Options Trading and Corporate Voluntary Disclosure[1]

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Abstract

This study examines the effect of options trading on corporate voluntary disclosure behavior. Using a large sample of U.S. public firms, we find that options trading volume is negatively and significantly associated with the occurrence and frequency of management earnings forecasts, suggesting that managers in firms with an active options market are less likely to make voluntary disclosures. The results hold in various robustness checks and tests that aim to address the endogeneity concerns. We further find that the effect of options trading on management earnings forecasts in more pronounced for firms with higher information asymmetry and firms with stronger price discovery facilitation. Last, we find that managers are more likely to issue more general forecasts when there is an active option market. Options trading also reduces informativeness of management earnings forecasts, because options trading helps incorporate information in expectation on future stock prices. Taken together, our findings suggest that options trading improves stock price efficiency, which reduces managers' incentive to issue voluntary disclosure.

Keywords: Options trading; Management earnings forecasts; Voluntary disclosure

JEL classifications: G12; G14; M40; M41

1. Introduction

In this study, we examine how exchanged traded options on the firm's stock affect the firm's voluntary disclosure behavior. Stock option is an ideal security for informed investors, because they can use options to trade on their private information due to options' low cost and high leverage (Black 1975). Options also alleviate short sale constraints by enabling investors to synthetically short a stock by purchasing puts and writing calls. Prior research finds that options trading increases the participation rate of informed traders (Chakravarty et al. 2004; Hu 2018) and increases informational efficiency of stock prices (Pan and Poteshman 2006; Cremers and Weinbaum 2010). For example, options trading is shown to reduce probability of informed trading (Hu 2018), the stock price response to earnings announcements (Truong and Corrado 2014), and costs of equity capital (Naiker et al. 2013). Nevertheless, most prior literature about options trading has focused exclusively on the effect of options trading on firm stock market conditions. Little is known about whether options trading also affects corporate decisions[2]. We help to fill the gap in extant literature by investigating how options trading shapes managers' voluntary disclosure behavior.

Voluntary disclosure is an important way mangers use to communicate with outside investors about the future prospects of the firm (Hirst et al. 2008). Managers exploit disclosure to reduce information asymmetry and adverse selection problem (Healy and Palepu 2001; Beyer et al. 2010). However, disclosure also incurs some costs, such as proprietary costs, litigation costs, managerial short-termism and investor short-termism (Verrecchia 1983; Johnson et al. 2001; Hilary 2006; Huang et al. 2017; Graham et al. 2005; Fuller and Jensen 2010; Kasznik 1999). Therefore, there

[2] Two papers examine the effect of options trading on corporate decisions. Gao (2010) finds that CEOs in firms with an active option market (i.e., lower hedging costs) have higher incentive pay. Blanco and Wehrheim (2017) document that options trading enhances corporate innovation.

is a tradeoff whether managers choose to disclose private information through voluntary disclosure, which makes it important to examine the determinants of firm voluntary disclosure behavior.

In this paper, we examine whether the likelihood and frequency that managers issue earnings forecasts are affected when there is an active option trading market on their firm's stock. There are reasons to expect options trading to increase or decrease voluntary disclosure. On one hand, being informed investors who trade on their private information, options trading can generate information transfers from the options market to the equity market and price discovery in the equity markets (Cremers and Weinbaum 2010; Jin et al. 2012; Johnson and So 2012). This, in turn, can reduce misalignment of expectations between firms and their equity investors. It can also result in capital market benefits for the firm such as lower cost of capital and improved stock liquidity. Prior literature has documented the evidence consistent with the information spillover role of options trading. For example, options trading increases uninformed trading relatively more than informed trading and stock market illiquidity (Hu 2018), increases informational efficiency of stock prices (Pan and Poteshman 2006), and reduces cost of equity capital (Naiker et al. 2013). Hence, to the extent that the information spillover from the options market to the equity market reduce expectation misalignment between firms and their equity investors and generate capital market benefits for the firms, we expect that managers have less incentive to issue earnings forecasts when there is an active option market.

On the other hand, one might expect options trading to increase voluntary disclosure. Informed investors exert great effort to acquire new and private information and trade on this information (Mayhew et al. 1995; Anthony 1988). To the extent that outcomes of these trades (e.g., spikes in option prices and trading, and possible equity market spillover effects such as stock price crashes) results in the perception or revelation that the managers have been hiding information,

especially information that should have been disclosed earlier, managers might suffer from litigation, reputation loss, and adverse career impact. Hence, faced with the threat that options trading will reveal hidden information, managers become more constrained in withholding information from equity investors. From this perspective, we expect managers to be more willing to issue earnings forecasts when there is active options trading on their firm's stock.

In sum, there is tension in the hypothesis linking option trading to voluntary disclosure. Cross-market information spillover, with its impact on reducing expectation misalignment and providing firms with capital market benefits, would predict a negative effect of option trading on voluntary disclosure. In contrast, if option trading constrains information withholding, the predication would be a positive association between option trading and voluntary disclosure. Hence, the effect of stock options trading on managers' voluntary disclosure is an empirical question, whose answer can shed insights into cross-market information dynamics.

Using a large sample of U.S. public firms with exchange-traded options on their stocks for the period 1996-2016, we find that options trading volume is negatively and significantly associated with the occurrence and frequency of management earnings forecasts, indicating that options trading reduces management voluntary disclosure behavior. We also conduct several robustness tests to confirm my baseline results. The baseline results remain when we use alternative sample of management forecasts, use alternative measures of option trading volume, drop financial crisis and dot-com bubble period or pre Reg-FD, use alternative specification such as change analysis, and control for CDS trading.

One important concern in our analysis is the endogeneity problem. It is possible that both options trading and management earnings forecasts are correlated with omitted variables, which leads to the relation between them. It is also likely that options trading may be endogenously

determined by management earnings forecasts. We use two methods to mitigate the potential endogeneity problem. First, we use moneyness and open interest as instrument variables of option trading volume following prior literature (Roll et al. 2009). Our results hold in the two-stage least squares (2SLS) regressions with these two variables as the instrument. Second, we conduct a difference-in-differences (DID) test based on option listing. Option listing decision is made by exchanges, so option listing is less likely to be affected by endogenous firms' decisions and is somewhat exogenous to firm characteristics. There are some criteria for option listing, such as the trading volume and market capitalization of the underlying stock (Mayhew and Mihov 2004). We use these criteria to define eligible non-listing stocks. We find one matched firm that has the closest propensity scores but no option listings in the same month for each option-listed firm. Using the matched sample, we find that after option listing, firms tend not to issue management earnings forecasts or issue them less frequently compared to the eligible non-listing firms. Overall, the results of instrument variables and DID test based on option listing confirm the causal effect of options trading on management earnings forecasts.

Options trading reduces information asymmetry between managers and outside investors, while one important motivation for managers to issue voluntary disclosure is to reduce information asymmetry. The reduction in information asymmetry caused by options trading is likely to be larger for firms with higher information asymmetry, thus lead to larger reduction in voluntary disclosure. We use accrual quality derived from Dechow-Dechev model and analyst forecast dispersion to measure information asymmetry between managers and outside investors. We find that the negative relation between options trading and management earnings forecasts is more pronounced for firms with higher abnormal accrual and higher analyst forecast dispersion. The price discovery in equity market due to options trading will also be larger for firms with more

facilitated information transfer from option market to equity market, such as higher stock liquidity and larger transient institutional ownership. The larger price discovery in equity market, the larger reduction in voluntary disclosure. We use amihud illiquidity and transient institutional ownership to capture the strength of information transfer, and we find the negative relation between options trading and management earnings forecasts is more pronounced for firms with lower amihud illiquidity and larger transient institutional ownership.

Lastly, we examine the effect of options trading on management forecast characteristics. We find that firms are more likely to issue more general forecasts rather than more specific forecasts when there is an active option market, which indicates that managers devote less energy to predict future earnings as the need of management forecasts is reduced. We further find that the stock price reaction of management earnings forecasts to earnings surprise is reduced for firms with active option market. The price discovery of options trading reduces the informativeness of management earnings forecasts, suggesting that there is actually less of a need for managers to issue forecasts.

This study makes several contributions. First, this paper adds to the growing literature on the effect of options trading from a voluntary disclosure perspective. The vast majority of studies in options trading have concentrated on the effect of options trading on firm stock market conditions (Easley et al. 1998; Kumar et al. 1998; Chakravarty et al. 2004; Johnson and So 2012). There is limited evidence about how managers respond to the options market in making corporate decisions. There are two notable exceptions. Gao (2010) finds that CEOs in firms with an active options market (i.e., lower hedging costs) tend to have higher pay-for-performance sensitivity and higher sensitivity of CEO wealth to stock volatility. Blanco and Wehrheim (2017) document that options trading enhances corporate innovation through the increased informational efficiency and

increased monitoring. In this paper, we examine how managers change their voluntary disclosure behaviors in responds to options trading. Our research question is important because management disclosure is an important way for managers to voluntarily communicate with outside investors (Beyer et al. 2010).

Second, this paper contributes to the voluntary disclosure literature by showing that price discovery originating from non-equity markets reduces the need of voluntary disclosure. Prior literature primarily focus on the effect of corporate disclosure on firm capital market conditions, such as stock liquidity (Welker 1995; Healy et al. 1999), and stock returns (Anilowski et al. 2007). Nevertheless, the information in stock market and derivative market may in turn shape managers' voluntary disclosure behavior. Kim et al. (2018) document that the availability of credit default swaps (CDSs) increases the occurrence and frequency of management voluntary disclosure. Our paper is different from the paper in that the underlying reference assets of CDSs is the bonds or loans of the reference firms, while the equity options are traded on stocks of firms. Given the importance of the options market[3], it is important to examine the effect of options trading on managers' voluntary disclosure behavior.

Third, this study contributes to the voluntary disclosure literature by investigating whether options trading is an important determinant of management disclosure behavior. Prior literature has documented that CEO characteristics, outside directors, institutional ownership, analysts, product market competition, and employee are important determinants of management disclosure behavior (Bamber et al. 2010; Ajinkya et al. 2005; Boone and White 2015; Anantharaman and Zhang 2011; Huang et al. 2017; Bova et al. 2015). This study explores whether managers take into account traders in the financial derivative market when making forecasting decisions. This study

[3] The total equity options volume has increased essentially, from 676 million contracts in 2000 to over 3,689 million contracts in 2017 (See http://www.optionsclearing.com.).

contributes to this literature by investigating how trading on options affects management earnings forecasts.

The rest of the paper is organized as follows. Section 2 reviews prior literature related to options and voluntary disclosure. Section 3 shows the development of hypothesis. Section 4 describes the data and variables. Section 5 reports the baseline results, and the results of robustness tests, endogeneity tests, and cross-sectional tests, while section 6 shows additional tests. Section 7 concludes.

2. Literature review

2.1. Options literature

Black and Scholes (1973) argue that, under the assumptions of a perfect market, options are redundant assets, whose payoffs can be replicated by taking positions in stocks and bonds. Nevertheless, Figlewski (1989) note that, in the real world, options are not redundant, because it is impossible to perfectly replicate them in the absence of a perfect market. Because of the low costs and high leverage in trading, options are ideal securities for informed investors with private information (Black 1975).

Informed trading in the options market and the enhanced information supply associated with options trading improve the informational efficiency of the stock market. Easley et al. (1998) show that options trading can convey important information about future stock prices because it is driven by more sophisticated investors. Informed traders act on their private information in the options market (Cremers and Weinbaum 2010; Jin et al. 2012; Johnson and So 2012). Truong and Corrado (2014) find that options trading volume reduces the stock price response to earnings announcements. This suggests that the information may have been partially revealed to the public prior to the earnings announcements for optioned firms. There is also evidence that prices of non-

optioned stocks take significantly longer to adjust to earnings announcements (Jennings and Starks 1986), takeover announcements (Cao et al. 2005), and stock split announcements (Chern et al. 2008). Kumar et al. (1998) suggest that option listings have a positive effect on the quality of the stock market in terms of higher liquidity, lower information asymmetry, and greater price efficiency. Pan and Poteshman (2006) find that option trading increases informational efficiency of stock prices. Informed trading in the options market and the enhanced information supply associated with options trading improve the informational efficiency of the stock market. Chakravarty et al. (2004) document that price discovery tends to be greater when options trading volume is higher than stock trading volume, and when the effective bid-ask spread in the options market is lower than that in the stock market. Hu (2018) finds that options trading increases uninformed trading by increasing hedging demand, and increases informed trading by providing higher leverage and relaxing short-sell constraints, but the increase in uninformed trading dominates the increase in informed trading, thus reduces information asymmetry of the underlying stocks. The reduction of information asymmetry is larger for good news than bad news because informed selling is larger than informed buying due to the short-sell relaxation,

There are researches examining the effect of options trading on firms' real effects. Roll et al. (2009) show that options trading improves the underlying stock's market valuation, that is, Tobin's Q, because options trading incorporates more information in the price, which help corporate resources to be allocated efficiently. Gao (2010) finds that CEOs with lower hedging costs, measured by option dummy and options trading volume, tend to have higher pay-for-performance sensitivity and higher sensitivity of CEO wealth to stock volatility, because CEO whose hedging costs is lower is less likely to be influenced by her/his incentive pay and then the optimal incentive pay should be higher. Naiker et al. (2013) find that optioned firms have a lower implied cost of

capital compared to non-optioned firms, because options trading disseminates private information to the stock market, and increases the quantity and quality of firm-specific information. Finally, Blanco and Wehrheim (2017) show that options trading enhances corporate innovation, as the increased informational efficiency helps to allocate corporate resources efficiently and the increased monitoring caused by reduced information asymmetry shield managers against the reputational consequences caused by innovation.

Despite the vast literature on the informational role of options trading, a few studies contend that options trading does not reveal new information to the market. Stephan and Whaley (1990) find that stock trading leads options trading, and Muravyev et al. (2013) show that option price quotes contain no economically significant information about future stock prices beyond what is already reflected in current stock prices. Bris et al. (2007) suggest that put options do not offer a viable substitute for short sales, while Grundy et al. (2012) find a significant decrease in option volumes and a significant increase in option bid-ask spreads for banned versus unbanned stocks during the September 2008 short sale ban. This suggests that bearish option strategies are not perfect substitutes for short sales.

2.2. Management forecasts literature

Managers disclose private information to reduce information asymmetry and adverse selection problem. Managers and other insider investors have information advantage over outside investors, which lead to lemon problems. Jensen and Meckling (1976) suggest that if both parties act to maximize their own utility, it is possible that agents will not always act for the best interest of principles. Due to the separation of ownership and control of company, this kind of agency problem will exist. High quality financial information and information environment can help to reduce agency costs.

Healy and Palepu (2001) and Beyer et al. (2010) document that managers will disclose more private information to reduce cost of capital and increase liquidity. As such, firms have incentive to disclose more information to reduce information asymmetry. Coller and Yohn (1997) find that firms that issue management earnings forecasts have higher information asymmetry prior to the forecast. Verrecchia (2001) finds that managers issue forecasts to reduce information asymmetry between managers and investors. Ajinkya and Gift (1984) also find that managers issue forecasts to move investor expectations toward managers' beliefs about future earnings. However, management forecast also leads to some costs, such as litigation costs and proprietary costs. Johnson et al. (2001) documents that firms are reluctant to disclose forward-looking information, as this kind of information may even invite lawsuits. Firms may also be less likely to disclose private information if the disclosure will damage their competitive positions (Verrecchia 1983; Huang et al. 2017). Hilary (2006) documents that if labor power increases, firms will disclose less private information due to proprietary costs. Graham et al. (2005) document that quarterly earnings forecasts may attract short-termism investors who focus on short-term performance, and thus incur managerial myopia. Managers who issue forecasts may engage in earnings management or suboptimal decisions to meet their previous guidance (Fuller and Jensen 2010). Overall, there is a tradeoff whether firms choose to disclose more information or not.

Nagar et al. (2003) find that managers with more stock-based incentives issue earnings forecasts more frequently in an effort to reduce equity mispricing. Ajinkya et al. (2005) document that better corporate governance lead to higher level of management forecast. There is also one paper examining the effect of financial derivate on management forecast. Kim et al. (2018) document that credit default swaps (CDSs) weaken lenders' incentive to monitor borrowers, leading shareholders to demand more management disclosure.

3. Hypothesis development

Managers have more information about firms' future prospects than outside investors, and there exists information asymmetry between managers and outside investors. Option traders are informed investors, who have private information about a firm. Option traders will exert extensive effort to acquire important firm-specific information to gain profits against uninformed investors (Mayhew et al. 1995; Anthony 1988), and trading by option traders might disseminate their private information to the market (Jennings and Starks 1986; Cao 1999; Skinner 1990; Ho 1993), which increases the information incorporated in stock price. There is information transfer from the options market to the equity market, therefore, the price discovery in the equity market due to the information transfer can increase price efficiency. Options trading volume contains the information in future stock price due to the valuable nonpublic information option traders incorporated into option market (Pan and Poteshman 2006). Easley and O'Hara (2004) document that options trading contributes to transfer firm-specific information from informed investors to uninformed investors, which reduces the information asymmetry. Option listing increases uninformed trading due to the increase of hedging demand, and increases informed trading by alleviating short-sell constraints as well, but the increase of uninformed trading dominates the increase of informed trading, therefore, options listing reduces information asymmetry (Hu 2018). In addition, options trading can also provide capital market benefits due to the reduced information asymmetry. Options increase market quality of the underlying stocks and then increases stock liquidity (Kumar et al. 1998). Options trading brings more private information into the stock market, which reduces the information asymmetry and increases information quality, thus reduces cost of equity capital (Naiker et al. 2013).

Managers have incentive to disclose more private information to reduce information asymmetry (Coller and Yohn 1997; Verrecchia 2001), and align investor expectations with management beliefs about future earnings (Ajinkya and Gift 1984). Voluntary disclosure can reduce the information asymmetry between informed and uninformed investors (Diamond and Verrecchia 1991; Kim and Verrecchia 1994), thus increase stock liquidity. Managers also have incentive to issue voluntary disclosure to reduce adverse selection problem, and then reduce the cost of capital. Botosan (1997) find that the level of voluntary disclosure reduces the cost of capital for firms with low analyst following. However, there are some concerns related to voluntary disclosure. Voluntary disclosure invites lawsuit (Johnson et al. 2001), increases proprietary costs (Verrecchia 1983; Huang et al. 2017), increase investor short-termism (Graham et al. 2005) and managerial short-termism (Fuller and Jensen 2010; Cheng et al. 2005; Kasznik 1999) as well.

Overall, options trading reduces the information asymmetry, thus reduces expectation misalignment, cost of capital, and illiquidity. Therefore, there will be less of a need for managers to issue voluntary disclosure. This can also help firms avoid some of the potential problems associated with voluntary disclosure.

H1: The likelihood and frequency that managers will issue voluntary disclosure is lower when there is an active options trading market on their firm's stock.

However, options trading may increase managers' voluntary disclosure. Informed investors may exert extensive effort to discover new and important information to gain profits against uninformed investors (Mayhew et al. 1995; Anthony 1988), so when there is new and private information, informed traders are likely to detect the new information and trade on it if managers do not disclose it on time. Managers' ability to acquire new information and anticipate economic environment changes (Trueman 1986) will be suspected, and then lead to managers' reputation

loss. Therefore, managers might be more willing to issue voluntary disclosure to convey information to the market to avoid the possible reputation loss and increased career concerns due to the informed trading by option traders. From this perspective, we expect managers to be more willing to issue voluntary disclosure when there is active options trading on their firm's stock.

An important reason for managers to issue voluntary disclosure is to reduce information asymmetry, and then reduce the cost of capital and increase stock liquidity (Coller and Yohn 1997; Verrecchia 2001). When firms have higher information asymmetry, thus higher cost of capital and illiquidity, the need for managers to issue voluntary disclosure is larger. The reduction in information asymmetry due to informational efficiency and price discovery arising from options trading is likely to be larger for firms that are more likely to have higher information asymmetry. Larger reduction in information asymmetry implies larger reduction in managers' voluntary disclosure.

H2: The negative relation between options trading and voluntary disclosure is more pronounced for firms with higher information asymmetry.

Stock options trading facilitates price discovery in the underlying stock market (Pan and Poteshman 2006), which can help to reduce information asymmetry between managers and outside investors (Easley and O'Hara 2004). There are various factors that affect the strength of the price discovery. Stock liquidity can facilitate trading in the equity market, which contributes to the information transfer from option market to equity market. The presence of institutional investors who trade based on information can also facilitate the price discovery in the equity market (Bushee and Goodman 2007). To the extent that the equity market conditions facilitate the information transfer from the option market to the equity market, and then strengthen the price discovery in

the equity market, there will be less of a need for managers to issue voluntary disclosure to reduce information asymmetry.

H3: The negative relation between options trading and voluntary disclosure is more pronounced for firms whose equity market conditions facilitate price discovery.

4. Data and Variables

4.1. Sample

We obtain data on management earnings forecast from I/B/E/S databases, which covers earnings forecasts made by managers prior to the official release of reported earnings. We collect data on option trading from OptionMetrics, which contains all options traded on U.S. listed equity since 1996. This dataset contains information for each individual put and call option on a daily basis, including the number of contracts traded, the closing bid and ask prices, implied volatility, and other equity option characteristics. Additionally, we collect firm financial information from Compustat, and stock information from CRSP, analyst coverage, equity issuance, and institutional ownership are from I/B/E/S, Thomson One, and Thomson Reuters Institutional Holdings (13f) database. We obtain institutional investor classification data from Brian Bushee's website [4].

Our sample period is from 1996 to 2016, because OptionMetrics' coverage begins in 1996. We begin with observations with non-missing total assets in Compustat. We keep firms with positive option trading volume as firms without option listing tend to be quite different (Mayhew and Mihov 2004). Roll et al. (2009) suggest that the informational efficiency benefited from options depends on the volume of options traded, not just the presence of option listing. We drop observations with missing control variables. Finally, we have 38,492 firm-year observations from 1996 to 2016.

[4] http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html

Table 1 provides the industry and year distribution of the sample. Panel A shows the Fama-French 12 industry distribution of the sample. Firms in utilities industry have the highest likelihood to issue management earnings forecasts, the second is firms in consumer non-durables industries, and then firms in industry of wholesale, retail, and some services. Only 16.01% of firms in the industry of oil, gas, and coal extraction and products issue earnings forecasts. Panel B shows the year distribution of the sample. The management earnings forecasts increase significantly in 2000 due to the passage Regulation Fair Disclosure (Reg FD). After 2000, the year distribution of management earnings forecasts is relatively stable without significant time trend.

[Insert Table 1 about here]

4.2. Variables

We use annual and quarterly management forecasts to capture firms' voluntary disclosure. Forecast likelihood (*DumMF*) is a dummy variable that equals one if the firm issues annual or quarterly earnings forecasts during the fiscal year, and zero otherwise. Forecast frequency (*FreqMF*) is the natural logarithm of one plus the number of annual and quarterly forecasts issued by the firm in a fiscal year.

According to Roll et al. (2009), options trading volume measures how rich the information environment is and how ease informed trading can be facilitated. Easley et al. (1998) suggest that informed traders are motivated to trade in the options market when liquidity is high. Therefore, we investigate the effect of options trading volume on management earnings forecasts. We calculate options dollar trading volume (*LnOptvol*) as follows. Following Roll et al. (2009), we aggregate the dollar trading volume of all options contracts for each firm during each fiscal year. To calculate annual dollar trading volume, we multiply daily trading volume and the midpoint of the end-of-day bid-ask spread for each options contract on a stock, and then aggregate across all trading days

in a year and across all listed options contracts on the stock. We take the natural logarithm of one plus the dollar trading volume (in tens of thousands of dollars).

Following prior literature (Kim et al. 2018; Bourveau et al. 2018), we include the following variables as controls in the regression. Firm size (*Size*) is the natural logarithm of the market value of equity at the fiscal year end. Larger firms have higher analysts rating of corporate disclosure (Lang and Lundholm 1993). Kasznik and Lev (1995) also suggests that the likelihood of disclosure is positively associated with firm size. Firm leverage (*Lev*) is total liabilities divided by total assets at the fiscal year end. Book to market ratio (*BM*) is the ratio of the book value to the market value of equity at the fiscal year end. Miller (2002) suggests that firm performance is positively associated with disclosure, therefore, we need to control performance variables. Return on assets (*ROA*) is income before extraordinary items divided by total assets. Operating loss dummy (*Loss*) is an indicator variable equal to one if income before extraordinary items for a fiscal year is negative, and zero otherwise. Stock return (*Ret*) is buy-and-hold size-adjusted return for a fiscal year. Earnings volatility (*EarnVol*) is standard deviation of the annual return on assets over the past 10 years with at minimum five non-missing observations. Firms with less volatile earnings are more likely to issue forecasts more frequently (Waymire 1985). Institutional ownership (*IO*) is the percentage of total shares outstanding held by institutional investors for a fiscal year. Bird and Karolyi (2016) suggest that institutional investors demand public information, therefore, managers disclose more and high-quality information faced with increased institutional ownership. Analyst following (*Analyst*) is the natural logarithm of one plus the number of analysts covering the firm in a fiscal year. Anantharaman and Zhang (2011) show that managers disclose more information to attract analysts. Litigation risk (*Litigation*) is ex ante class action litigation risk, calculated using the coefficient estimates from model (3) in Kim and Skinner (2012). Altman Z-Score (*Mid_Zscore*)

is an indicator variable takes the value of one if the firms' Altman Z-Score falls within the middle quintile of the sample distribution in a given year, and zero otherwise. Equity issuing (*Issue*) is an indicator variable takes the value of one if firm issues equity during the fiscal year, and zero otherwise. Firms are more likely to forecast if they need access to capital market, but their forecast behaviors do not change around the period of an offering (Frankel et al. 1995). Detailed variable definitions are available in Appendix A.

4.3 Descriptive Statistics

Table 2 provides summary statistics of main variables. We winsorize all the continuous variables at the 1st and 99th percentiles in order to mitigate the effect of outliers. The mean value of *DumMF* indicates that 46.3% of firm-year observations have at least one annual or quarterly earnings forecast. *FreqMF* has a mean value of 0.803, which reflects that firms issue an average of 1.23 annual and quarterly forecasts during a year. The mean value of *LnOptvol* (natural logarithm of total annual dollar option volume) is 2.34, and the median value is 1.86. The mean *Size* of 7.367 indicates that firms with positive option trading volume mostly are large firms. The mean value of *Lev* and *BM* is 0.223 and 0.562 respectively. The mean of *ROA* and *Loss* is 0.013 and 0.227 respectively, indicating that most firms with positive options trading volume are profitable firms. The sample firms have a mean *IO* of 65.7%. The mean of *Analyst* is 2.037, which suggests an average of 6.6 analysts that follow a firm. The mean value of *Ret* and *EarnVol* is 0.028 and 0.111 separately. The mean of *Litigation* and *Mid_Zscore* is 0.172 and 0.200, indicating that the sample firms have lower litigation risk and default risk. The mean value of *Issue* is 0.137, which suggests 13.7% firms issue equity in a year.

[Insert Table 2 about here]

5. Empirical Results

5.1. Options trading and management earnings forecasts

To empirically investigate the effect of options trading on management earnings forecasts, we use the following regression.

$$DumMF_{i,t+1}/FreqMF_{i,t+1} = \alpha_0 + \alpha_1 LnOptvol_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 BM_{i,t} + \alpha_5 ROA_{i,t} + \alpha_6 Loss_{i,t} + \alpha_7 IO_{i,t} + \alpha_8 AnalstFollow_{i,t} + \alpha_9 Ret_{i,t} + \alpha_{10} EarnVol_{i,t} + \alpha_{11} Litigation_{i,t} + \alpha_{12} Mid\_Zscore_{i,t} + \alpha_{13} Issue_{i,t} + Firm\ fixed\ effect + Year\ fixed\ effect + \varepsilon$$

where *i* denotes firm, *t* denotes the year, and ε is the error term. The dependent variables are management earnings forecast likelihood (*DumMF*) and frequency (*FreqMF*). The independent variable is options trading dollar volume (*LnOptvol*). Detailed variable definitions are showed in Appendix A. We also include firm fixed effect to control time-invariant firm-specific characteristics, and year fixed effect to control the time trend of management earnings forecasts. We use ordinary least squares (OLS) model for both forecast dummy and forecast frequency.[5] We also adjust standard errors for heteroscedasticity and cluster at the firm level.

Table 3 shows the effect of options trading volume on management earnings forecasts. Column (1) shows the results for forecast dummy. The coefficient of options trading volume (*LnOptvol*) is negative and statistically significant, suggesting that larger options dollar trading volume leads to lower likelihood of management earnings forecasts. In terms of economic significance, increasing options trading volume by one standard deviation (1.986) reduces forecast dummy by 1.986 × 0.016=0.032. Given the mean of forecast dummy is 0.463, the effect of options

[5] We use ordinary least squares for *DumMF*, which is binary variable. Logistic regressions are inconsistent and also suffer from quasi-separation issues when the number of fixed effects becomes large (Albert and Anderson 1984). I also use logit regression in robustness test, but many observations are automatically dropped as we add firm fixed effect, and this is also one reason for me to choose OLS regression when the dependent variable is dummy variable.

trading volume on earnings forecasts is not only statistically significant, but also economically significant. Column (2) shows the results of the frequency of earnings forecasts. The coefficient of options trading volume (*LnOptvol*) is negative and statistically significant, which indicates that options trading volume reduces the frequency of management earnings forecasts. In terms of economic significance, increasing options trading volume by one standard deviation (1.986) reduce forecast frequency by 1.986 × 0.036=0.071. This magnitude is comparable to other key determinants. For example, one-standard-deviation increases in return on assets (*ROA*) is associated with an increase of forecast frequency of 0.033 (0.141 × 0.231=0.033). Therefore, the effect of options trading volume on the frequency of earnings forecast is not only statistically significant, but also economically significant.

[Insert Table 3 about here]

The coefficient estimates of control variables are generally consistent with prior literature. *Size* is significantly and positively associated with *DumMF* and *FreqMF*, indicating that larger firms are more likely to issue earnings forecasts and issue more frequently (Kasznik and Lev 1995; Lang and Lundholm 1993). Consistent with Miller (2002), *ROA* is positively related to forecast dummy and frequency, and *Loss* is negatively associated with *DumMF* and *FreqMF*, suggesting that profitable firms are more likely to issue earnings forecasts and issue more frequently. Graham et al. (2005) show that analysts demand managers' information to predict earnings, therefore, forecasting activity also increases for firms with higher analyst following. The results show that *Analyst* is significantly and positively associated with *DumMF* and *FreqMF*. Firms issuing equity are less likely to issue earnings forecasts and issue less frequently. Collectively, the results in Table 3 imply that options dollar trading volume reduces the likelihood and frequency of management earnings forecasts

5.2. Robustness tests

We conduct a rich set of robustness tests on our baseline results. To summarize, we find our results are robust to alternative sample for management forecasts, alternative measures for options trading volume, alternative sample period, and alternative regression specification. We report the results of robustness tests in Table 4. For the sake of brevity, we only report the coefficient estimate on the variable of interest, that is, options trading volume. In Panel A of Table 4, we use alternative sample of management forecasts. Firstly, we only consider annual earnings forecasts to measure the issuance and frequency of earnings forecasts. The results are showed in column (1) and (2), and the coefficient estimate on *LnOptvol* is still negative and statistically significant. Secondly, we only use quarterly earnings forecast in a fiscal year to measure the issuance and frequency of forecasts. As showed in column (3) and (4), the coefficient estimate on *LnOptvol* is still consistent with that of baseline regression. Thirdly, we consider other management forecast items except for EPS, as managers release more than one estimate during a particular disclosure event. The results are consistent with the baseline results, which are presented in column (5) and (6).

[Insert Table 4 about here]

Panel B shows the results using alternative proxies of options trading volume. Firstly, we define option trading volume to zero for stocks without options following Roll et al. (2009). Secondly, we aggregate the trading volume of all options contracts for each firm during each fiscal year, and then we use the natural logarithm of the total annual option volume. Thirdly, following Roll et al. (2010), we examine the options trading volume to the volume in underlying stocks. We use the annual dollar option/stock volume ratio (*$O/S*), which is the natural logarithm of the ratio of annual dollar option trading volume to the corresponding dollar stock trading volume. *ShO/S* is

the natural logarithm of the annual option trading volume to stock trading volume in shares. The results remain consistent despite of using different option trading volume measures.

Panel C shows the results using alternative sample period. Specifically, we first exclude dot-com bubble period (2000-2001) and financial crisis period (2007-2008), because the forecast activity during these periods may not reflect firms' normal forecast activity. The results are showed in column (1) and (2), and are consistent with baseline results. In addition, firms may communicate with analysts or other stakeholders privately, and relatively few firms issue earnings forecasts before Reg-FD, therefore, we limit the sample to the post Reg-FD only, the results are showed in column (3) and (4), and are consistent with our main findings.

Panel D shows results using alternative specification. Firstly, as we use ordinary linear squares (OLS) in the baseline regression for forecast dummy, we use logit regression when the dependent variable is forecast dummy for robustness check. Although the sample size is reduced largely[6], the results are still consistent with our main findings. Second, we use change analysis to mitigate the possibility that some time-invariant firm-specific characteristics may contribute to our main findings. The change analysis can also help to mitigate reverse causality problem. The results of change analysis are presented in column (2) and (3). The coefficient of change in option trading volume ($\Delta LnOptvol_t$) is negatively associated with the change in forecast dummy ($\Delta DumMF_{t+1}$) and significant at the 1% level in column (2). The coefficient of change in option trading volume ($\Delta LnOptvol_t$) is negative and statistically significant in column (3).

Panel E shows the results controlling for CDS trading. We examine whether our results are robust controlling for CDS trading, because Kim et al. (2018) find that CDS trading is positively related to the incidence and frequency of management earnings forecasts. *PostCDS* is an indicator

[6] The sample size reduced to 19,056 when I use logit regression.

variable that equals to one for years after CDS initiation, and zero otherwise. *CDSTraded* is an indicator variable that equals to one if the firm has CDS trading during our sample period, and zero otherwise. Using CDS data from 1997 to 2015, we find *CDSTraded* is positively and significantly related to the incidence and frequency of management earnings forecasts in column (1) and (2)[7]. Similar to Kim et al. (2018), we do not put in firm fixed effect because there is no within-firm variation in *CDSTraded*. In column (3) and (4), we find that options trading is still negatively and significantly associated with the incidence and frequency of management earnings forecast after controlling for CDS trading.

5.3. Endogeneity of options trading

One concern in our analysis is that both options trading and management earnings forecasts are correlated with omitted variables from the regression, which results in the apparent relation between them. It is also likely that options trading may be endogenously determined by management earnings forecasts. In other words, the causality extends from management earnings forecasts to options trading. For example, firms constantly issue management earnings forecasts have less private information for option traders to trade, which results in low options trading volume. We use two methods to mitigate the potential endogeneity problems. First, we use moneyness and open interest as instrument variables of option trading volume. Second, we conduct a difference-in-differences (DID) test based on option listing.

Following Roll et al. (2009), we use moneyness and open interest as instrument variables to confirm the causal effect of options trading volume on management earnings forecasts. Specifically, moneyness is the annual average absolute difference between a stock's market price and an option's strike price. Moneyness is related to options trading. Informed traders may be

[7] When we replicate Kim et al. (2018) using the same sample selection and regression specification, we find statistically significant and positive coefficients on *PostCDS* and *CDSTraded*.

attracted by out-of-the-money (OTM) options because they provide largest leverage, while uninformed traders are interested in in-the-money (ITM) options to avoid risky positions (Pan and Poteshman 2006). In addition, volatility traders are likely to dodge deep ITM or OTM since the vega of such options is close to zero (Roll et al. 2009). However, there is no economic intuition that moneyness is related to management forecasts. Open interest is the total number of outstanding options contracts that have not been settled. In this paper, open interest is measured as the annual average open interest across all options on a stock. Open interest, which is unsettled options contracts, is related to option trading volume, however, there is no linkage between open interest and management forecasts. Therefore, these two instruments are good instruments as they are strong indicators of options trading volume, but they are not directly related to management earnings forecasts (i.e., exclusion restriction). We follow the standard two-stage least squares (2SLS) estimation using option moneyness and open interest as the instrumental variables. Table 5 shows the results for instrument variables. In the first-stage regression, moneyness and open interest is positively associated with option trading volume, and the relation is significant. In the second stage, we use the predicted option trading volume estimated in the first-stage as explanatory variable, and it is negatively and significantly associated with both forecast dummy and forecast frequency. Overall, the results of instrument variable is consistent with the baseline results, and confirm the causal effects of option trading volume on management earnings forecasts.

[Insert Table 5 about here]

The second way to eliminate endogeneity problem is DID test based on option listing. Option listing decision is made by stock exchanges, therefore, option listing is less likely to be affected by endogenous firm characteristics and is somewhat exogenous to firms' decisions. There are some criteria for option listing, such as the trading volume and market capitalization of the underlying

stock (Mayhew and Mihov 2004). Based on the option listing criterion imposed by SEC, I use the following requirement to define eligible non-listing stocks: (1) The stocks should be listed on the NYSE, Amex, and Nasdaq; (2) The stocks should issue at least seven million publicly hold shares; (3) The stocks should reach the minimum price[8]; (4) The stocks should have no option trading history and have been traded for at least 252 trading history in the CRSP database. The information on option listing events is acquired from OptionMetrics database. OptionMetrics database begins in 1996, therefore, for the option trading happened in 1996, we cannot differentiate the option trading begins in 1996 or before 1996. We drop stocks with option trading in 1996, and then use the first day that appeared in OptionMetrics as the option listing day.

To conduct the test, we first estimate the propensity score of option listing controlling for factors that may affect the exchanges' decision of which stocks to list. The propensity scores are calculated using a logit model, where the dependent variable is the options listing dummy (*Optlist*). *Optlist* is a dummy variable equaling to one for firm-month observation when an option exchange listed a stock without options trading previously, and zero otherwise. Following Mayhew and Mihov (2004) and Hu (2018), we use firm size at the end of previous month, average trading volume, return standard deviation, and average bid-ask spread in the previous year, the previous month, and twelve months ago, industry and year dummies as explanatory variables in the regression. The logit regression is estimated using a sample of 320,684 firm-month observations during 1997-2016[9]. The results are showed in Appendix B.1. Next, for each option listed firm, we match it with a control firm that has the closest propensity scores but no option listings in the same month. We find a matched non-listing stock with the closed propensity score for each of 3,269

[8] The minimum price is $7.5 before 2002, and is $3 after 2002.

[9] I only keep option listing events after 1997 because OptionMetrics begins in 1996, so for stocks listed before 1996, we do not know their exact listing year. The option listing events ends in 2016 to make sure there are at least one-year observations after listing to compare the difference before and after option listing.

listing stocks. After requiring no missing value of all controlling variables, we have 1,084 eligible listing stocks. As showed in Appendix B.2, there are no significant difference between the listing and non-listing stocks in the pre-listing firm characteristics. Lastly, we adopt the standard DID approach, and examine changes in management earnings forecasts for both option listing firms (treatment firms) and matched non-listing firms (control firms) around the listing year of options. Specifically, we use the following regression to examine the effect of option listing on management earnings forecasts:

$$DumMF_{i,t+1}/FreqMF_{i,t+1}$$
$$= \alpha_0 + \alpha_1 Treat_{i,t} * Post_{i,t} + \alpha_2 Treat_{i,t} + \alpha_3 Post_{i,t} + \alpha_4 Size_{i,t} + \alpha_5 Lev_{i,t}$$
$$+ \alpha_6 BM_{i,t} + \alpha_7 ROA_{i,t} + \alpha_8 Loss_{i,t} + \alpha_9 IO_{i,t} + \alpha_{10} AnalstFollow_{i,t} + \alpha_{11} Ret_{i,t}$$
$$+ \alpha_{12} EarnVol_{i,t} + \alpha_{13} Litigation_{i,t} + \alpha_{14} Mid\_Zscore_{i,t} + \alpha_{15} Issue_{i,t}$$
$$+ Industry\ fixed\ effect + Year\ fixed\ effect + \varepsilon$$

where *i* denotes the firm, *t* denotes the year, and ε denotes the error term. *Treat* is a dummy variable equaling to one for stocks with listed stocks, and zero otherwise. *Post* is an indicator equaling to one for the years after option listing and zero otherwise. *Treat*Post* is the main variable, which examine the effect of option listing on management earnings forecasts. We keep three year before and after option listing to keep a balanced sample. We also require firms to have at least one-year observations before and after the option listing.

Table 6 presents the results of DID approach. In the first column, the coefficient of *Treat*Post* is negative and significant to forecast dummy (*DumMF*), which indicates that after option listing, firms are less likely to issue management earnings forecasts. The coefficient of *Treat*Post* is negative to forecast frequency (*FreqMF*) in the second column, suggesting that firms

are more likely to issue less earnings forecast after option listing. Therefore, our DID tests results mitigate the possible endogeneity problem and support our main findings.

[Insert Table 6 about here]

5.4. Cross-sectional tests

5.4.1 The effect of information asymmetry

Table 7 shows the effect of information asymmetry on the relation between options trading and management earnings forecasts. We use two measures to capture information asymmetry, that is, abnormal accrual estimated from the modified Dechow-Dichev model (*AccrualQuality*) and analyst forecast dispersion (*Dispersion*). Higher abnormal accrual indicates lower financial reporting quality, which increases the information asymmetry between managers and outside investors. In column (1), the coefficient of *LnOptvol*AccrualQuality* is negative and significant at 5% level to forecast dummy, suggesting that the negative relation between options trading and the incidence of management earnings forecasts is more pronounced for firms with larger information asymmetry. In column (2), the coefficient of *LnOptvol*AccrualQuality* to forecast frequency is negative and significant at 10% level. We also use analyst forecast dispersion to measure the information asymmetry. Higher analyst forecast dispersion indicates higher information asymmetry. In column (3) and (4), the coefficient of *LnOptvol*Dispersion* is significant and negative to both forecast dummy and forecast frequency, which indicates that the reduction in information asymmetry arising from options trading is stronger for firms with higher information asymmetry.

[Insert Table 7 about here]

5.4.2. The effect of price discovery facilitation

Table 8 shows the effect of price discovery facilitation on the relation between options trading and management earnings forecasts. We use Amihud illiquidity (*AmihudIlliq*)[10] and transient institutional ownership (*TraIO*) to measure price discovery facilitation. Amihud illiquidity captures the illiquidity in the equity market, which may impede the trading in the equity market and then weaken the information transfer and price discovery in the equity market. In column (1), the coefficient of *LnOptvol*AmihudIlliq* is positive and significant at 5% level, indicating that higher illiquidity weaken the price discovery effect of options trading. In column (2), the coefficient of *LnOptvol*AmihudIlliq* is positive and significant at 10% level. We classify institutional investors into transient institutional investors (*TraIO*), quasi-indexer institutional investors and dedicated institutional investors following Bushee (2001), who categorizes institutional investors based on characteristics of past trading behavior. Transient institutional investors are likely to have high portfolio turnovers, higher diversified portfolio holdings, and focus on short-term trading profits. Bushee (2001) suggests that transient institutional investors have intense incentive to acquire private information because they employ strategies to gain profits from short-term price change. Transient institutional investors mainly obtain abnormal return based on their private information (Bushee and Goodman 2007). Therefore, transient institutions mainly play an information role by boosting information transfer. The coefficient of *LnOptvol*TraIO* is negative and significant at 5% level in column (3), and the coefficient of *LnOptvol*TraIO* is negative and significant at 10% level in column (4), suggesting that transient institutional investors can facilitate the information transfer and price discovery, therefore, amplify the price discovery caused by options trading.

[Insert Table 8 about here]

[10] We also use bid-ask spread to measure stock liquidity, the results is quite similar with the results using Amihud illiquidity measure.

6. Additional tests

6.1 Management earnings forecasts characteristics

Options trading not only affects the occurrence and frequency of management earnings forecasts, but also affect management forecast characteristics. Options trading increases informational efficiency and reduces information asymmetry. Therefore, managers may devote less energy to predict future earnings, because there is less of a need for managers to issue management forecast to reduce information asymmetry. Overall, we predict that managers will issue more general forecasts instead of more specific forecasts when there is an active option market.

Table 9 presents the results of forecast characteristics. *Precision* is measured as -100 multiply the averaged difference between the upper- and lower-end estimates, scaled by price (point estimates have a range of zero). We only keep firms with management earnings forecasts for the tests. The coefficient of options trading (*LnOptvol*) is negative and significant at 1% level in column (1), which indicates that options trading increases the width of earnings forecasts. In column (2) and (3), we examine the intensity of management earnings forecasts. *Intensity1* is the log of one plus the management forecast score. We assign a value of 0 if the firm provides no forecast, a value of 1 to the forecast with an open range estimate, a value of 2 to the forecast with a close range estimate, and a value of 3 to the forecast with a point estimate. We sum the values over all forecasts made by the firm in that particular year. For *Intensity2*, we first drop firms without management earnings forecasts and then sum the values over all forecasts made by the firm in that particular year. We find that options trading reduces the intensity of management earnings forecasts no matter whether we consider firms without management earnings forecasts.

[Insert Table 9 about here]

6.2. Stock price reaction of management earnings forecasts

Options trading increases informational efficiency and reduces information asymmetry. In addition, options trading can contribute to price discovery in the underlying stock market, and options prices contain information about expectations of future stock prices. In this regard, considering the price discovery arising from options trading, management earnings forecasts may be less informative. We examine the stock price reaction of management earnings forecasts when there is an active option market in Table 10. For multiple management earnings forecasts issued in a year, we only keep the latest management annual earnings forecasts to reduce the problem of data interdependence. *MFSURP* is the management forecast news, measured as the difference between management forecast and the median analyst forecast consensus scaled by the stock price. *CAR* is the three-day value weighted adjusted cumulative abnormal returns around the release of management forecasts. In column (1), we change continuous options trading volume variables into indicator variable (*H_LnOptvol*), which equals one if options trading volume is larger than the year median, and zero otherwise. The coefficient of *H_LnOptvol*MFSURP* is negative and significant at 5% level, indicating that active options trading can actually improve price discovery and reduce the informativeness of management earnings forecasts. In column (2), we interact the raw variable *LnOptvol* with *MFSURP*, and the coefficient of the interaction term is negative and significant at 10% level. Overall, our results indicate that options trading can help incorporate information about expectations in future stock prices and then reduce the informativeness of management earnings forecasts.

[Insert Table 10 about here]

7. Conclusion

This paper is the first to examine the effect of options trading on management earnings forecasts. Option traders are informed investors who have private information about the firm. The trading of option traders disseminates their private information into prices. Options trading reduces information asymmetry and increases informational efficiency. Therefore, due to the reduced information asymmetry and the capital market benefits provided by options trading, there is less of a need for managers to issue earnings forecasts. As a result, we find options trading reduces the occurrence and frequency of management earnings forecasts.

Using a large sample of U.S. public firms with positive options trading volume, we find that options trading volume is significantly and negatively associated with the occurrence and frequency of management earnings forecasts. Our findings are robust to a battery of robustness tests. We use instrument variables and DID tests based on option listing to alleviate potential endogeneity problems. Specifically, the results of using instrument variables are consistent with the baseline results. After option listing, option-listed firms are less likely to issue management earnings forecasts or issue them less frequently compared to eligible non-option-listed firms. In the cross-sectional tests, we find the negative relation between options trading and management earnings forecasts is more pronounced for firms with higher information asymmetry, and for firms with stronger price discovery facilitation. Lastly, we find that firms are more likely to issue more general earnings forecasts when there is an active option markets. Additionally, options trading reduces the informativeness of management earnings forecasts because options trading helps incorporate information of expectation in future stock prices.

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Appendix A: Variable definition

Variable	Definition
DumMF	An indicator variable equals one if the firm issues at least one annual or quarterly earnings forecast during the fiscal year, and zero otherwise.
FreqMF	The natural logarithm of one plus the number of annual and quarterly forecasts issued by the firm in a fiscal year.
LnOptvol	The natural logarithm of one plus the total annual dollar option volume (in million U.S. dollars) in a fiscal year.
Size	The natural logarithm of the market value of equity at the fiscal year end.
Lev	Total liabilities divided by total assets at the fiscal year end.
BM	The ratio of the book value to the market value of equity at the fiscal year end.
ROA	Income before extraordinary items divided by total assets.
Loss	An indicator variable equal to one if income before extraordinary items for a fiscal year is negative, and zero otherwise.
IO	The percentage of total shares outstanding held by institutional investors for a fiscal year.
Analyst	The natural logarithm of one plus the number of analysts covering the firm in a fiscal year.
Ret	Buy-and-hold size-adjusted return for a fiscal year.
EarnVol	Standard deviation of the annual return on assets over the past 10 years with at minimum five non-missing observations.
Litigation	Ex ante class action litigation risk, calculated using the coefficient estimates from model (3) in Kim and Skinner [2012].
Mid_Zscore	An indicator variable takes the value of one if the firms' Altman Z-Score falls within the middle quintile of the sample distribution in a given year, and zero otherwise. Z-Score = 1.2 × (current assets minus current liabilities, divided by total assets) + 1.4 × (retained earnings divided by total assets) + 3.3 × (earnings before interest and taxes divided by total assets) + 0.6 × (market value of equity divided by total liabilities) + 0.999 × (sales divided by total assets).
Issue	An indicator variable takes the value of one if firm issuers equity during the fiscal year, and zero otherwise.
Lnsoptvol	The natural logarithm of one plus the total annual option volume in a fiscal year.
$O/S	The natural logarithm of the options/stock trading volume ratios in dollars.
ShO/S	The natural logarithm of the options/stock trading volume ratios in shares.
Moneyness	The annual average absolute difference between a stock's market price and the option's strike price.
OpenInterest	The average open interest across all options on a stock throughout the calendar year.
AccrualQuality	An indicator variable that equals one if accrual quality is larger than the sample median and zero otherwise. Accruals quality is the accruals residual calculated from the model of Dechow and Dichev (2002) and McNichols (2002).
Dispersion	An indicator variable that equals one if analyst forecast dispersion is larger than the sample median and zero otherwise. Analyst forecast dispersion is the standard deviation of analysts' forecasts divided by the absolute value of the mean analyst forecast for the fiscal period.
AmihudIlliq	An indicator variable that equals one if Amihud stock illiquidity is larger than the sample median and zero otherwise. Amihud stock illiquidity is defined as the average ratio of the daily absolute return to the (dollar) trading volume on that day.

TraIO	An indicator variable that equals one if transient ownership is larger than the sample median and zero otherwise. Transient ownership is the percentage of total shares outstanding held by transient institutional investors for a fiscal year.
Precision	Management forecast precision, measured as -100 multiply the averaged difference between the upper- and lower-end estimates, scaled by price (point estimates have a range of zero).
Intensity1	The log of one plus the management forecast score. We assign a value of 0 if the firm provides no forecast, a value of 1 to the forecast with an open range estimate, a value of 2 to the forecast with a close range estimate, and a value of 3 to the forecast with a point estimate. We sum the values over all forecasts made by the firm in that particular year.
Intensity2	The log of one plus the management forecast score. We assign a value of 1 to the forecast with an open range estimate, a value of 2 to the forecast with a close range estimate, and a value of 3 to the forecast with a point estimate. We sum the values over all forecasts made by the firm in that particular year.
CAR	Three-day value-weighted market adjusted cumulative abnormal returns around the release of management forecast.
H_LnOptvol	An indicator variable that equals one if option dollar trading volume is larger than the year median and zero otherwise.
MFSURP	Management forecast news, measured as the difference between management forecast (point or midpoint of the range forecast) and the median analyst forecast consensus prior to the time of management forecast, scaled by the share price at the analyst consensus day.

Appendix B: Option listing

This table shows the logit regression of option listing. The option listing event date from 1997 to 2016 is from OptionMetrics. Following the selection criterion in Mayhew and Mihov (2004) and Hu (2018), we define eligible stocks for option listing in the next month as those meeting the following requirements: (1) being listed on the NYSE, Amex, and Nasdaq; (2) issuing at least seven million publicly held shares; (3) reaching the minimum price ($7.5 before 2002 and $3 after 2002); and (4) having no option trading history and being traded for at least 252 trading days in the CRSP database. The dependent variable (*Optlist*) equals one for firm-month observation when an option exchange listed a stock without options trading previously, and zero otherwise. The control variables includes log market value ($Size_{t-1}$), at the end of last month, log average daily volume in the past 12 months ($Volume_{t-1,t-12}$), log average daily volume in the last month ($Volume_{t-1}$), log average daily volume in month t-12 ($Volume_{t-12}$), log standard deviation of daily returns in the past year ($STD_{t-1,t-12}$), log standard deviation of daily returns in the last month (STD_{t-1}), log standard deviation of daily in month t-12 (STD_{t-12}), average daily percentage bid-ask spread at market close in the past year ($Spread_{t-1,t-12}$), average daily percentage bid-ask spread in the last month ($Spread_{t-1}$), average daily percentage bid-ask spread in month t-12 ($Spread_{t-12}$), industry (two-digit SIC code) and year dummies. The *z*-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Logit regression of probability of option listing

	$Optlist_t$
	(1)
$Size_{t-1}$	-0.1832***
	(-6.11)
$Volume_{t-1,t-12}$	-0.8116***
	(-12.48)
$Volume_{t-1}$	1.1563***
	(28.59)
$Volume_{t-12}$	-0.4942***
	(-11.90)
$STD_{t-1,t-12}$	0.4563***
	(4.81)
STD_{t-1}	0.2649***
	(5.80)
STD_{t-12}	0.5648***
	(10.23)
$Spread_{t-1,t-12}$	-0.3840***
	(-5.80)
$Spread_{t-1}$	-0.6002***
	(-9.30)
$Spread_{t-12}$	-0.0446
	(-1.16)
Constant	6.7793***
	(14.55)
Industry FE	Yes
Year FE	Yes
N	320,684
Pseudo R^2	0.149

Panel B: Different in pre-listing firm characteristics

Variables	Listing stocks	Control stocks	Difference
$Size_{t-1}$	12.900	12.940	0.032
$Volume_{t-1,t-12}$	11.690	11.700	0.009
$Volume_{t-1}$	12.070	12.060	-0.008
$Volume_{t-12}$	11.170	11.200	0.032
$STD_{t-1,t-12}$	-3.571	-3.562	0.009
STD_{t-1}	-3.599	-3.589	0.010
STD_{t-12}	-3.710	-3.699	0.011
$Spread_{t-1,t-12}$	0.956	0.955	-0.001
$Spread_{t-1}$	0.681	0.711	0.031
$Spread_{t-12}$	1.198	1.156	-0.042

Table 1: Sample distribution

This table shows the industry and year distribution of observations with management earnings forecasts. The industry distribution is based on Fama-French 12 industry.

Panel A: Industry distribution of observations with management earnings forecasts

Industry	Forecast	Total	Percent
Consumer Non-Durables	1,188	1,854	64.08%
Consumer Durables	485	954	50.84%
Manufacturing	2,058	3,904	52.72%
Oil, Gas, and Coal Extraction and Products	317	1,980	16.01%
Chemicals and Allied Products	627	1,042	60.17%
Business Equipment	4,403	7,148	61.60%
Telephone and Television Transmission	203	899	22.58%
Utilities	981	1,445	67.89%
Wholesale, Retail, and Some Services	2,412	3,784	63.74%
Healthcare, Medical Equipment, and Drugs	1,821	4,214	43.21%
Finance	1,428	6,541	21.83%
Other	1,898	4,728	40.14%
Total	17,821	38,493	46.30%

Panel B: Year distribution of observations with management earnings forecasts

Year	Forecast	Total	Percent
1996	241	990	24.34%
1997	411	1,178	34.89%
1998	482	1,341	35.94%
1999	636	1,406	45.23%
2000	869	1,344	64.66%
2001	842	1,296	64.97%
2002	927	1,433	64.69%
2003	1,003	1,535	65.34%
2004	1,006	1,666	60.38%
2005	1,034	1,765	58.58%
2006	1,030	1,867	55.17%
2007	966	1,909	50.60%
2008	867	1,977	43.85%
2009	906	2,090	43.35%
2010	942	2,168	43.45%
2011	950	2,222	42.75%
2012	1,007	2,418	41.65%
2013	982	2,456	39.98%
2014	941	2,483	37.90%
2015	927	2,488	37.26%
2016	852	2,461	34.62%
Total	17,821	38,493	46.30%

Table 2: Summary statistics

This table presents the summary statistics of main variables in the analysis. All variables are defined in the Appendix A. All continuous variables are winsorized at the 1st and 99st percentiles.

Variable	N	Mean	SD	Median	P5	P25	P75	P95
$DumMF_{t+1}$	38493	0.463	0.499	0.000	0.000	0.000	1.000	1.000
$FreqMF_{t+1}$	38493	0.803	0.955	0.000	0.000	0.000	1.609	2.485
$LnOptvol_t$	38493	2.340	1.986	1.862	0.053	0.627	3.668	6.238
$Size_t$	38493	7.367	1.678	7.295	4.705	6.198	8.450	10.331
Lev_t	38493	0.223	0.192	0.198	0.000	0.046	0.350	0.585
BM_t	38493	0.562	0.437	0.459	0.107	0.276	0.714	1.350
ROA_t	38493	0.013	0.141	0.035	-0.241	0.005	0.075	0.158
$Loss_t$	38493	0.227	0.419	0.000	0.000	0.000	0.000	1.000
IO_t	38493	0.657	0.264	0.713	0.082	0.504	0.864	1.000
$Analyst_t$	38493	2.037	0.820	2.079	0.693	1.609	2.639	3.219
Ret_t	38493	0.028	0.452	-0.019	-0.595	-0.238	0.211	0.822
$EarnVol_t$	38493	0.111	0.208	0.049	0.005	0.022	0.108	0.396
$Litigation_t$	38493	0.172	0.138	0.145	0.002	0.041	0.303	0.395
Mid_Zscore_t	38493	0.200	0.400	0.000	0.000	0.000	0.000	1.000
$Issue_t$	38493	0.137	0.344	0.000	0.000	0.000	0.000	1.000

Table 3: Options trading and management earnings forecasts

The table presents the effect of option trading on the incidence and frequency of management forecast. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The *t*-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	$DumMF_{t+1}$	$FreqMF_{t+1}$
$LnOptvol_t$	-0.016***	-0.036***
	(-4.915)	(-5.565)
$Size_t$	0.063***	0.141***
	(8.309)	(9.285)
Lev_t	0.053*	0.096
	(1.770)	(1.632)
BM_t	0.015	0.030
	(1.368)	(1.516)
ROA_t	0.145***	0.231***
	(4.876)	(4.256)
$Loss_t$	-0.045***	-0.106***
	(-5.861)	(-7.826)
IO_t	0.009	0.002
	(0.429)	(0.053)
$Analyst_t$	0.055***	0.094***
	(7.622)	(6.866)
Ret_t	-0.018***	-0.031***
	(-3.654)	(-3.598)
$EarnVol_t$	-0.048	-0.046
	(-1.333)	(-0.623)
$Litigation_t$	0.013	0.041
	(0.801)	(1.372)
Mid_Zscore_t	0.011*	0.021*
	(1.759)	(1.715)
$Issue_t$	-0.004	-0.018*
	(-0.720)	(-1.694)
Firm FE	Yes	Yes
Year FE	Yes	Yes
N	38493	38493
Adjusted R^2	0.595	0.669

Table 4: Robustness tests

This table shows the results of a battery of robustness tests. Panel A shows the results using alternative management forecast sample. Panel B presents the results using different option trading measures. Panel C shows the results using alternative sample period excluding dot-com bubble period (2000-2001) and financial crisis period (2007-2008). Panel D shows the results using different regression specifications. Panel E shows the results controlling for CDS trading. Firm level control variables and fixed effects are controlled as in Table 3. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The *t/z*-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Alternative management forecast sample

	Annual management forecasts		Quarterly management forecasts		Other management forecasts	
	(1)	(2)	(3)	(4)	(5)	(6)
	$DumMF_{t+1}$	$FreqMF_{t+1}$	$DumMF_{t+1}$	$FreqMF_{t+1}$	$DumMF_{t+1}$	$FreqMF_{t+1}$
$LnOptvol_t$	-0.018***	-0.025***	-0.011***	-0.025***	0.001	-0.016**
	(-5.745)	(-4.651)	(-3.219)	(-4.987)	(0.364)	(-2.505)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	38493	38493	38493	38493	38493	38493
Adjusted R^2	0.593	0.655	0.504	0.595	0.663	0.729

Panel B: Alternative options trading measure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$DumMF_{t+1}$	$FreqMF_{t+1}$	$DumMF_{t+1}$	$FreqMF_{t+1}$	$DumMF_{t+1}$	$FreqMF_{t+1}$	$DumMF_{t+1}$	$FreqMF_{t+1}$
$LnOptvol_t$	-0.010***	-0.010**						
	(-4.162)	(-2.164)						
$Lnsoptvol_t$			-0.010***	-0.022***				
			(-4.463)	(-5.158)				
$\$OS_t$					-0.010***	-0.022***		
					(-4.320)	(-4.880)		
$ShOS_t$							-0.008***	-0.018***
							(-3.291)	(-3.963)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	75086	75086	38306	38306	38306	38306	38306	38306
Adjusted R^2	0.569	0.649	0.595	0.669	0.595	0.669	0.595	0.669

Panel C: Alternative Sample period

	Exclude dot-com bubble period and financial crisis period		Post Reg-FD period only	
	(1)	(2)	(3)	(4)
	$DumMF_{t+1}$	$FreqMF_{t+1}$	$DumMF_{t+1}$	$FreqMF_{t+1}$
$LnOptvol_t$	-0.016***	-0.031***	-0.016***	-0.039***
	(-4.235)	(-4.268)	(-5.109)	(-6.180)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

N	31967	31967	32234	32234
Adjusted R^2	0.600	0.678	0.680	0.738

Panel D: Alternative regression specification

	Logit regression	Change analysis	
	(1)	(2)	(3)
	$DumMF_{t+1}$	$\Delta DumMF_{t+1}$	$\Delta FreqMF_{t+1}$
$LnOptvol_t$	-0.143***		
	(-4.694)		
$\Delta LnOptvol_t$		-0.009***	-0.021***
		(-2.775)	(-4.450)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	22240	32619	32619
Pseudo/Adjusted R^2	0.098	0.022	0.046

Panel E: Controlling for CDS trading

	(1)	(2)	(3)	(4)
	$DumMF_{t+1}$	$FreqMF_{t+1}$	$DumMF_{t+1}$	$FreqMF_{t+1}$
$LnOptvol_t$			-0.016***	-0.029***
			(-4.137)	(-3.631)
$PostCDS_t$	-0.006	0.016	0.005	0.036
	(-0.291)	(0.405)	(0.284)	(0.893)
$CDSTraded_t$	0.070***	0.113***	0.064***	0.103**
	(3.515)	(2.800)	(3.215)	(2.543)
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	35042	35042	35042	35042
Adjusted R^2	0.168	0.194	0.170	0.195

Table 5: Instrument variable

This table shows the effect of option trading on management forecast using 2SLS regression with the average absolute moneyness and open interest as instrument variables. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The *t*-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	First-stage	Second-stage	
	(1)	(2)	(3)
	$LnOptvol_t$	$DumMF_{t+1}$	$FreqMF_{t+1}$
$LnOptvol_t$		-0.056***	-0.106***
		(-5.359)	(-4.966)
$Size_t$	0.892***	0.099***	0.204***
	(38.452)	(8.590)	(8.794)
Lev_t	0.466***	0.075**	0.135**
	(5.809)	(2.470)	(2.256)
BM_t	0.184***	0.027**	0.052**
	(5.854)	(2.461)	(2.553)
ROA_t	0.337***	0.151***	0.243***
	(3.628)	(5.094)	(4.500)
$Loss_t$	0.171***	-0.036***	-0.090***
	(8.782)	(-4.532)	(-6.451)
IO_t	0.263***	0.015	0.013
	(4.154)	(0.733)	(0.340)
$Analyst_t$	0.145***	0.060***	0.104***
	(7.364)	(8.215)	(7.418)
Ret_t	-0.239***	-0.027***	-0.048***
	(-17.681)	(-5.051)	(-4.915)
$EarnVol_t$	0.284***	-0.033	-0.019
	(2.947)	(-0.912)	(-0.259)
$Litigation_t$	0.457***	0.030*	0.070**
	(10.352)	(1.760)	(2.271)
Mid_Zscore_t	-0.038**	0.009	0.017
	(-2.217)	(1.373)	(1.364)
$Issue_t$	0.110***	0.001	-0.009
	(6.861)	(0.085)	(-0.858)
$Moneyness_t$	0.818***		
	(11.425)		
$OpenInterest_t$	0.001***		
	(17.266)		
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	37919	37919	37919
Adjusted R^2	0.855	0.591	0.667

Table 6: DID approach based on option listing

This table shows the causal effects of option listing on management earnings forecasts using the DID regressions based on option listing. We use observations three years before and three after option listing. *Treat* is a dummy variable takes the value of one if a stock is in treatment group and zero otherwise. *Post* is a dummy variable equal to one for the years after option listing and zero otherwise. *Treat*Post* is the interaction between these two variables. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The *t*-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	$DumMF_{t+1}$	$FreqMF_{t+1}$
$Treat_t*Post_t$	-0.040***	-0.055*
	(-2.622)	(-1.949)
$Treat_t$	-0.020	-0.050
	(-1.135)	(-1.581)
$Post_t$	0.012	0.016
	(0.984)	(0.711)
$Size_t$	-0.008	-0.002
	(-1.029)	(-0.165)
Lev_t	0.102**	0.144*
	(2.358)	(1.833)
BM_t	0.001	0.006
	(0.059)	(0.254)
ROA_t	0.156***	0.235***
	(3.945)	(3.372)
$Loss_t$	-0.076***	-0.150***
	(-4.287)	(-4.904)
IO_t	0.187***	0.351***
	(5.238)	(5.487)
$Analyst_t$	0.132***	0.230***
	(10.952)	(10.606)
Ret_t	0.002	0.022
	(0.290)	(1.525)
$EarnVol_t$	-0.024	-0.006
	(-0.605)	(-0.088)
$Litigation_t$	0.028	0.021
	(0.749)	(0.310)
Mid_Zscore_t	0.023	0.041
	(1.334)	(1.282)
$Issue_t$	-0.028*	-0.048*
	(-1.880)	(-1.895)
Industry FE	Yes	Yes
Year FE	Yes	Yes
N	12249	12249
Adjusted R^2	0.276	0.294

Table 7: The effect of information asymmetry

This table presents the effect of information asymmetry on the relation between option trading and management forecast. We use accrual quality (*AccrualQuality*) and analyst forecast dispersion (*Dispersion*) to measure the extent of expectation misalignment. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The t-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) $DumMF_{t+1}$	(2) $FreqMF_{t+1}$	(3) $DumMF_{t+1}$	(4) $FreqMF_{t+1}$
$LnOptvol_t$	-0.012***	-0.033***	-0.011***	-0.022***
	(-3.001)	(-4.340)	(-2.981)	(-2.901)
$LnOptvol_t$*$AccrualQuality_t$	-0.004**	-0.006*		
	(-2.012)	(-1.742)		
$AccrualQuality_t$	0.013**	0.021*		
	(1.992)	(1.828)		
$LnOptvol_t$*$Dispersion_t$			-0.008***	-0.024***
			(-2.680)	(-4.191)
$Dispersion_t$			-0.044***	-0.087***
			(-5.094)	(-5.490)
$Size_t$	0.061***	0.152***	0.058***	0.131***
	(7.216)	(8.747)	(6.830)	(7.770)
Lev_t	0.013	0.059	0.053*	0.123*
	(0.416)	(0.900)	(1.660)	(1.958)
BM_t	0.020	0.040*	0.027**	0.047**
	(1.611)	(1.755)	(2.164)	(2.046)
ROA_t	0.120***	0.174***	0.143***	0.235***
	(3.787)	(2.962)	(4.422)	(4.145)
$Loss_t$	-0.042***	-0.107***	-0.035***	-0.086***
	(-4.826)	(-6.873)	(-4.067)	(-5.905)
IO_t	0.017	-0.002	-0.001	-0.002
	(0.771)	(-0.042)	(-0.057)	(-0.055)
$Analyst_t$	0.062***	0.113***	0.051***	0.095***
	(7.292)	(6.794)	(5.438)	(5.388)
Ret_t	-0.017***	-0.034***	-0.017***	-0.029***
	(-3.097)	(-3.422)	(-3.187)	(-3.049)
$EarnVol_t$	-0.033	-0.031	-0.045	-0.037
	(-0.849)	(-0.379)	(-1.097)	(-0.439)
$Litigation_t$	0.028	0.072**	0.009	0.024
	(1.492)	(2.139)	(0.529)	(0.752)
Mid_Zscore_t	0.012*	0.019	0.014**	0.024*
	(1.706)	(1.441)	(2.120)	(1.848)
$Issue_t$	-0.004	-0.020	-0.005	-0.014
	(-0.620)	(-1.505)	(-0.727)	(-1.227)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	29225	29225	33893	33893
Adjusted R^2	0.607	0.684	0.592	0.671

Table 8: The effect of price discovery facilitation

This table presents the effect of information transfer on the relation between option trading and management forecast. We use Amihud stock illiquidity (*AmibudIlliq*) and transient ownership (*TraIO*) to measure information transfer from the option market to the stock market. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The t-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) $DumMF_{t+1}$	(2) $FreqMF_{t+1}$	(3) $DumMF_{t+1}$	(4) $FreqMF_{t+1}$
$LnOptvol_t$	-0.021***	-0.045***	-0.012***	-0.031***
	(-5.588)	(-5.831)	(-3.348)	(-4.412)
$LnOptvol_t$*$AmibudIlliq_t$	0.012**	0.017*		
	(2.507)	(1.920)		
$AmibudIlliq_t$	-0.058***	-0.115***		
	(-4.186)	(-4.370)		
$LnOptvol_t$*$TraIO_t$			-0.007**	-0.011*
			(-2.532)	(-1.923)
$TraIO_t$			0.014	0.025
			(1.494)	(1.483)
$Size_t$	0.057***	0.127***	0.062***	0.142***
	(7.419)	(8.217)	(8.182)	(9.241)
Lev_t	0.053*	0.094	0.055*	0.102*
	(1.746)	(1.611)	(1.817)	(1.712)
BM_t	0.014	0.027	0.014	0.029
	(1.293)	(1.403)	(1.244)	(1.437)
ROA_t	0.146***	0.235***	0.148***	0.235***
	(4.915)	(4.313)	(4.888)	(4.247)
$Loss_t$	-0.045***	-0.104***	-0.047***	-0.108***
	(-5.793)	(-7.730)	(-5.935)	(-7.846)
IO_t	0.000	-0.014		
	(0.017)	(-0.372)		
$Analyst_t$	0.053***	0.091***	0.056***	0.095***
	(7.319)	(6.600)	(7.678)	(6.879)
Ret_t	-0.016***	-0.026***	-0.018***	-0.031***
	(-3.219)	(-2.940)	(-3.594)	(-3.574)
$EarnVol_t$	-0.049	-0.047	-0.049	-0.046
	(-1.355)	(-0.636)	(-1.347)	(-0.614)
$Litigation_t$	0.016	0.046	0.015	0.043
	(0.955)	(1.553)	(0.926)	(1.436)
Mid_Zscore_t	0.011*	0.022*	0.011*	0.020
	(1.790)	(1.753)	(1.662)	(1.621)
$Issue_t$	-0.005	-0.018*	-0.004	-0.019*
	(-0.752)	(-1.698)	(-0.708)	(-1.730)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	37919	37919	37457	37457
Adjusted R^2	0.596	0.671	0.594	0.670

Table 9: Forecast Characteristics

This table shows the effect of options trading on the precision and intensity of management forecasts. We use management forecast precision (*Precision*) and management forecast score (*Intensity1* and *Intensity2*) to measure the precision and intensity of management earnings forecasts. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The *t*-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	$Precision_{t+1}$	$Intensity1_{t+1}$	$Intensity2_{t+1}$
$LnOptvol_t$	-0.021***	-0.048***	-0.032***
	(-4.107)	(-5.747)	(-4.426)
$Size_t$	0.119***	0.185***	0.129***
	(7.906)	(9.339)	(7.297)
Lev_t	-0.127***	0.118	0.076
	(-2.996)	(1.544)	(1.074)
BM_t	-0.260***	0.027	-0.062*
	(-8.274)	(1.059)	(-1.921)
ROA_t	0.273***	0.312***	0.154*
	(2.731)	(4.340)	(1.754)
$Loss_t$	-0.073***	-0.141***	-0.094***
	(-4.061)	(-7.940)	(-4.949)
IO_t	0.077**	0.010	0.037
	(2.139)	(0.203)	(0.820)
$Analyst_t$	0.005	0.117***	0.024
	(0.393)	(6.561)	(1.436)
Ret_t	0.026***	-0.042***	-0.014
	(2.867)	(-3.684)	(-1.090)
$EarnVol_t$	0.036	-0.082	0.024
	(0.665)	(-0.863)	(0.318)
$Litigation_t$	-0.000	0.051	0.034
	(-0.002)	(1.328)	(0.846)
Mid_Zscore_t	0.010	0.029*	0.026*
	(1.083)	(1.803)	(1.824)
$Issue_t$	0.002	-0.022	0.004
	(0.167)	(-1.526)	(0.268)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	17147	38493	17821
Adjusted R^2	0.668	0.664	0.494

Table 10: Stock price reaction of management earnings forecasts

The table shows the results of stock market reaction of management earnings forecasts issued by firms with positive option trading volume. All other variables are defined in Appendix A. The regressions are performed by ordinary least squares (OLS). The *t*-statistics in parentheses are adjusted for heteroscedasticity and clustered by firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) CAR_t	(2) CAR_t
$MFSURP_t$	3.381**	2.812
	(2.034)	(1.608)
$H\_LnOptvol_{t-1}$	-0.012***	
	(-3.509)	
$H\_LnOptvol_{t-1}*MFSURP_t$	-0.918**	
	(-2.154)	
$LnOptvol_{t-1}$		-0.007***
		(-5.637)
$LnOptvol_{t-1}*MFSURP_t$		-0.286*
		(-1.817)
$Size_t*MFSURP_t$	-0.176	-0.069
	(-0.829)	(-0.296)
$BM_t*MFSURP_t$	-0.398	-0.288
	(-0.943)	(-0.668)
$Loss_t*MFSURP_t$	-1.103***	-1.036**
	(-2.626)	(-2.455)
$Analyst_t*MFSURP_t$	0.771**	0.740**
	(2.147)	(2.116)
$Size_t$	0.016***	0.018***
	(4.380)	(4.933)
BM_t	-0.018**	-0.017**
	(-2.314)	(-2.150)
$Loss_t$	-0.001	0.001
	(-0.255)	(0.147)
$Analyst_t$	-0.015***	-0.013***
	(-3.976)	(-3.470)
Firm FE	Yes	Yes
Year FE	Yes	Yes
N	9921	9921
Adjusted R^2	0.210	0.212