Guider* are similar in magnitude and statistical significance.

TABLE 4

Guidance Characteristics and Other Voluntary Disclosures

Panel A: Guidance Characteristics

Dep. Var. =	*Accuracy*	*Precision*	*Specificity*	*Horizon*
	(1)	(2)	(3)	(4)
AT	0.005**	−0.002***	0.000	−0.003
	(2.50)	(−4.41)	(0.04)	(−0.30)
Firm and Quarter FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
n	33,786	30,530	37,813	37,789
R^2	0.65	0.58	0.38	0.36

Panel B: Guidance Measures

	EPS	**Revenue**	**CapEx**	**Other**
Dep. Var. =		***LnGuideCount***		
	(1)	**(2)**	**(3)**	**(4)**
AT	0.014***	0.020***	0.006*	0.011**
	(3.85)	(5.31)	(1.99)	(2.04)
Firm and Quarter FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
n	76,988	76,988	76,988	76,988
R^2	0.75	0.71	0.57	0.61

Panel C: Other Voluntary Disclosures

Dep. Var. =	*Ln8Ks*	*NonGAAP*	*ConfCall*	*LnConfCall_Seconds*
	(1)	(2)	(3)	(4)
AT	−0.001	−0.005	0.025***	−0.012***
	(−0.54)	(−0.84)	(6.47)	(−3.87)
Firm and Quarter FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
n	76,980	57,151	76,988	67,801
R^2	0.51	0.63	0.62	0.66

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.
Table 4 presents regressions of the characteristics of guidance and other voluntary disclosures on pre-announcement AT. Panel A examines the association between pre-announcement AT and the accuracy, precision, specificity, and horizon of guidance issued (columns (1)–(4), respectively). Panel B examines individual measures of guidance issued around earnings announcements, where *LnGuideCount* is measured specifically for EPS, revenue, capital expenditure, and other guidance (columns (1)–(4), respectively). Panel C examines other voluntary disclosures, including the number of voluntary 8-Ks, whether the firm releases a non-GAAP earnings metric, whether the firm holds a conference call, and the length in seconds of the conference call (columns (1)–(4), respectively). Controls are those tabulated in Table 3. Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm.
See Appendix B for variable definitions.

Bentley, Christensen, Gee, and Whipple 2018).[11] I also define an indicator for whether the firm holds a conference call (*ConfCall*) and measure the length of the conference call as the logarithm of the number of audio seconds of the call (*LnConfCall_Seconds*). As shown in Table 1, the average number of 8-Ks issued is two (median *Ln8Ks* is 0.693), 58 percent of firm-quarters include non-GAAP earnings (from the subsample of firms that issue non-GAAP earnings at least once), and 88 percent of firm-quarters include a matched conference call. I find that pre-announcement AT is not significantly associated with 8-Ks and non-GAAP disclosure (columns (1) and (2), respectively). However, the coefficient on *AT*

[11] The non-GAAP sample includes only firms that issue at least one non-GAAP earnings measure throughout the sample period to identify those firms that might respond to AT through non-GAAP disclosures.

is positive and significant for *ConfCall* (p-value < 0.01, column (3)) and negative and significant for *LnConfCall_Seconds* (p-value < 0.01, column (4)). A greater likelihood of holding a conference call is consistent with managers responding to AT with more informative disclosures. If call participation by investors is a form of information acquisition, shorter call lengths may be explained by AT driving away information acquisition. Finding that managers respond to pre-announcement AT through the conference call channel, instead of 8-Ks or non-GAAP disclosures, suggests managers are conveying complex information through a rich channel (Skinner 2024).

Cross-Sectional Analyses

Table 5 tests the cross-sectional predictions from Section II for information intermediaries, the firm's investor base, and the sign of the manager's private information.[12] Continuous cross-sectional variables are divided into terciles to allow for nonlinearities in the relation. In column (1), I proxy for information intermediaries using analyst following (*AnalystFollowing*). The positive association between pre-announcement AT and guidance is decreasing in analyst coverage; I find a positive and significant (negative and not significant) coefficient on $AT \times AnalystFollowing\_Low$ ($AT \times AnalystFollowing\_High$), and the difference is statistically significant (p-value < 0.05). This result is consistent with the prediction that analysts substitute for management guidance and/or weaken AT's influence on liquidity and market responses to firm news.[13]

In column (2), I examine cross-sectional variation based on institutional ownership (*IO*). The positive association between AT and guidance is weakest for firms in the lowest tercile of institutional ownership (i.e., a negative coefficient on $AT \times IO\_Low$, p-value < 0.01). This result is consistent with the information acquisition channel (i.e., institutions decrease information acquisition in response to AT, and managers increase guidance in response) but inconsistent with the market response channel (i.e., institutions substitute for the pricing efficiency benefits of AT).

In column (3), I examine whether the sign of the manager's private information affects the association between pre-announcement AT and announcement guidance. To proxy for the manager's private information, I measure the analyst consensus EPS forecast for quarter t+1 immediately before the quarter t earnings announcement. *FutureBadNews* is an indicator for whether the analyst consensus is higher than actual earnings eventually reported for t+1, representing whether the manager's *potential* guidance contains negative news at the quarter t announcement. This measure assumes managers can reasonably predict t+1 earnings at the quarter t announcement. The association between pre-announcement AT and announcement guidance is stronger when the manager holds bad news (i.e., a positive coefficient on $AT \times FutureBadNews$, p-value < 0.10), which is inconsistent with the market response and liquidity channels. Overall, the cross-sectional tests most consistently align with the information acquisition channel.

Channel Tests

To provide more evidence on the channel through which AT influences guidance, Table 6 presents a path analysis design to test whether pre-announcement AT is associated with announcement guidance through a mediating variable (the *Path Variable*). A structural model simultaneously estimates the direct path from pre-announcement AT to guidance, the direct path from AT to the mediating variable, and the indirect path from AT to guidance through the mediating variable (Landsman, Maydew, and Thornock 2012; Dambra, Schonberger, and Wasley 2023). EDGAR downloads and analyst forecast updates serve as mediating variables for the information acquisition channel. *LnEDGAR* is the logarithm of 1 plus the average daily nonrobot EDGAR downloads over the pre-announcement window.[14] *AbsAnalystUpdates* is the absolute value of the percentage change in the consensus analyst EPS forecast over the pre-announcement window for quarter t+1. This measure captures how much analysts learn about earnings for the *subsequent* quarter in the pre-announcement window. *ESpread* and *Illiquidity*, measured over the pre-announcement window contemporaneously with AT, serve as mediating variables for the liquidity channel. I proxy for the market response

[12] In robustness tests (untabulated), I perform descriptive cross-sectional tests on variation in firm size, liquidity, and the magnitude of the manager's private information (i.e., absolute future analyst forecast errors). The association between AT and disclosure is strongest for firms in the middle tercile of size, liquidity, and the magnitude of the manager's private information. These results suggest that the association between pre-announcement AT and guidance exists for "average" firms and is not limited to a unique subset of firms driving the results.

[13] I examine cross-sectional variation with media coverage, a second information intermediary, in an untabulated robustness test. Like analysts, media coverage benefits liquidity and price discovery and thus may substitute for the effects of AT through the liquidity and market response channels (Twedt 2016; Blankespoor, deHaan, and Zhu 2018). However, unlike analysts, media coverage likely provides less novel information to the market and is unlikely to substitute for firm disclosures (i.e., the information acquisition channel). The association between pre-announcement AT and guidance is weakest in the lowest tercile of media coverage, which is inconsistent with the analyst coverage results. Combined, the analyst and media coverage results suggest AT likely operates through the information acquisition channel, where analysts, but not media coverage, can substitute for firm disclosures and weaken the association between pre-announcement AT and guidance.

[14] Data on EDGAR downloads are only available through mid-2017, and therefore the sample size is lower.

TABLE 5

Cross-Sectional Tests

***CrossVar* =**	***AnalystFollowing***	***IO***	***FutureBadNews***
Dep. Var. =		***LnGuideCount***	
	(1)	**(2)**	**(3)**
I. *AT* × *CrossVar_High*	**–0.013**	**–0.006**	**0.009***
	(–1.22)	**(–0.69)**	**(1.85)**
II. *AT* × *CrossVar_Low*	**0.014***	**–0.023*****	
	(1.75)	**(–2.82)**	
CrossVar_High	0.044***	0.023**	−0.026***
	(3.23)	(2.33)	(−4.96)
CrossVar_Low	−0.030***	−0.038***	
	(−2.74)	(−2.95)	
AT	0.031***	0.044***	0.028***
	(3.28)	(5.24)	(3.97)
I minus II:	**–0.027****	**0.017**	
F-statistic	**5.46**	**2.84**	
p-value	0.02	0.10	
Firm and Quarter FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
n	76,988	76,988	76,988
R^2	0.70	0.70	0.70

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.
Table 5 tests cross-sectional factors that moderate the association between pre-announcement AT and announcement guidance. The dependent variable is *LnGuideCount*. Column (1) tests analyst coverage, column (2) institutional ownership, and column (3) whether the manager holds negative private information. Continuous cross-sectional variables are ranked into terciles, and indicators are defined for the top and bottom tercile (*CrossVar_High* and *CrossVar_Low*, respectively). In column (3), the cross-sectional variable is an indicator (*FutureBadNews*) tabulated as *CrossVar_High*. Controls are those tabulated in Table 3. Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm.
See Appendix B for variable definitions.

channel using RavenPack news stories. For each news story over the pre-announcement window, I measure the dollar trading volume in the minute the news story is released, scaled by the volume over that day. I assume that AT increases volume in the minute of the news release, whereas non-AT traders process the news story before trading. *NewsResponse* is the average ratio across all news stories in the pre-announcement period, where higher values of *NewsResponse* reflect stronger market responses to firm news attributable to AT.

The path analysis in Table 6 includes controls from Equation (1), quarter fixed effects, and the firm's average *LnGuideCount* over the sample period.[15,16] For the information acquisition channel in columns (1) and (2), I find *AT* is negatively associated with information acquisition (*LnEDGAR* and *AbsAnalystUpdates*), and the information acquisition proxies are negatively associated with *LnGuideCount.* The indirect path of *AT* to *LnGuideCount* is positive and significant for both mediating variables (p-values < 0.01), consistent with AT affecting guidance by decreasing information acquisition. In columns (3) and (4), I find the indirect path through the liquidity channel is positive and marginally significant for *ESpread* (p-value < 0.10) and not statistically significant for *Illiquidity*. This result is consistent with managers responding to liquidity declines for large traders. Lastly, I find the indirect path through *NewsResponse* is not statistically significant in column (5). These results are consistent with pre-announcement AT influencing guidance through the information acquisition and possibly the liquidity channel but are inconsistent with the market response

[15] Because the earnings news is not disclosed during the pre-announcement window over which the mediating variables are measured, the earnings announcement controls (*UE*, *PosUE*, *NegUE*, *Loss*, and *SalesGrowth*) are only included in the model predicting *LnGuideCount* and not the model predicting the mediating variable.

[16] The structural model does not estimate with firm fixed effects, and therefore a continuous variable capturing the firm's average *LnGuideCount* over the sample period approximates a firm fixed effect.

TABLE 6

Path Analysis

Path Variable =	***LnEDGAR***	***AbsAnalystUpdates***	***ESpread***	***Illiquidity***	***NewsResponse***
Dep. Var. =			***LnGuideCount***		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Direct Path					
ρ[*AT*, *LnGuideCount*]	0.017***	0.003	0.004**	0.004**	−0.001
	(6.17)	(1.61)	(1.97)	(2.07)	(−0.02)
Mediated Path					
I. ρ[*AT*, *Path Variable*]	−0.078***	−0.079***	0.043***	0.027***	0.056***
	(−18.09)	(−12.32)	(14.69)	(7.93)	(6.39)
II. ρ[*Path Variable*, *LnGuideCount*]	−0.021***	−0.014***	0.006*	0.003	0.001
	(−2.87)	(−6.84)	(1.72)	(1.17)	(0.64)
Indirect Effect (I × II)	**0.002*****	**0.001*****	**0.000***	**0.000**	**0.000**
	(2.85)	**(5.98)**	**(1.70)**	**(1.15)**	**(0.64)**
Firm and Quarter FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
n	49,621	75,909	76,988	76,988	44,404
Overall Model R^2	0.93	0.70	0.95	0.92	0.71

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.
Table 6 presents a path analysis examining the channel through which pre-announcement AT is associated with announcement guidance. The *Path Variable* represents the mediating variable in the analysis for the information acquisition, liquidity, and market response channels. The information acquisition channel proxies are EDGAR downloads (*LnEDGAR*) and the absolute percentage change in the consensus analyst EPS forecast for quarter *t*+1 (*AbsAnalystUpdates*) over the pre-announcement window. The liquidity channel proxies are *ESpread* and *Illiquidity* measured over the pre-announcement window. *NewsResponse* is the proxy for the market response channel, calculated as the volume in the minute a news story is published scaled by volume for that trading day, averaged across all the news stories over the pre-announcement window. Controls are those tabulated in Table 3. Earnings announcement news variables (e.g., *UE*, *NegUE*, *PosUE*, *Loss*, *SalesGrowth*) are only included in the second stage regression that predicts *LnGuideCount* because they are not disclosed as of the measurement of the mediating variables. Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm. t-statistics are in parentheses.
See Appendix B for variable definitions.

channel. It is important to note that these tests are not causal but associations that depend upon the strength of the proxies for each channel. Moreover, these channels are not mutually exclusive. As such, these tests should be interpreted as initial evidence of the mechanism; they do not prove or disprove the existence of any individual channel.

V. ASSESSING IDENTIFICATION

In this section, I use an instrumental variable and two natural experiments to identify quasi-exogenous variation in AT and address endogeneity concerns in the pooled regression.[17]

Instrumental Variables Analysis

In Table 7, I instrument for AT using the decile-ranked lagged stock price (*LagPrice*), where a higher stock price is associated with more AT (Weller 2018). The rationale is that the cost of the minimum tick size is decreasing in stock price. In other words, a $0.01 minimum tick size only costs 0.01 percent of a $100 stock but 0.1 percent of a $10 stock. AT strategies, which often involve providing small amounts of liquidity near the midpoint, incur lower costs when the tick size is relatively "cheap" in relation to the stock price. Therefore, AT is more active in higher-priced stocks. After

[17] In untabulated analyses, I use the NYSE Autoquote as a third natural experiment. In 2003, NYSE implemented Autoquote, a system allowing market makers to update inside quotes automatically. Hendershott et al. (2011) provide evidence that Autoquote exogenously increased AT for NYSE firms. Matching NYSE firms to untreated Nasdaq firms, I perform a difference-in-differences analysis around the implementation of Autoquote. After Autoquote is implemented, NYSE firms see a larger increase in the issuance of management guidance compared to Nasdaq firms. The strength of this setting is that it provides a clean shock to AT and has been used in multiple other studies (Hendershott et al. 2011; Chordia and Miao 2020). I do not tabulate these results out of concerns for external validity, where AT was likely different in the early 2000s compared to my current sample period.

TABLE 7

Instrumental Variables Analysis

Dep. Var. =	***LnGuideCount***	***Guider***
	(1)	**(2)**
$\widehat{AT}$	**0.041****	**0.017***
	(2.59)	**(1.82)**
UE	−0.058***	−0.023***
	(−6.64)	(−4.44)
PosUE	0.039*	0.022**
	(1.99)	(2.28)
NegUE	−0.187***	−0.070***
	(−8.19)	(−5.70)
PPUE	0.102***	0.036***
	(17.45)	(10.63)
Loss	−0.006	−0.044***
	(−0.36)	(−4.28)
SalesGrowth	−0.031***	−0.029***
	(−6.40)	(−8.33)
Q4	0.029*	0.013
	(1.87)	(1.34)
LnCAR_PreAnn	0.008*	0.004
	(1.89)	(1.23)
NewsEvents	0.003	0.002
	(0.24)	(0.34)
InsiderSales	0.001	−0.007**
	(0.16)	(−2.04)
Dispersion	−0.063***	−0.033***
	(−8.68)	(−6.14)
LnMktCap	−0.074***	−0.035***
	(−4.42)	(−3.21)
AnalystFollowing	0.083***	0.052***
	(6.09)	(6.70)
IO	0.075***	0.047***
	(6.73)	(6.41)
Turnover	−0.012	−0.010*
	(−1.31)	(−1.77)
ESpread	−0.267***	−0.185***
	(−11.24)	(−10.77)
iVol	0.074***	0.050***
	(5.60)	(5.28)
Illiquidity	0.090***	0.060***
	(7.93)	(7.10)
Quarter FE	Yes	Yes
Controls (1st and 2nd stages)	Yes	Yes
n	76,988	76,988
R^2	0.14	0.13

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.

Table 7 presents an instrumental variables analysis, where the decile of the firm's lagged stock price (*LagPrice*) instruments for $\widehat{AT}$. Columns (1) and (2) present the two-stage least squares regression results for the instrument with *LnGuideCount* and *Guider* as the dependent variables. $\widehat{AT}$ represents the instrumented value of AT from the first stage regression. Controls are those tabulated in Table 3. Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm.

See Appendix B for variable definitions.

controlling for spreads, institutional ownership, and other factors influencing disclosure and share prices, I expect the stock price to affect disclosure only through AT. In columns (1) and (2), I run a two-stage least squares regression and find that the instrumented AT ($\widehat{AT}$) is positively associated with management guidance (p-value < 0.05 and p-value < 0.10 for *LnGuideCount* and *Guider*, respectively).

TSP Program

The TSP program was a controlled experiment where a randomized group of small-capitalization stocks had their minimum tick size increased for approximately two years beginning in October 2016. Following Lee and Watts (2021), who document that treated firms saw substantial decreases in AT, I utilize this randomly controlled experiment to examine whether exogenous decreases in AT lead to less management guidance.[18] I obtain the TSP data from the Financial Industry Regulatory Authority (FINRA) to identify treated and control firms (approximately 2600 total firms, split evenly into treatment and control groups), dropping those that engage in M&A activity, delist during the sample period, or have a stock price drop below $1, and those in the financial services industry. The treatment began on October 3, 2016 (with a rollout over the month) and ended on October 3, 2018. I keep two years before the treatment start date, the two-year treatment period, and two years after the program ended. I define *Treated* as an indicator equal to 1 for firms assigned to the treatment group (approximately 50.2 percent of my firm-quarters) and *Post* as an indicator equal to 1 if the firm's earnings announcement falls after the implementation of the treatment (November 1, 2016). *PostCompletion* is an indicator equal to 1 if the firm's earnings announcement falls after the conclusion of the treatment period (October 3, 2018). Hope and Liu (2022) document that, although the parallel trends assumption is not violated, there are different *levels* of guidance pre-treatment.[19] In my analyses, I include controls from Equation (1), their interactions with *Treated*, and firm and quarter fixed effects.

Table 8, Panel A presents the main results of the TSP. Columns (1) and (2) include only the two pre-treatment and two treatment years, whereas columns (3) and (4) include the two years following the completion of the experiment. *Treated* × *Post* is negative and significant across all four models (p-values < 0.05 in columns (1) through (3), and p-value < 0.01 in column (4)), consistent with treated firms reducing guidance when their tick size increases and AT falls during the treatment period. *Treated* × *PostCompletion*, which compares the post-experiment period to the treatment period, is not significantly different from zero. Management guidance remaining lower for treated firms after the experiment ends is consistent with guidance being a relatively "sticky" disclosure policy, which may prevent the expected guidance recovery after the experiment ends.

Examining the TSP and management guidance, Hope and Liu (2022) propose that increased tick sizes reduce liquidity and weaken the market response to management guidance, and, as a result, firms issue less guidance. Expanding on their analyses in the TSP setting, I test whether the effect of the TSP varies with the change in *AT* and the three channels through which AT may affect management guidance.[20] I proxy for information acquisition using EDGAR downloads (*LnEDGAR*), liquidity using intraday effective spreads (*ESpread*), and market responses using the firm's earnings response coefficient (*ERC*) (see Appendix B for variable definitions). Taking the average of each variable by firm over the pre-treatment and treatment periods, I redefine the treatment variable (*Treated*) using the change from the pre-treatment to treatment periods. *Treated_High* (*Treated_Low*) is an indicator for whether the firm has an above (below) median change in the mediating variable within the treatment group.

In Panel B, columns (1) and (2), the effect of the TSP on guidance is directionally stronger for firms that see larger decreases (or smaller increases) in AT, consistent with expectations (i.e., *Treated_Low* × *Post* is more negative than *Treated_High* × *Post*). However, the differences between the groups are not statistically significant, raising questions about whether the TSP affects disclosure through AT.[21] Examining the information acquisition, liquidity, and market response changes in columns (3) through (8), the only statistically significant difference in the treatment effect is for the

[18] I replicate their main result that treated firms experience a greater decline in AT compared to control firms (untabulated).

[19] Following Hope and Liu (2022), I test the effects of the TSP on EPS guidance, although I measure it over earnings announcement windows, consistent with my research question. I replicate their result using guidance measured over full calendar quarters. Since most guidance is released with earnings announcements, restricting guidance to announcement windows has little effect on the results. I find similar results for tests of parallel trends but do not tabulate them for brevity.

[20] Considering the three channels, Lee and Watts (2021) provide evidence that the TSP reduced AT and increased information acquisition for treated firms. Chung, Lee, and Rösch (2020) find mixed effects of the TSP on liquidity—treated firms see worse liquidity for small trades but improved liquidity for large trades. For the market response channel, treated firms have lower absolute returns and volume around earnings announcements (Hope and Liu 2022).

[21] The lack of significance could result for several reasons: perhaps AT is not the channel through which the TSP operates, the change in AT is endogenous with firm disclosure, or even small changes in AT could drive changes in information acquisition and disclosure. In untabulated tests, I separate the change in AT by quintile, instead of above/below the median, to explore whether the effect of AT is concentrated in especially large changes in AT. I do not find a discernible pattern that suggests the effect of the TSP on guidance is stronger when AT decreases more.

TABLE 8

TSP Program

Panel A: Main Results

Dep. Var. =	***LnGuideCount*** **(1)**	***Guider*** **(2)**	***LnGuideCount*** **(3)**	***Guider*** **(4)**
Treated* × *Post	**–0.023****	**–0.033****	**–0.023****	**–0.035*****
	(–1.98)	**(–2.52)**	**(–2.05)**	**(–2.71)**
Treated* × *PostCompletion			**0.003**	**0.005**
			(0.32)	**(0.39)**
Firm and Quarter FE	Yes	Yes	Yes	Yes
Controls and Controls × *Treated*	Yes	Yes	Yes	Yes
n	13,884	13,884	20,879	20,879
R^2	0.82	0.84	0.76	0.77

Panel B: Mechanism Tests

Cross-Sectional Variable =	**Δ*AT***		**Δ*LnEDGAR***		**Δ*ESpread***		**Δ*ERC***	
Dep. Var. =	***LnGuideCount*** **(1)**	***Guider*** **(2)**	***LnGuideCount*** **(3)**	***Guider*** **(4)**	***LnGuideCount*** **(5)**	***Guider*** **(6)**	***LnGuideCount*** **(7)**	***Guider*** **(8)**
I. *Treated_High* × *Post*	−0.007	−0.014	−0.038**	−0.052***	−0.016	−0.028*	−0.010	−0.023
	(−0.48)	(−0.78)	(−2.69)	(−3.17)	(−1.25)	(−1.91)	(−0.74)	(−1.47)
II. *Treated_Low* × *Post*	−0.021	−0.033*	−0.003	−0.009	−0.029*	−0.034*	−0.036**	−0.043**
	(−1.38)	(−1.92)	(−0.26)	(−0.61)	(−1.78)	(−1.87)	(−2.46)	(−2.58)
I minus II:	0.014	0.019	−0.035**	−0.043**	0.013	0.006	0.026	0.02
F-statistic	0.72	0.87	4.86	5.47	0.58	0.11	2.58	1.26
p-value	0.40	0.35	0.04	0.03	0.46	0.75	0.13	0.28
Firm and Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls and Controls × *Treated*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
n	12,207	12,207	13,786	13,786	13,798	13,798	13,837	13,837
R^2	0.82	0.83	0.82	0.84	0.82	0.84	0.82	0.84

(continued on next page)

TABLE 8 (continued)

Panel C: Pre-Treatment AT

Dep. Var. =	*LnGuideCount* (1)	*Guider* (2)
Treated_PreAT1 × *Post (Lowest)*	−0.025	−0.028
	(−1.31)	(−1.19)
Treated_PreAT2 × *Post*	0.007	0.009
	(0.45)	(0.44)
Treated_PreAT3 × *Post*	0.010	−0.001
	(0.54)	(−0.06)
Treated_PreAT4 × *Post*	−0.051	−0.060*
	(−1.69)	(−1.91)
Treated_PreAT5 × *Post (Highest)*	−0.050**	−0.060*
	(−2.33)	(−2.11)
Firm and Quarter FE	Yes	Yes
Controls	Yes	Yes
Controls × *Treated*	Yes	Yes
n	13,884	13,884
R^2	0.82	0.84

Panel D: AT and Guidance by Firm Size

	TSP Firms	Non-TSP Firms		
		Small	Medium	Large
Dep. Var. =	*LnGuideCount*			
	(1)	(2)	(3)	(4)
AT	0.030***	0.053***	0.067***	0.025*
	(3.21)	(4.34)	(3.82)	(1.92)
Firm and Quarter FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
n	26,658	11,133	13,963	25,019
R^2	0.71	0.74	0.69	0.70

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.
Table 8 presents results for the TSP program. The dependent variables are *LnGuideCount* and *Guider* measured for EPS forecasts only. Panel A examines the effect of the tick size treatment on guidance during the treatment period only (columns (1) and (2)) and including the two years post-treatment (columns (3) and (4)). Panel B examines the results cross-sectionally. Columns (1) and (2) use the change in AT (Δ*AT*), columns (3) and (4) the change in EDGAR downloads (Δ*LnEDGAR*), columns (5) and (6) the change in effective spreads (Δ*ESpread*), and columns (7) and (8) the change in earnings response coefficients (Δ*ERC*) from the pre-treatment to post-treatment period. In Panel B, the treated firms are divided into above and below median groups for the cross-sectional variables. Panel C explores whether the association between the TSP treatment and guidance varies with the level of pre-treatment AT. AT is measured over the two-year pre-treatment period, divided into quintiles, and then interacted with the treatment indicator (*Treated_PreAT1* through *Treated_PreAT5* for quintiles 1 through 5, respectively). Panel D replicates the research design from Table 3, regressing *LnGuideCount* on *AT*, but splits the sample into firms included in the TSP as treatment or controls (column (1)), and small, medium, and large non-TSP firms (columns (2), (3), and (4), respectively). Controls are those included in Table 3 (*ESpread* is excluded as a control in columns (5) and (6) in Panel B). Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm.
See Appendix B for variable definitions.

change in EDGAR downloads (p-values < 0.05, columns (3) and (4)), where firms that experience relatively more growth in EDGAR downloads see larger declines in disclosure.[22] This result is consistent with the information

[22] Hope and Liu (2022) also perform a cross-sectional test on EDGAR search volume but do not find statistically significant results. Their research design splits the sample on *raw* increases or decreases in EDGAR search volume (e.g., there are 3,499 firm-quarters with decreases in search volume and 11,966 firm-quarters with increases in search volume). Finding a similar treatment effect in each subgroup, they conclude that search volume is not the channel through which the TSP operates. However, if the TSP causes search volume to increase (decrease) more (less) than the control group in the search volume increase (decrease) subsample, the TSP could operate through search volume and exist in both the search volume increase and decrease subsamples. In Table 8, Panel B, I divide the treatment sample into above and below-median changes in search volume, identifying *relative* differences within the treatment group. This design choice identifies firms that are likely to have stronger or weaker responses to the TSP treatment compared to the control group.

acquisition channel. The change in effective spreads is not statistically significant, but the ERC results are close (p-value = 0.13 and p-value = 0.28, columns (7) and (8)). Although the results are consistent with the TSP operating through the information acquisition channel, they should be interpreted with care. Although the TSP treatment is exogenous, the changes in the cross-sectional variables are not. These tests have endogeneity and reverse causality concerns and should be interpreted as associative evidence of the mechanism.

To explore further whether AT is involved in the causal chain between the TSP and disclosure, I test whether a firm's *ex ante* level of AT is associated with the strength of the relation between the TSP treatment and disclosure. In Table 8, Panel C, I measure the level of AT over the two years before the TSP implementation begins and rank AT into quintiles. I interact the *ex ante* AT level with a treatment indicator (*Treated_PreAT1* through *Treated_PreAT5*, for quintiles 1 through 5) and a post-treatment indicator (*Treated_PreAT1* × *Post* through *Treated_PreAT5* × *Post*). These interaction terms indicate whether the effect of the TSP treatment on guidance varies with the firm's level of pre-treatment AT. By measuring AT before the treatment, the cross-sectional variation between firms is plausibly exogenous with respect to the treatment and firms' responses to the treatment, mitigating concerns about reverse causality and confounding variables. The weakness of this test is that it is purely exploratory; I do not have a prediction as to whether the TSP's effect on guidance will be strongest for firms with low, medium, or high levels of pre-treatment AT. Panel C shows that the negative association between the TSP treatment and guidance is only statistically significant in quintiles 4 and 5 of pre-treatment AT. These results suggest that the tick size treatment affected firms with high AT levels the most, and AT may be part of the causal relationship between the TSP and disclosure.

One limitation of the TSP is that treatment and control firms are selected from small capitalization stocks, raising questions about the generalizability of the results. In Table 8, Panel D, I examine whether the association between AT and disclosure extends to larger firms by returning to my sample and research design from Table 3. I categorize each firm-quarter as a small, medium, or large firm based on its tercile of market capitalization by year. I further define each firm as "TSP" if it was included as a treatment or control firm in the experiment, and "non-TSP" otherwise. The TSP designation is made at the firm level, so a firm-quarter in 2012 (pre-TSP) would still be designated as a "TSP" firm if it is later included in the pilot program. Regressing *LnGuideCount* on *AT*, I present results for TSP firms in column (1), and small, medium, and large non-TSP firms in columns (2), (3), and (4), respectively. The positive association between AT and guidance is consistent across the various samples.[23] These results extend the findings of Chen et al. (2023) by suggesting that the association between AT and disclosure generalizes to larger firms.

Nasdaq Technological Upgrade

For my final identification setting, I use a technological upgrade at the Nasdaq Stock Exchange in April and May of 2010 that reduced order processing and implementation speeds from microseconds to nanoseconds. Assuming the speed upgrade exogenously increased AT more strongly for Nasdaq-listed firms compared to NYSE-listed firms, I define Nasdaq firms as my treatment group (*Nasdaq*) and NYSE firms as my control group. Following Chordia and Miao (2020), I use two years before and after the upgrade for a difference-in-differences design, matching treated firm-quarters to control firm-quarters on the controls from Equation (1) and requiring exact matches on quarter, Fama-French 48 industry, and size decile. I define *Post* as an indicator equal to 1 for earnings announcements made after the upgrade in May 2010.[24]

In Table 9, I regress *LnGuideCount* and *Guider* on *Nasdaq*, *Post*, and *Nasdaq* × *Post,* along with a suite of controls and fixed effects. The variable of interest, *Nasdaq* × *Post*, is positive in both regressions (p-value = 0.13 and p-value < 0.05 for *LnGuideCount* and *Guider*, respectively), consistent with Nasdaq firms issuing relatively more guidance compared to NYSE firms after the speed upgrade in 2010. These results are further evidence that increases in AT are causally associated with increases in guidance.

[23] To test the statistical significance of the differences between small, medium, and large non-TSP firms, I include all three groups in the same regression and interact indicators for large and small firms with AT. The differences between small and medium firms and medium and large firms are not statistically significant (p-values of 0.94 and 0.12, respectively.) Results are robust to using *Guider* as the outcome variable as well (untabulated).

[24] I test the post-match covariate balance and pre-treatment parallel trends (untabulated). The covariate balance is improved compared to the unmatched sample. However, some statistically significant differences remain. After requiring exact matches on industry and size decile within quarter, linear controls are likely more effective at capturing minor differences between matched firms. I also test the parallel trends assumption over the pre-treatment period by regressing *LnGuideCount* and *Guider* on *Nasdaq*, a continuous variable capturing pre-treatment quarters 1–8 (*Quarters*), and the interaction between *Nasdaq* × *Quarters*. The coefficient on *Nasdaq* × *Quarters* is not statistically significant in both regressions.

TABLE 9

Nasdaq Technological Upgrade

Dep. Var. =	***LnGuideCount***	***Guider***
	(1)	**(2)**
Nasdaq* × *Post	**0.027**	**0.024****
	(1.50)	**(1.96)**
Post	0.029*	0.009
	(1.72)	(0.76)
Firm and Quarter FE	Yes	Yes
Controls	Yes	Yes
Controls × *Nasdaq*	Yes	Yes
n	30,299	30,299
R^2	0.78	0.68

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.
Table 9 presents results for the Nasdaq technological upgrade natural experiment in 2010. The dependent variables are *LnGuideCount* and *Guider*. *Nasdaq* is an indicator equal to 1 if the firm is listed on the Nasdaq exchange. *Post* is an indicator equal to 1 if the earnings announcement occurs after the upgrade in May, 2010. The sample period comprises two years before and two years after the upgrade. Controls are those tabulated in Table 3. Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm.
See Appendix B for variable definitions.

VI. AT AND THE POST-GUIDANCE INFORMATION ENVIRONMENT

In my final set of analyses, I consider whether announcement guidance in response to AT effectively substitutes for the decrease in investors' information acquisition and improves the firm's information environment. Evidence suggests that investors rely more on firm disclosures for information when AT reduces information acquisition (Weller 2018). If investors are more reliant on firm disclosures, I predict that pre-announcement AT will (1) increase the effectiveness of guidance at reducing information asymmetry and improving liquidity (Balakrishnan et al. 2014; Schoenfeld 2017) and (2) decrease investors' reliance on other sources of information for valuing the firm in the post-announcement quarter.

In Table 10, Panel A, I proxy for information asymmetry and liquidity using spreads, illiquidity, and intraday volatility (*ESpread*, *Illiquidity*, and *iVol*) measured over the post-announcement quarter. The coefficients on $AT \times Guider$ are negative and significant across all three regressions (p-values < 0.01), consistent with guidance more effectively reducing information asymmetry and improving liquidity when pre-announcement AT is high.

In Panel B, I use a return variance decomposition to estimate the percentage of daily return variance attributable to market-wide information (*MktInfo*), firm-specific public information (*PublicInfo*), firm-specific private information (*PrivateInfo*), and noise (*Noise*). I calculate these measures over the 90 days after the earnings announcement (see Brogaard et al. 2022, for details). I find the coefficients on $AT \times Guider$ are negative for *MktInfo* (p-value = 0.12, column (1)) and *PrivateInfo* (p-value = 0.28, column (3)) and positive for *PublicInfo* (p-value = 0.11, column (2)) and *Noise* (p-value = 0.13, column (4)). In columns (5) and (6), I combine return variance attributable to external information sources (*MktInfo* plus *PrivateInfo*) and variance not attributable to external information (*PublicInfo* and *Noise*). The coefficient on $AT \times Guider$ is negative for external information (p-value < 0.05) and positive for firm-provided information and noise (p-value < 0.05). These results suggest that post-announcement returns reflect relatively less external information after guidance is issued in response to pre-announcement AT. Overall, the results in Table 10 indicate that guidance effectively levels the playing field by enriching the public information environment, which limits the importance of private information in prices following the earnings announcement.

VII. CONCLUSION

I investigate pre-announcement AT's influence on management guidance around earnings announcements. Pre-announcement AT is positively associated with the likelihood of issuing guidance and the quantity of guidance issued. This positive association is consistent across various guidance measures, guidance issued is more accurate and precise, and managers also increase the likelihood of holding a conference call. Overall, the evidence indicates that managers provide more informative voluntary disclosures in response to pre-announcement AT. I identify three channels through

TABLE 10

Post-Announcement Information Environment

Panel A: Post-Announcement Liquidity and Volatility

Dep. Var. =	***ESpread***	***Illiquidity***	***iVol***
	(1)	**(2)**	**(3)**
AT	0.078***	0.085***	0.100***
	(5.48)	(5.09)	(6.22)
Guider	0.023	0.016	0.035
	(1.14)	(0.57)	(1.44)
AT × Guider	**–0.040*****	**–0.031*****	**–0.038*****
	(–5.15)	**(–3.07)**	**(–4.13)**
Firm and Quarter FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Controls × *Guider*	Yes	Yes	Yes
n	74,978	76,970	74,978
R^2	0.85	0.74	0.73

Panel B: Post-Announcement Return Variance Information Sources

Dep. Var. =	***MktInfo***	***PublicInfo***	***PrivateInfo***	***Noise***	***Mkt + Private***	***Public + Noise***
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
AT	0.014	0.016	−0.011	−0.016	0.003	−0.000
	(0.95)	(1.42)	(−0.75)	(−1.06)	(0.18)	(−0.03)
Guider	−0.054	0.046	0.015	−0.007	−0.039	0.038
	(−1.32)	(1.14)	(0.32)	(−0.17)	(−0.82)	(0.75)
AT × Guider	**–0.020**	**0.021**	**–0.017**	**0.018**	**–0.037****	**0.039****
	(–1.57)	**(1.60)**	**(–1.08)**	**(1.51)**	**(–2.45)**	**(2.33)**
Firm and Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls × *Guider*	Yes	Yes	Yes	Yes	Yes	Yes
n	76,323	76,323	76,323	76,323	76,323	76,323
R^2	0.25	0.10	0.12	0.08	0.12	0.11

*, **, *** Indicate significance at 0.10, 0.05, and 0.01, respectively, based on a two-tailed test.

Table 10 presents regressions of the post-announcement information environment on pre-announcement AT (*AT*), an indicator for whether the firm issued guidance at the earnings announcement (*Guider*), and the interaction of the two (*AT* × *Guider*). In Panel A, the dependent variables are *ESpread*, *Illiquidity*, and *iVol,* measured over the post-announcement quarter. Panel B uses proxies for the percentage of daily return variance driven by market information (*MktInfo*), public firm-specific information (*PublicInfo*), firm-specific private information (*PrivateInfo*), and noise (*Noise*) (see Brogaard et al. 2022). External information sources (*MktInfo* plus *PrivateInfo*) are combined in column (5), and other information sources (*PublicInfo* plus *Noise*) in column (6). Controls are those tabulated in Table 3. Independent variables are standardized with a mean of 0 and standard deviation of 1. Standard errors are double clustered by quarter and firm.

See Appendix B for variable definitions.

which pre-announcement AT could affect management guidance: the information acquisition, liquidity, and market response channels. Evidence in the pooled regression path analysis and cross-sectional TSP tests is most consistent with AT reducing information acquisition and managers increasing disclosure to offset this information loss. However, because these channel tests are neither causal nor mutually exclusive, they should be interpreted with care.

I contribute to the literature by providing evidence that AT increases managers' voluntary disclosures. Prior literature examines how AT affects what information is acquired and how efficiently it is priced, finding that AT prices available information more efficiently but may deter investors from becoming informed (Weller 2018; Chordia and Miao 2020). My study considers whether these effects of AT on markets change the incentives for managers to disclose information voluntarily. Identifying a new pathway through which AT can affect price informativeness, increased guidance by managers could offset or surpass changes in price informativeness through other channels. Lastly, my results show that guidance is more effective at improving firms' information environments when issued following high AT, demonstrating that managers can effectively respond to market quality changes brought about by AT.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the author used ChatGPT in order to improve the clarity and brevity of some sentences in the manuscript. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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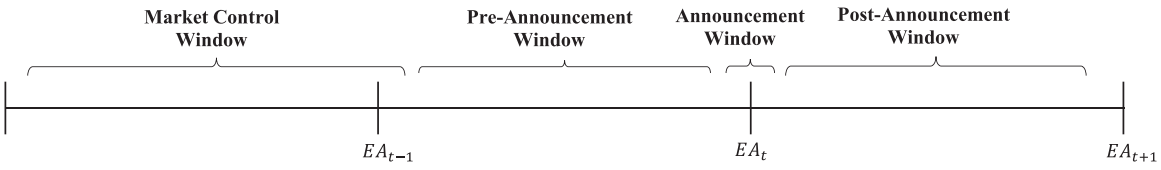
APPENDIX A

Variable Measurement Timeline

Appendix A presents a timeline for variable construction. The announcement window is trading day [−1,+1] around the current earnings announcement (EA_t). *LnGuideCount* and *Guider* are measured within this window, along with control variables for the earnings surprise and firm characteristics (e.g., firm size). The post-announcement window begins two trading days after EA_t and ends two days before EA_{t+1}. *AT* is measured over the pre-announcement window, which begins six trading days following the prior earnings announcement (EA_{t-1}) and ends two trading days before the current earnings announcement (EA_t). The market control window is measured over trading days [−126,+5] around EA_{t-1}. Market-based measures, such as share turnover, intraday spreads, illiquidity, and intraday volatility are measured over the market control window because they may be directly affected by *AT*.



APPENDIX B

Variable Definitions

Variable	Definition
AT Variables	
AT	The first principal component of the *OddLotVolumeRatio*, *TradeToOrderRatio*, *CancelToTradeRatio*, and *TradeSize*. Multiplied by –1 such that the *CancelToTradeRatio* and *OddLotVolumeRatio* (*TradeToOrderRatio* and *TradeSize*) are positively (negatively) correlated with AT.
CancelToTradeRatio	Logarithm of the number of cancelations divided by the number of trades executed. Measured daily and averaged over the pre-announcement window.
OddLotVolumeRatio	Logarithm of the volume of trades executed in odd-lot sizes divided by the total volume traded. Measured daily and averaged over the pre-announcement window.
TradeSize	Logarithm of the daily dollar volume traded divided by the number of trades executed. Measured daily and averaged over the pre-announcement window.
TradeToOrderRatio	Logarithm of the total volume traded divided by the total volume of orders placed. Measured daily and averaged over the pre-announcement window.
Disclosure Variables	
AbsFrcstRange	Absolute difference between the upper and lower bounds for closed range management forecasts, scaled by stock price.
Accuracy	Absolute value of the difference between management forecasted EPS and actual EPS, scaled by stock price and multiplied by –1.
ConfCall	Indicator equal to 1 if the firm holds a conference call in the announcement window, 0 otherwise.
Guider	Indicator equal to 1 if the firm releases guidance in the announcement window, 0 otherwise.
Horizon	Logarithm of 1 plus the number of days between the date the management guidance is released and the forecasted quarter end date.
Ln8Ks	Logarithm of 1 plus the number of voluntary 8-Ks (issued under code 7.01 for Reg FD disclosures and 8.01 for Other Events) measured over the announcement window.
LnConfCall_Seconds	Logarithm of the number of seconds in a conference call.
LnGuideCount	Logarithm of 1 plus the number of pieces of guidance issued in the announcement window. Subscripts indicate EPS (*EPS*), revenue (*REV*), capital expenditure (*CAPEX*), and all other guidance (*OTHER*).
NonGAAP	Indicator equal to 1 if the firm releases non-GAAP earnings in the announcement window, 0 otherwise.
Specificity	A discrete measure that equals 1 if the management forecast projects EPS above or below a numerical value, 2 if it is a closed range forecast, and 3 if it is a point estimate.
Other Variables	
AbsAnalystUpdates	The absolute value of the percentage change in the analyst consensus forecast for quarter t+1 from the beginning to the end of the pre-announcement window.
AnalystFollowing	The number of unique analysts that issue a forecast for the firm in the pre-announcement or market control windows.
Dispersion	Standard deviation of the forecasts that make up the consensus earnings expectation as of two days before the earnings announcement.
ERC	Earnings response coefficient measured at the firm level. Calculated by regressing announcement window cumulative abnormal returns on *UE* in the pre-treatment and treatment windows of the TSP experiment.
ESpread	Difference between the trade price and midpoint, multiplied by two times a signed indicator for whether the trade is a buy (+1) or a sell (–1), scaled by the midpoint, averaged across all trades over the day. Measured daily and averaged over the market control window. Multiplied by 10,000 for presentation in basis points.
FutureBadNews	Indicator equal to 1 if the analyst consensus forecast for quarter t+1 (measured immediately before the quarter t earnings announcement) is greater than reported earnings for quarter t+1, and 0 otherwise.

(continued on next page)

APPENDIX B (continued)

Variable	Definition
Illiquidity	Absolute value of the return between the market open and market close, divided by the dollar volume traded on that day. Measured daily by firm and averaged over the market control window. Multiplied by 1,000,000 for presentation.
InsiderSales	Net purchases and sales volume for officers and directors over the pre-announcement window, divided by the firm's market value.
IO	Percentage of shares owned by institutions from 13-F filings.
iVol	Sum of squared returns by trade across a given day, scaled by the number of trades on that day. Measured daily and averaged over the market control window. Multiplied by 10,000 for presentation.
LnCAR_PreAnn	Logarithm of 1 plus the cumulative abnormal return in the pre-announcement window, estimated from the Fama-French three-factor model.
LnEDGAR	Logarithm of the number of nonrobot EDGAR downloads measured daily and averaged over the pre-announcement window.
LagPrice	The stock price at the end of the market control window, ranked into deciles.
LnMktCap	Logarithm market value of equity, calculated as the share price times the common shares outstanding.
Loss	Indicator equal to 1 if the firm recorded negative earnings and 0 otherwise.
MktInfo	Using the variance decomposition in Brogaard et al. (2022), the percentage of return variance attributable to market-wide news over the 90 days after the announcement window.
NegUE	Indicator equal to 1 if *UE* is less than –0.0001, 0 otherwise.
NewsResponse	Dollar volume traded in the minute a news story is released, divided by the total volume traded on that day. Measured by news story and averaged across all news stories over the pre-announcement window.
NewsEvents	Number of unique event keys by firm from the Dow Jones Edition of RavenPack over the pre-announcement window.
Noise	Using the variance decomposition in Brogaard et al. (2022), the percentage of return variance attributable to noise over the 90 days after the announcement window.
Post	Indicator equal to 1 if the earnings announcement occurs after the treatment begins for the TSP experiment (November 1, 2016) or the Nasdaq technological upgrade (June 1, 2010), 0 otherwise.
PostCompletion	Indicator equal to 1 if the earnings announcement occurs after the treatment period ends for the TSP experiment (October 3, 2018).
PosUE	Indicator equal to 1 if *UE* is greater than +0.0001, 0 otherwise.
PPUE	Proportion of the prior four quarters for which the firm beat earnings expectations (i.e., the proportion for which *PosUE* equals 1).
PrivateInfo	Using the variance decomposition in Brogaard et al. (2022), the percentage of return variance attributable to firm-specific, private information over the 90 days after the announcement window.
PublicInfo	Using the variance decomposition in Brogaard et al. (2022), the percentage of return variance attributable to firm-specific, public news over the 90 days after the announcement window.
Q4	Indicator equal to 1 if it is the firm's fourth fiscal quarter, 0 otherwise.
SalesGrowth	Percentage change in sales compared to the prior quarter.
Treated	Indicator equal to 1 if the firm is a treatment firm in the TSP experiment, 0 otherwise.
Turnover	Number of shares traded divided by the common shares outstanding. Measured daily and averaged over the market control window.
UE	Standardized unexpected earnings calculated as actual EPS less the mean consensus forecast, based on the most recent forecast from each analyst up to two trading days before the earnings announcement, scaled by the share price at the beginning of the pre-announcement window. The measure reflects the seasonal random walk earnings surprise if there is no analyst forecast. Ranked into deciles.