COMBATING INSIDER TRADING IN THE PHARMACEUTICAL INDUSTRY: DOES FDA-MANDATED CLINICAL TRIAL DISCLOSURE PROVIDE A REMEDY ?

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Abstract

This paper examines the effect of mandatory clinical trial disclosures on the profits of insider trading, which is prevalent in the pharmaceutical industry. Using the implementation of the U.S. Food and Drug Administration Amendments Act (FDAAA) of 2007, which significantly increased the disclosure of clinical trials at Phase II or above, as an exogenous shock, I find a decrease in insider trading profits in affected firms. The cross-sectional analyses indicate that the effect is more pronounced for firms with higher uncertainty, poorer information environment, more detailed description of clinical trials, a higher degree of clinical trial completion, and an earlier submission of clinical trial results. Additionally, I find that the decrease in insider trading profits is concentrated among non-routine insider trades. These findings suggest that the increased disclosure under the FDAAA reduces the informational advantage of insiders and thus potentially constrains their profitable trading. My study highlights the importance of understanding the effectiveness of non-SEC disclosure regulations in deterring insider trading.

Keywords: FDAAA; insider trading profits; non-SEC disclosure regulations.

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1. Introduction

Insider trading based on material non-public information is prohibited under the SEC Rule 10b5-1 yet has been prevalent (Jagolinzer, 2009; Hugon and Lee, 2016; Mavruk and Seyhun, 2016; Ryan et al., 2016). Pharmaceutical firms are particularly prone to the risk of employees' illegal insider trading because of their heavy dependence on information about drug discovery and development, which is highly confidential and valuable. SEC has prosecuted numerous cases of illegal insider trading involving pharmaceutical firms.[1] Despite of insider trading laws in place and the heightened SEC enforcement actions, corporate insiders' trading on confidential information remains rampant among pharmaceutical firms. In this study, I examine whether the disclosure regulation imposed by the FDA provides a remedy for the illegal insider trading problem in the pharmaceutical industry.

In 2007, the U.S. Food and Drug Administration Amendments Act (FDAAA) was enacted by the U.S. government. This act played a significant role in expanding the compulsory reporting criteria for clinical trials listed on the ClinicalTrials.gov database (Title VIII, Section 801).[2] The rule was meant to bring more safety and less waste to the drug research and development process by publicly exposing a drug's potential side effects early on. Specifically, under the mandate of the FDAAA, it became compulsory to report the summary results of clinical trials for Phase II or above within one year after the completion of the trial. While the implementation of this policy does not specifically target insider trading, it improves the transparency of clinical trial outcomes.[3] As a result, it may diminish the informational advantage of insiders and affect their ability to profit from confidential information about

[1] For example, SEC charged a medical investigator of KarXT, a drug developed by Karuna Therapeutics, Inc., with insider trading using confidential information about clinical trial results (https://www.sec.gov/litigation/litreleases/lr-25099) and a former Pfizer statistician with abusing his access to confidential clinical trial results to enrich himself and his friend (https://www.sec.gov/news/press-release/2023-123).

[2] See https://clinicaltrials.gov/ct2/manage-recs/fdaaa for Section 801 of the FDAAA.

[3] Lassman et al. (2017) find that industry compliance with the FDAAA disclosure requirements is consistently high, with an overall compliance rate across trials of 86%.

clinical trial results. Therefore, I examine whether the required disclosure of clinical trial results under the FDAAA affects the profits of insider trading in the pharmaceutical industry.[4]

Prior research has shed light on the impact of mandatory disclosure on insider trading profits. Theory predicts that increased corporate disclosure improves the transparency of the company and thus reduces the informational advantage of its insiders, resulting in the reduction of insider trading profits (Baiman and Verrecchia, 1996). However, increased disclosure may crowd out the production of private information by investors (Gao and Liang, 2013; Goldstein and Yang, 2017). In the model of Bushman and Indjejikian (1995), more public disclosure can make insider trading more profitable. Prior empirical studies on the impact of mandatory disclosure on insider trading profit mainly focus on SEC disclosure regulations. For example, Godigbe and Akorsu (2024) document evidence that the improved segment reporting under the SFAS 131 diminishes insider trading profits by limiting insiders' informational advantage.

The FDAAA provides a good setting for studying whether and how non-financial disclosure required by non-SEC regulatory agencies affects insider trading profits. The objective of the FDAAA is to enhance the availability and timeliness of clinical trial information, which provides outsiders with better access to the details of a company's drug development, thereby reducing the private information advantage of insiders. However, unlike financial information disclosure, clinical trial result disclosures often involve drug-specific information that is difficult for outsiders to understand. Thus, the FDAAA may not significantly expand the information set of outsiders, who do not necessarily have the professional knowledge and processing power to interpret the disclosed results. Moreover, there may be a larger degree of private information production being crowded out because the

[4] Insiders make profits by executing trades based on non-public information (Frankel and Li, 2004). Trade size and trade frequency can only capture an insider's trading behaviour, but insider trading profit indicates that an insider takes advantage of information that is not publicly available in the market. Thus, insider trading profit is the most direct measure of whether insiders have made use of private information.

substantial amount of clinical trial information disclosed under the FDAAA largely fills outsiders' information needs. Furthermore, SEC disclosure regulations are often stringent in the timing of public disclosure whereas the FDA gives pharmaceutical companies the discretion to submit clinical trial results at any time within a year of the trial completion, which may allow insiders to make a profit by strategically timing the result submission and their trades. Therefore, the impact of mandatory clinical trial disclosures on insider trading profits remains an empirical question.

To examine the impact of mandatory clinical trial disclosures on corporate insider trading profits, I utilize a difference-in-differences (DID) methodology over a period of six years, centered around the implementation of the FDAAA, from 2004 to 2009. The test sample includes 21,313 firm-year observations for 359 pharmaceutical firms in the U.S.. Following Aghamolla and Thakor (2022), I create a continuous treatment variable to measure the proportion of companies' drug development projects in Phase II or above immediately before the implementation of the FDAAA in 2007. Following Jagolinzer et al. (2011), I define insider trading profits as the daily alpha, which represents the risk-adjusted return estimated using the Carhart four-factor model (Carhart, 1997). For each trade, alpha is estimated over the 180 days following the trading date and it is positive for days when insiders are net purchasers and is negative for days when insiders are net sellers.

My DID estimations reveal that insiders that are more affected by the FDAAA trade less profitably relative to less affected insiders. Following the implementation of the FDAAA, insiders in firms with more than one projects in Phase II or above are found to experience a notable decrease of 4.2 percent in abnormal returns over the 180 days following the trading day, compared to those with no projects in Phase II or above. A test of parallel trend reveals no significant alteration in insider trading profits before the FDAAA takes effect.

To further understand why insider trading profitability declines with the increased disclosures of clinical trials following the passage of the FDAAA, I conduct a series of cross-sectional tests to uncover the possible mechanisms underlying the baseline result. I examine whether the main result differs based on variations in investors' uncertainty and information environment. First, I find that the impact of the FDAAA on insider trading profits is predominantly observed among firms with a higher level of uncertainty proxied by standardized unexpected earnings and stock return volatility. Second, I find that the impact of the FDAAA on insider trading profits is mainly concentrated in companies with poorer information environment measured with analyst following and institutional ownership. Lastly, I test whether the documented effect varies with the characteristics of clinical results disclosed and find that the effect of the FDAAA on insider trading profits is more pronounced in the firms with more detailed description of clinical trials, a high degree of clinical trial completion, and an earlier submission of clinical trial results.

Furthermore, I conduct additional test to examine whether the main result varies with the heterogeneity of insider trade characteristics. If the FDAAA diminishes the private information advantage of insiders, the insider trading profits based on private information will be more affected. Following Cohen et al. (2012), I categorize insider trades as either routine or non-routine and find that the decrease in insider trading profits is concentrated among non-routine trades, which are more likely to be driven by private information. Combined with the cross-sectional results, it indicates that the decreasing impact of the FDAAA on insider trading profits occurs through the reduction in insiders' informational advantage.

This paper contributes to several strands of research. First, it adds to the existing literature concerning disclosure factors that influence insiders' trading profits. Prior literature finds that mandatory adoption of XBRL (Zhu, 2018), mandatory disclosure of key audit matters (KAMs) in China (Liu et al., 2023), narrative R&D disclosures (Huang and Liang, 2024), disclosure of

detailed segment information (Godigbe and Akorsu, 2024), and reduced access to corporate information due to newspaper closures can affect insider trading profits (Kyung and Nam, 2023). I conduct a study using a non-SEC regulation on disclosure in the pharmaceutical industry to investigate the factors influencing insider trading profits. I find that the FDA-mandated disclosure of clinical trials may decrease insider trading profits. This result helps us understand that the FDA-mandated clinical trial disclosure may be able to constrain insider trading profits.

Second, this study informs policy makers who are interested in the consequences of policies that increase disclosure of clinical trials. By exploring the FDAAA as a plausibly exogenous shock, this study highlights the informational value that the FDA regulation in the product markets bring to the capital market. The research conducted by Bourveau et al. (2020) demonstrates that enhanced disclosure of clinical trial results can benefit investors and customers and facilitate stakeholders in evaluating the drug or device. However, Hsu et al. (2022) document a negative effect of mandatory clinical study results disclosure on drug innovation, specifically more suspensions of ongoing drug projects and fewer new project initiations after the FDAAA. I complement this research by providing evidence that the disclosure of clinical trial results may also impact capital market behaviors. The FDAAA has an unintended effect of reducing the profits of insider trading.

The rest of this paper is organized as follows. Section 2 presents a literature review and develops the hypothesis. Section 3 describes the research design and sample selection. Section 4 contains the empirical findings including the baseline and cross-sectional analyses. Section 5 includes additional tests and the robustness tests of the main findings. Section 6 concludes the paper.

2. Literature review and hypothesis development

2.1 Institutional setting

Insider trading regulations have been established to prevent insiders from engaging in trading activities based on material non-public information. The Securities and Exchange Acts of 1933 and 1934, the Insider Trading Sanctions Act of 1984, and the Insider Trading and Securities Fraud Enforcement Act of 1988 are key legislations that enforce these prohibitions. To further restrict insider trading, many firms have implemented internal policies such as imposing restrictions on trading during specific periods and mandating prior approvals for trades. The purpose of these policies is to mitigate the potential for insider trading and promote fair and transparent market practices (Jagolinzer et al., 2011). Yet many insiders continue to trade opportunistically (Brochet, 2010; Cohen et al., 2012; Jagolinzer et al., 2020). For example, a prominent example of the rule's abuse occurred in 2017 when Intel Corp. CEO Brian Krzanich sold shares and exercised options worth $39 million shortly before the public was informed that the company's chips had security flaws.[5] In the pharmaceutical industry, this problem is even more severe because of insiders' privileged access to information about the drug discovery and development process that is highly confidential and valuable.

The pharmaceutical industry, centered on drug development, plays a crucial role in the economy. Introducing a product to the market is a multifaceted process that usually lasts 10 to 12 years and involves significant costs ranging from hundreds of millions to billions of dollars (Babiarz and Pisano, 2008). The Food and Drug Administration (FDA) has established industry guidelines to standardize this process (Guo et al., 2004; Xu et al., 2007; Enache et al., 2022). The guidelines generally categorize the drug development process into two phases: preclinical and clinical.

[5] "Intel CEO Sold Shares Before Chip Security Flaw Disclosed to Public", January 5, 2018, CBS NEWS. See https://www.cbsnews.com/texas/news/intel-ceo-sold-shares-security-flaw/ for details.

The preclinical phase comprises several key steps, including screening, development, preclinical testing, and initial new drug applications (NDAs). During this phase, the chemical composition, stability, solubility, safety, toxicity, pharmacokinetics, and metabolism of a potential drug candidate are thoroughly evaluated after its identification for potential disease treatment (Enache et al., 2022). The primary goal of these trials is to determine the optimal dosage and administration schedule for future patients. The findings from the preclinical study, along with an initial NDA proposal, are then submitted to the FDA for approval to proceed with clinical trials. Upon the FDA approval, the company can initiate clinical trials, which involve testing the drug on human subjects.

The clinical phase encompasses three sequential phases of testing, along with post-approval studies following the FDA approval of the product. All of these phases involve conducting tests with human subjects. Phase I, which usually spans several months, focuses on testing the drug on 20-100 healthy volunteers. The primary objective is to determine a safe dosage and effective delivery method. Phase II typically lasts from several months to two years and involves testing the drug on 50-300 patients. The purpose of this phase is to validate the drug's efficacy and establish the optimal therapeutic dosage range. Phase III typically lasts one to four years and involves testing the drug on up to 3,000 patients. The test results, along with a proposed manufacturing process, are then submitted to the FDA. The primary goal of the clinical phases is to obtain NDA approval and initiate the marketing of the new drug.

The development of drugs involves substantial research funding, prolonged laboratory experiments, numerous animal lives, and many human subjects. Drug development is one of the most expensive innovative activities, so pharmaceutical companies have a strong incentive not to publicly disclose details of clinical trials because of the value of patent information. However, the development of drugs greatly serves the public interest. Timely and accurate disclosure of information about ongoing clinical trials is therefore important because it

contributes to the accumulation of scientific knowledge and the discovery process, and advocates for patient rights (Lehman and Loder, 2012).

In the U.S., the FDA regulates drug development, and drugs must undergo specific phases within the FDA approval process prior to their availability for marketing and sale to consumers. In 1997, the Food and Drug Administration Modernization Act was enacted. Following its enactment, the U.S. government launched a website, registry, and searchable database (i.e., ClinicalTrials.gov). ClinicalTrials.gov serves as a monitoring platform for all types of clinical trials, irrespective of their funding source, including public, industry, or academic funding. The primary purpose of creating this database was to enhance transparency in human experimentation and allow the public to easily access all trials and their results (U.S. Congress, 1997).

Although the establishment of the database was legally required, the reporting of registry and clinical trial results remained primarily voluntary, as the 1997 legislation did not mandate the reporting of clinical trial results. In 2007, the U.S. government expanded and mandated the reporting requirements through the FDAAA (Title VIII, Section 801). The FDAAA was passed on the heels of the infamous 2004 Vioxx recall, set off by the drug manufacturer's belated release of data from post-approval trials that linked Vioxx to heart issues. The rule was meant to bring more safety and less waste to the drug research and development process by publicly exposing a drug's potential side effects early on. Specifically, the FDAAA mandated the reporting of summary results from Phase II clinical trials or above within one year after the trial's completion. Additionally, the law extended the mandatory reporting obligations to encompass all interventional studies involving drugs, medical devices, and biologics.

Noncompliance with the reporting requirements could result in monetary penalties (U.S. Congress, 2007).[6]

The information provided on ClinicalTrials.gov following the enactment of the FDAAA is very detailed. It encompasses various details such as drug information, the specific disease being targeted, participant information (including recruitment details, age and gender distribution, and health conditions), clinical study design (including participant count and distribution for each drug and dosage), treatment outcomes, adverse events, as well as additional descriptive information about the company and investigators involved. For reference, an example of a disclosure can be found in Appendix B. Inside knowledge of new drugs, devices, clinical trial results, and other medical innovations developed by publicly traded companies can affect the value of a company's stock. Therefore, even though the purpose of the FDAAA is to improve the safety of drugs, the mandatory disclosure of clinical outcome information can affect insider traders' profits.

2.2 Literature Review

Some prior studies have examined the impacts of mandated public disclosure on corporate insider trading profits. Zhu (2018) finds that mandatory adoption of XBRL leads to decreased information asymmetry, thereby diminishing the profitability of insider trading. Liu et al. (2023) find that the mandatory disclosure of key audit matters (KAMs) in China limits the profitability of insider trading because of the informative nature of KAMs. Godigbe and Akorsu (2024) investigate the impact of mandatory disclosure on insider trading profits by utilizing SFAS 131 (now ASC 280). This accounting standard mandates the disclosure of internally derived

[6] Prayle et al. (2012) discover that only 126 (40%) out of 317 industry-sponsored trials had timely submitted their results to ClinicalTrials.gov. However, the FDA has contested the findings of Prayle et al. (2012) and highlighted methodological shortcomings in their study, such as including trials not covered by the FDAAA and only tracking on-time registrations. In response to this dispute, the NIH conducted an unofficial analysis and reported that 52% of industry-sponsored trials had submitted results on time. In a reexamination of the data by Miller et al. (2015), Lassman et al. (2017) discovered that nearly all of the 15 new drugs sponsored by big firms and approved in 2012 were in full compliance with the FDAAA.

comprehensive segment information by managers. This requirement facilitates a more informed analysis for external stakeholders, enhancing their understanding of the company's performance at different business unit levels. They find that the mandatory disclosure requirement increases corporate transparency and reduces insider trading profits. Huang and Liang (2024) present strong evidence suggesting that insiders in companies with more extensive narrative R&D disclosures tend to achieve significantly higher profits when selling their stocks by using China's distinctive mandatory R&D disclosure regime. This can be attributed to two factors: (1) the intentional obfuscation of narrative R&D information by managers to protect proprietary costs and (2) the elevated information processing costs arising from the technical nature of R&D information.

Different from these prior papers on the effect of mandated public disclosures on insider trading profits, my study does not focus on the disclosure rules adopted by financial regulatory authorities such as the SEC. The mandatory disclosure regulations adopted by the SEC have a strong purpose of enhancing transparency in capital markets and improving information efficiency. However, the reporting requirements of the FDAAA reflect the ethical obligation of researchers and sponsors to respect human trial participants by adhering to explicit commitments in informed consent, aiming to enhance drug safety and reduce waste in the drug development process. Pharmaceutical companies, as innovation-intensive industries, are highly concerned about information leakage to competitors. Nevertheless, the mandatory disclosure under the FDAAA provides a favorable setting to study the impact of disclosure on this industry. Insider trading is prevalent within this industry and whether the information advantage of insider traders is constrained by these regulations is not known beforehand. Therefore, it is crucial to investigate whether FDA policies provide a complement to SEC regulations in limiting insider trading.

Prior research on the FDAAA finds that the passage of the FDAAA enables pharmaceutical firms to provide useful information. Such information can not only reduce the information asymmetry in the capital market, but also help peers learn from the disclosed information. In their research, Bourveau et al. (2020) provide evidence of a decrease in information asymmetry between pharmaceutical firms that disclose clinical trial information and various stakeholders. Pharmaceutical firms under the FDAAA show reduced bid-ask spread post-2007, indicating increased information efficiency and transparency, benefiting market participants. Aghamolla and Thakor (2022) find a notable trend where private firms have a higher likelihood of transitioning to public equity markets after the implementation of the FDAAA, supporting the notion that this increase in transition is primarily driven by a reduction in the costs associated with disclosing proprietary information. Hsu et al. (2022) find significantly more suspensions of ongoing drug projects and fewer new project initiations after the FDAAA. They find that drug developers' learning from peer failures is the main mechanism and is amplified by financial constraints. Previous studies have examined the economic consequences of mandatory clinical trial disclosures from various perspectives. However, the impact of increased information transparency resulting from mandatory clinical trial disclosures on insider trading profits in pharmaceutical companies, where insider trading is rampant, remains unexplored to date.

2.3 Hypothesis development

Theoretical analysis indicates that enhanced corporate disclosure enhances company transparency, thereby diminishing the informational advantage held by insiders and leading to a decrease in insider trading profits (Baiman and Verrecchia, 1996). However, increased disclosure may crowd out the generation of private information by investors (Gao and Liang, 2013; Goldstein and Yang, 2017). As per the Bushman and Indjejikian (1995) model, greater public disclosure may even amplify the profitability of insider trading. Therefore, the effect of

mandatory clinical trial disclosures on corporate insider trading profits remains an empirical question.

I posit that the enactment of the FDAAA decreases the companies' insider trading profits. Firstly, the enactment of the FDAAA increases the amount of publicly available drug-related information on the market. Using a trend graph, Aghamolla and Thakor (2022) observe a significant surge in company disclosures pertaining to Phase II or higher projects, rising from 2.5 to 3, during the year of FDAAA implementation. Before the policy, people do not have clear information about the detailed results and side effects of the company's drugs, but after the policy, not only insiders, but everyone can see the information related to the drug on publicly accessible database (CinicalTrials.gov). Therefore, this regulation may help outsiders in the capital markets understand the company's drug development situation, thereby reducing the private information advantage of insiders. Secondly, ClinicalTrials.gov is closely monitored by professionals in the biopharmaceutical industry. In fact, there are dedicated companies that develop products to extract and analyse information from ClinicalTrials.gov, providing specialized information analysis services. Furthermore, media outlets frequently utilize the drug-related information disclosed on ClinicalTrials.gov as a basis for generating and publishing news articles. Therefore, the regulation will draw the attention of the public, such as the media, patients, and doctors, which will increase scrutiny of companies and improve firms' information environment, thereby preventing insiders from profiting from their private information (Jagolinzer et al., 2011). As a result, the profit of corporate insiders may decline due to the decrease of insider information advantage and the improvement of information environment. Accordingly, I make the following hypothesis:

Hypothesis: the adoption of the FDAAA reduces corporate insider trading profits.

My story is not without tension. In contrast to financial information disclosure, the disclosure of clinical trial results often encompasses drug-specific details that are difficult for outsiders to understand. As a result, the FDAAA may not have an incremental informational effect to outsiders, who may lack the necessary expertise and analytical capacity to interpret the disclosed outcomes. Then, the adoption of the FDAAA will not have an impact on insider trading profits. Meanwhile, the FDA's mandatory disclosure requirements may crowd out the production of private information by investors. The disclosure of clinical trial results may meet many information needs of outsiders, resulting in a reduction in their acquisition of private information, thereby increasing the information advantage of insiders. Furthermore, the FDA grants pharmaceutical companies the discretion to submit clinical trial results within a year of trial completion. This may create an opportunity for insiders to profit by strategically timing the submission of results and their trades.[7] Thus, even if the FDAAA, which requires pharmaceutical firms to disclose their clinical results in a timelier manner, is passed, it does not guarantee a decrease in corporate insider trading profits.

3. Research design and sample selection

3.1 Research design

To investigate the causal effect of the mandated clinical trial result disclosures under the FDAAA on insider trading profits, I use the following DID specification:

$$TradingProfit_{i,t} = \alpha + \beta_1 PropPhaseII_i * FDAAA_t + \beta_2 PropPhaseII_i + \beta_3 FDAAA_t + \gamma' X_{i,t} + \varepsilon_{i,t}, \quad (1)$$

In Equation (1), $PropPhaseII_i$ represents the treatment variable, which quantifies the percentage of drug portfolio of firm i that is in Phase II or above as of 2006. As the FDAAA

[7] In November 2019, Bari, a medical investigator involved in the KarXT trial, was informed by the company the company that the therapy had been found safe and effective during the phase II trial. Karuna company was preparing to announce these results, which were hailed as a "significant milestone" for the clinical-stage biotech. Within hours, Bari began placing orders to purchase Karuna common stock, acquiring over 1,600 shares. When the trial news was subsequently announced, Bari profited nearly $120,000, as Karuna's share price skyrocketed by 440%. See https://www.fiercebiotech.com/biotech/karuna-investor-settles-insider-trading-charges-sec-netted-120k-non-public-clinical-trial for details.

mandates clinical trial result disclosures for projects in Phase II and above, while exempting Phase I (and preclinical) projects, I follow Aghamolla and Thakor (2022) to construct a continuous treatment variable that measures the proportion of drug development projects in Phase II or above for companies immediately before the FDAAA implementation. The rationale is that companies with a larger percentage of their drug portfolios in Phase II or above will be more impacted by the FDAAA requirements. $FDAAA_t$ is a binary variable, taking a value of 1 if the year t is 2007 or later, and 0 otherwise. The interaction between these two variables serves as the DID estimator, with the coefficient β_1 indicating the marginal effect of changes in the treatment variable following the FDAAA implementation. My dependent variable is $TradingProfit_{i,t}$. Following Jagolinzer et al. (2011), I calculate insider trading profits as the abnormal returns from insider trades. For purchases (sales), I measure the α (-α) using the four-factor Fama and French (1993) and Carhart (1997) model, which is estimated over the 180 days following the transaction.

$$(R_{j,t} - R_{f,t}) = \alpha + \beta_1\left(R_{mkt,t} - R_{f,t}\right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_1, \quad (2)$$

where $R_{j,t}$ is the daily return to firm j's equity; $R_{f,t}$ is the daily risk-free interest rate; $R_{mkt,t}$ is the daily CRSP value-weighted market return; and SMB_t, HML_t, and UMD_t are the daily size, book-to-market, and momentum factors (Fama and French, 1993; Carhart, 1997). The estimated intercept term α (-α) represents the average daily risk-adjusted return associated with a net purchase (sale) during the 180 days following the trade ($TradingProfit_{i,t}$). Higher values of $TradingProfit_{i,t}$ indicate higher profitability.[8]

In Equation (1), I include a set of control variables and fixed effects, represented as $X_{i,t}$. Following Jagolinzer et al. (2011), and Goldman and Ozel (2023), I control for whether the

[8] In cases where a company has multiple insider trades on a given date, I consolidate and combine those trades into a single observation.

transaction occurs during a firm-imposed restricted trade window by including an indicator variable (*ResWin*) that takes a value of one if the transaction takes place during the 48-day period starting 46 days prior to an earnings announcement, and zero otherwise. Additionally, I include in the regression the natural logarithm of total assets (*FirmSize*), total debt scaled by assets (*Leverage*), sales growth (*SalesGrowth*), book-to-market ratio (*BTM*), the 12-month stock returns (*RET*), return on assets (*ROA*), bid-ask spread (*Bid_Ask*), firm age (*log(1+Age)*), and the number of analysts following the firm (*log(1+Analysts)*) to control for various firm characteristics. Appendix A provides definitions of all variables. Throughout the paper, I cluster standard errors by transaction date and firm (Gow et al., 2010). To minimize the impact of extreme values, all continuous variables are winsorized at the 1st and 99th percentiles.

3.2 Sample Selection

I obtain the drug portfolio information between 2004 and 2009 from the ClinicalTrials.gov, which provides comprehensive details on individual drug projects undertaken by companies, including the specific stage of the FDA development process for each drug. I collect insider trading data from the Thomson Reuters Insider Filings database, specifically focusing on the open-market purchases and sales (TRANCODE= "P" or "S") of common shares traded by insiders. I obtain firm financial characteristics from Compustat database, stock return information from Center for Research in Security Prices (CRSP) database, and analyst data from Thomson Reuters I/B/E/S database. I filter and keep only those observations that involve trial sponsors that can be linked to the necessary financial information for analysis from Thomson Reuters Insider Filings, Compustat, CRSP, and I/B/E/S. The final sample comprises 21,313 daily trades observations, pertaining to 359 unique firms.

4. Empirical results

4.1 Descriptive Statistics

Table 1 presents the summary statistics. From Table 1, the mean of $TradingProfit_{i,t}$ is 0.0004%, while the median is 0%, suggesting that most insider trades are not profitable during the sample period. In my sample, the mean of $PropPhaseII_i$ is 41.03%, which is consistent with estimates from Aghamolla and Thakor (2022), revealing that a minority of the drug portfolios, comprising less than 50%, are composed of projects in Phase II or above. The standard deviation of 45.94% in $PropPhaseII_i$ indicates that there is significant variation across firms, which makes it possible to explore the treatment effects of the FDAAA. A small portion of transactions (32.6%) occur during the estimated restricted trading window. An average firm has 6.41 (*FirmSize*) and 0.29 (*MTB*), which are consistent with what prior studies found about a pharmaceutical company (Higgins and Rodriguez, 2006).

[To Insert Table 1 Here]

4.2 Main results

Table 2 provides the regression results from Equation (1). In column 1, I include only the main variables. In column 2, I include the main variables, firm fixed effects, and year fixed effects. In column 3, I include the main variables and all control variables. Column 4 presents the findings for the most rigorous specification, which includes all controls, firm fixed effects, and year fixed effects. Across all model specifications, the DID estimator is consistently negative and statistically significant. The coefficient magnitudes suggest that, on average, transitioning from a firm without any projects in Phase II or above to a firm with multiple projects in Phase II or above reduces insider trading profit by 3.8 to 5.9 basis points. Considering the average insider trade profits of 0.04 basis points in the sample, the documented decrease of 4.2 basis points in insider trade profits (Column 4, Table 1) is of substantial

economic significance. These findings suggest that the mandatory disclosure of clinical trial outcomes may decrease insiders' trading profits, consistent with the hypothesis.

[To Insert Table 2 Here]

In a DID model, the identification of treatment effects heavily relies on the parallel trend assumption (Angrist and Pischke, 2010). If the FDAAA does not occur, there should be no difference in insider trade profits between the treatment and control firms. To test this assumption, I analyse the dynamic changes in insider trading profits before and after the FDAAA implementation. I take the year before the FDAAA as the base year, and I conduct a parallel trend analysis where I replace the main *PropPhaseII*FDAAA* variable with *PropPhaseII* times indicators of years relative to the event: $PropPhaseII*Before^{3}$; $PropPhaseII*Before^{2}$; $PropPhaseII*Period^{0}$; $PropPhaseII*After^{1}$; $PropPhaseII*After^{2}$. For instance, $Before^{2}$ $(After^{2})$ takes a value of 1 for year -2 (year +2), i.e., two years before (after) the passage of the FDAAA, and 0 otherwise. Table 3 presents the dynamic effect of the FDAAA on *TradingProfit*. The coefficients estimated on $PropPhaseII*Before^{3}$ and $PropPhaseII*Before^{2}$ are not statistically different from zero. This implies that there is no significant pre-trend difference between the treatment and control firms before the implementation of the FDAAA, indicating that the parallel trend assumption holds. Regarding the post-event trends, the coefficient on $PropPhaseII *Period^{0}$ is significantly negative, suggesting that insiders promptly respond to the decrease in information asymmetry following the enactment of the FDAAA. However, the coefficients on $PropPhaseII*After^{2}$ are not significant. This indicates that the impact of mandated clinical trial result disclosures is short-term and diminishes over time. This could be attributed to insiders devising strategies to counteract the effects of the FDAAA over time.

[To Insert Table 3 Here]

4.3 Cross-sectional analysis

This section further analyses the mechanism of the increased disclosure of clinical trial results on informed insider trading. If the FDA-mandated clinical trial disclosure reduces insiders' information advantage, then the impact of the FDAAA on insider trading profits will be more pronounced in firms with high investor uncertainty and poorer information environment. In light of this, I investigate whether the documented effect of the FDAAA on insider trading profits varies with investors' uncertainty and information environment. Meanwhile, I also test whether the documented effect of the FDAAA on insider trading profits varies with the characteristics of clinical results disclosed.

4.3.1 Investor uncertainty

Huddart and Ke (2007) show that informed insider trading is driven by two components of an insider's information advantage: the prior variance of stock price and the precision of the insider's private information. Higher prior variance of the stock price and higher precision of insider information both increase information asymmetry. Therefore, insider trading profit is determined by outsiders' uncertainty about the value of the company and the accuracy of insiders' information about future firm performance. It remains unclear whether the increased disclosure of clinical trials is accurate in predicting future performance, but increased disclosure helps to partially bridge the information gap between insiders and outsiders. More public disclosures by firms reduce the uncertainty about the size and the timing of future cash flows (Christensen et al., 2010). Thus, increased disclosure of clinical trials may decrease the uncertainty of outsiders about the firm value and thereby restricting the opportunities for insiders to capitalize on their trades for profit. In other words, I anticipate that the impact of the FDAAA on insider trading profits will be more pronounced for firms experiencing greater uncertainty among outside investors regarding their performance.

To examine this prediction, I employ two indicators as proxies for the uncertainty among outside investors regarding future firm performance: ex ante standardized unexpected earnings (*EX_SUE*) and ex ante stock return volatility (*EX_VOLA*). Uncertainty occurs where the probability distribution is itself unknow (Miller, 1977). When a company's actual earnings consistently deviate from expectations, it increases the likelihood of investor uncertainty regarding the company's performance. In such cases, accounting-based standardized unexpected earnings (*SUE*) serves as a reliable proxy indicator. When the stock return volatility is higher, investors may be more uncertain about the firm stock price, and the market-based stock volatility variable (*VOLA*) is a good proxy indicator.

Following Livnat and Mendenhall (2006), I calculate *SUE* as the absolute deviation between actual quarterly earnings and expected earnings, which is subsequently scaled by the stock price at the end of the quarter. The expected earnings are derived from the prior quarterly earnings. To capture the SUE for a given firm in each year, I choose the median value of the scaled absolute quarterly deviations. To obtain the ex ante values (*EX_SUE*), I calculate the median annual *SUE* for three years preceding the enactment of the FDAAA for each firm. I split the sample into two groups, namely high and low uncertainty, based on the median value of *EX_SUE* within the year.

Following prior literature (Beaver, 1968; Landsman and Maydew, 2002; Barth et al., 2020), I calculate *VOLA* as the square of residual stock return. The residual stock return is calculated as the difference between the realized excess return and the expected return, as estimated using the four-factor model proposed by Carhart (1997). For each firm-year, I estimate the factor betas by utilizing 60 monthly returns preceding the fiscal-year end date. Subsequently, I multiply the estimated betas by the current fiscal-year-end values of the excess market return, daily size, book-to-market, and momentum factors. The resulting products, in addition to the intercept term, are summed to obtain the expected return. The realized excess

return is computed by subtracting the monthly risk-free interest rate at the end of the fiscal year from the CRSP monthly return of the firm. The square of the difference between the realized excess return and the expected return, referred to as the residual return, is defined as the stock return volatility for the corresponding firm-year. To obtain the ex ante values (*EX_VOLA*), I calculate the median return volatility for three years preceding the enactment of the FDAAA for each firm. I split the sample into two groups, namely high and low uncertainty, based on the median value of *EX_VOLA* within the year.

The results in columns (1) and (2) of Table 4 demonstrate that the coefficient on *PropPhaseII*FDAAA* (-0.0489) for high investor uncertainty firms is significantly negative than it is for low investor uncertainty firms (-0.0141), and this difference in coefficients is significant at the 5% level. I also find consistent results when I use stock return volatility as a proxy for investor uncertainty, as shown in columns (3) and (4) of Table 4. The results suggest that the impact of the FDAAA on insider trading profits is more pronounced for firms characterized by heightened uncertainty among external investors regarding firm performance.

[To Insert Table 4 Here]

4.3.2 Information environment

A high-quality information environment serves to alleviate market mispricing, consequently reducing opportunities for insider trading profits (Lambert et al., 2007; Drake et al., 2009). Previous studies have shown that firms' information environment is associated with insider trading profits (Frankel and Li, 2004; Huddart and Ke, 2007). If the FDAAA draws the attention of the public, such as the media, patients, and doctors, which can increase scrutiny of companies and improve firms' information environment, thereby preventing insiders from profiting from their private information (Jagolinzer et al., 2011). Then, I anticipate the impact

of the FDAAA on insider trading profits should be more significant for firms with poorer firms' information environment.

To test this prediction, I use two proxies for the information environment: *Analyst Following* (Cheng and Subramanyam, 2008) and *Institutional Ownership* (Boone and White, 2015). More analysts following, or a high proportion of institutional investors means a better information environment for the company and low opacity. I calculate *Analyst Following* as the average logarithm of 1 plus the number of unique quarterly earnings forecasts issued by analysts over four fiscal quarters. Subsequently, I divide the sample into highly and less opaque groups using the median value of *Analyst Following* within the year. I calculate *Institutional Ownership* as the average percentage of total institutional ownership relative to shares outstanding over four fiscal quarters. I split the sample into two groups, namely highly and less opaque, based on the median value of *Institutional Ownership* within the year.

Results in Table 5 show that the coefficient on *PropPhaseII*FDAAA* for highly opaque firms is significantly negative than it is for less opaque firms. The results indicate that the effect of the FDAAA on insider trading profits is more pronounced for firms with a relatively poorer information environment.

[To Insert Table 5 Here]

4.3.3 The characteristics of clinical results

I also test the information environment from the characteristics of clinical results provided by the company. If the FDAAA increased disclosure improves a company's information environment and reduces an insider's information advantage, then the effect should be more pronounced when companies provide more detailed descriptions. At the same time, the disclosure of clinical trial results is more relevant for completed projects than terminated projects. With terminated projects, there is probably no much result to be disclosed at the first

place. Therefore, I predict that the effect should be more pronounced when companies have a higher degree of clinical trial completion. Furthermore, since the FDA allows companies to determine the timing of submitting clinical trial results within one year after the completion of the trial, the earlier the company submits the results, the narrower the potential room for insider manipulation of trading and result submission timing. I predict that the timelier the results are submitted, the greater the impact of FDAAA on insider trading profits.

I use the level of detail information disclosed (*Detail_Infor*) by the company, the degree of completion of clinical trials (*Completion_Degree*) sponsored by the company, and the month between the completion date and result submitted date (*Submit_Time*) to proxy for the level of detail in clinical trial descriptions, degree of clinical trial completion, and the timeliness of submitted clinical trial results. I calculate *Detail_Infor* as the number of detailed description words provided on ClinicalTrials.gov as a percentage of all description words (including detailed description, brief description, and criteria description). I split the sample into two groups, namely highly and less detailed based on the median value of *Detail_Infor* within the year. I calculate *Completion_Degree* as the proportion of firm i's drug portfolio that has been completed. I split the sample into high and low completion groups based on the median value of *Completion_Degree* within the year. I calculate *Submit_Time* as the month between the completion date and result submitted date. If a company has multiple drugs, I use the median of the calculated submit time as the submit time for each company for each year. I split the sample into early and late submit groups based on the median value of *Submit_Time* within the year.

Results presented in columns (1) and (2) of Table 6 indicate that the coefficient on *PropPhaseII*FDAAA* for highly detailed firms is significantly negative than it is for less detailed firms. The results suggest that the impact of the FDAAA on insider trading profits is more pronounced for firms with more detailed information. Results presented in columns (3)

and (4) of Table 6 indicate that the coefficient on *PropPhaseII*FDAAA* for high completion firms is significantly negative than it is for low completion firms. The results suggest that the impact of the FDAAA on insider trading profits is more pronounced for firms with more completed projects. Results presented in columns (5) and (6) of Table 6 indicate that the coefficient on *PropPhaseII*FDAAA* for early submit firms is significantly negative than it is for late submit firms. The results suggest that the impact of the FDAAA on insider trading profits is more pronounced for firms with an earlier submission of clinical trial results. The results here indicate that, with regards to the increased information disclosure by the FDAAA, the more detailed, relevant and timelier disclosure provided by companies, the greater the reduction in the informational advantage of insiders.

[To Insert Table 6 Here]

5. Additional and the robustness tests

5.1 Additional test in effect of the FDAAA on insider trading profits: Routine trades and non-routine trades

I conduct an additional test to examine whether the primary result varies with heterogeneity in insider trade characteristics. If the FDAAA reduces the private information advantage of insiders, it is expected that insider trading profits based on private information will be more affected. Following the approach of Cohen et al. (2012), I categorize insider trades as either routine or non-routine based on an individual insider's past trading behavior. Routine trades are considered less likely to be driven by private information, while non-routine trades are more likely to involve private information. Consequently, I predict that the decline in insider trading profits will be concentrated among non-routine trades, which are most likely to be based on private information.

To classify insider trades as routine or non-routine, the following criteria are applied: A routine insider must have conducted at least one trade in the same calendar month over at least three consecutive years. For routine traders, any trade made during a "routine month" (i.e., the same calendar month) is categorized as a routine trade. Conversely, trades made by a routine insider during a non-routine month are considered non-routine trades. All other insiders who do not meet the criteria for routine traders are classified as non-routine traders, and consequently, all their trades are classified as non-routine trades.

Results in Table 7 show that the coefficient on *PropPhaseII*FDAAA* for non-routine trades is significantly negative and for routine trades is negative but not significantly. The results suggest that the decline in insider trading profits is primarily concentrated among non-routine trades, which are more likely to be driven by private information. This evidence indicates that the FDAAA leads to a decrease in profits for insiders based on private information.

[To Insert Table 7 Here]

5.2 Additional results: Trade size and trade frequency

While the insider trading literature primarily examines abnormal returns from trades, it is important to recognize that insiders can also alter other aspects of their trading behaviors. In the following analysis, I investigate whether insiders modify the frequency or size of their trades following the implementation of the FDAAA. The corresponding results are presented in Table 8.

I measure *Trade Size* as the average number of shares traded scaled by 1,000 by insiders on the same company per transaction date and I measure *Trade Frequency* as the number of trades made by different insiders on the same company per transaction date. The results in Table 8 show that the coefficients on *PropPhaseII*FDAAA* for trade size and trade frequency

are not significant This means affected insiders do not trade less frequently and trade fewer shares per trade following the event, suggesting that the FDAAA reduces insider trading profits but not has substantial impact on net insider trading activities. This is reasonable. Although the information advantage of the insider after the FDAAA is reduced, there is no reason for the insider to suddenly change their trading activities and bring unnecessary regulatory problems.

[To Insert Table 8 Here]

5.2 Robustness tests

In this section, I verify the main results through a variety of robustness tests. First, I use alternative variables to measure insiders' trading profits. In my main result, $TradingProfit_{i,t}$ is the estimated intercept term α (-α) that is the average daily risk-adjusted return to a net purchase (sale) during the 180 days following the trade. In the columns (1) and (2) of Table 9, I measure $TradingProfit_{i,t}$ as the estimated intercept term α (-α) that is the average daily risk-adjusted return to a net purchase (sale) during the 90 days and 120 days following the trade respectively. I find that the coefficients on *PropPhaseII*FDAAA* are still significantly negative. Second, I group insider trading by buying and selling, and from the columns (3) and (4) of Table 9, I find that the FDAAA effectively reduce insider trading profits for both buying and selling insider trading. Third, I note that the enactment of the FDAAA in 2007 was close to the 2008-2009 financial crisis and that my results may have been affected by the financial distress during the crisis. I address this by using a refined sample that completely excludes observations during the financial crisis (i.e., 2008 and 2009). The result in column (5) of Table 9 shows that the coefficient on *PropPhaseII*FDAAA* is still significantly negative after excluding these observations. Fourth, since the FDAAA requirement is effective from 27 September 2007, that is, the FDAAA will not be effective until the end of 2007. To rule out confusing results, I have excluded observations from 2007. The result in column (6) of Table 9 shows that the coefficient on *PropPhaseII*FDAAA* is still significantly negative after excluding these observations.

Finally, due to the evolving nature of a company's drug portfolio, it is important to note that the classification of Company A into the treatment group is based on its drug portfolio being in Phase II or above in 2006. However, it is possible that Company A may not have a drug portfolio in Phase II or above in subsequent years. Thus, theoretically, it should not be influenced by the FDAAA. Therefore, to solve this problem, I define the treatment variable in this paper more strictly. If the company's drug portfolio is in Phase II or above, and it is in or after 2007, I measure *PropPhaseII*FDAAA* as a proportion of companies' drug development projects in Phase II or above, otherwise 0. I find that in column (7) of Table 9, the main results still exist.

[To Insert Table 9 Here]

6. Conclusion

I examine the effect of the mandated disclosure of clinical trial results under the FDAAA of 2007 on insider trading profits in the pharmaceutical industry. I find a greater decrease in insider trading profits after the FDAAA in firms that are more affected. My cross-sectional analyses show that the effect is more pronounced among firms with higher uncertainty and poorer information environment. I also find that the impact is concentrated in firms providing more detailed description of clinical trials, having a higher degree of clinical trial completion, and submitting clinical trials timelier. In addition, the decline in insider trading profits is concentrated among non-routine trades. These findings provide evidence to support the notion that the increased transparency of clinical trial results reduces insiders' informational advantage, thus limiting the ability of insiders to profit from significant non-public information. This paper provides potential implications for constraining insider trading in pharmaceutical companies with non-SEC regulatory tools.

Appendix A: Variable Definitions

Variables	Definition
Dependent variable	
TradingProfit	The alpha from the Fama and French (1993) and Carhart (1997) four-factor model estimated over the 180 calendar days following insider trading date. For sells, alpha is multiplied by -1. *TradingProfit* is in percentages.
Inependent variable	
*PropPhaseII*FDAAA*	*PropPhaseII* is my treatment variable, which quantifies the proportion of firm i's drug portfolio in Phase II or above as of 2006. *FDAAA* is a binary variable, taking a value of 1 if the year t is 2007 or later, and 0 otherwise.
Control variables	
ResWin	Indicator variable takes a value of one if the transaction takes place during the 48-day period starting 46 days before an earnings announcement, and zero otherwise.
FirmSize	The natural logarithm of total assets (*AT*).
Leverage	Debt (*DLTT* + *DLC*) scaled by total assets (*AT*).
SalesGrowth	Current period sales (*SALE*) minus prior year sales scaled by prior year sales.
BTM	Book value of equity (*CEQ*) scaled by the market value of equity (*CSHO*PRCC_F*).
RET	Compounded 12-month stock returns.
ROA	IB/AT (Income Before Extraordinary Items (ib)).
Bid_Ask	|*Bid-Ask*|/((*Bid+Ask*)/2), averaged over 12 months.
Log (1+Age)	The logarithm of 1 plus firm age based on the first appearance with non-missing stock prices in CRSP
Log (1+Analysts)	The average logarithm of 1 plus the number of unique quarterly earnings forecasts issued by analysts over four fiscal quarters.
Potential mediators	
SUE	Standardized unexpected earnings. The absolute deviation of actual quarterly earnings from expected earnings, which is then scaled by the stock price at the end of the quarter. The expected earnings are based on the prior quarterly earnings. For a given firm in each year, I select the median scaled absolute quarterly deviation as the *SUE*.
EX_SUE	*SUE* Ex ante values, the median annual *SUE* for three years preceding the enactment of the FDAAA for each firm.
VOLA	Stock return volatility, the square of residual stock return. The residual stock return is calculated as the difference between the realized excess return and the expected return based on the four-factor model proposed by Carhart (1997). For each firm-year, I estimate the factor betas using 60 monthly returns preceding the fiscal-year end date. Then, I multiply the estimated betas by the current fiscal-year-end values of the excess market return, daily size, book-to-market, and momentum factors. The resulting products, along with the intercept term, are summed to obtain the expected return. The realized excess return is determined by subtracting the monthly risk-free interest rate at the end of the fiscal year from the CRSP monthly return of the firm. I define the square of the difference between the realized excess return and the expected return (i.e., residual return) as the stock return volatility for the respective firm-year.
EX_VOLA	*VOLA* Ex ante values, the median return volatility for three years preceding the enactment of the FDAAA for each firm.

Analysts Following	The average logarithm of 1 plus the number of unique quarterly earnings forecasts issued by analysts over four fiscal quarters.
Institutional Ownership	The average percentage of total institutional ownership relative to shares outstanding over four fiscal quarters.
Detail_Infor	The level of detail information disclosed by the company, the number of detailed description words provided on ClinicalTrials.gov as a percentage of all description words (including detailed description, brief description, and criteria description.
Completion_Degree	The degree of completion of clinical trials, the proportion of firm i's drug portfolio that is complete.
Submit_Time	The month between the completion date and result submitted date. If a company has multiple drugs, I use the median of the calculated submit time as the submit time for each company for each year.
Other variables	
Routine	An insider is designated as a routine trader if the trader must have conducted at least one trade in the same calendar month over at least three consecutive years the past three years. For routine traders, any trade made during a "routine month" (i.e., the same calendar month) is categorized as a routine trade. Conversely, trades made by a routine insider during a nonroutine month are considered nonroutine trades.
Nonroutine	All trades that are not classified as routine trades are classified as nonroutine.
Trade Frequency	The number of trades made by different insiders on the same company per transaction date.
Trade Size	The average number of shares traded scaled by 1,000 by insiders on the same company per transaction date.

Appendix B: ClinicalTrials.gov disclosure example

In this appendix, I provide excerpts of a disclosure from ClinicalTrials.gov. This disclosure pertains to Phase III results of a clinical study assessing the effect of MK0663 in treating patients with postoperative dental pain, and it was issued by the public healthcare company Organon and Co on January 29, 2010. It is identified by the unique identifier NCT00694369. The disclosure on ClinicalTrials.gov related to this information can be accessed through the web address: https://clinicaltrials.gov/study/NCT00694369.

Participant Flow

Recruitment Details	Study Conducted at 3 investigational sites in the US. Patients were recruited from the sites patient pool and through advertising. A total of 588 patients were randomized. First Patient Entered 27-June-2008; First Patient In (randomized) on 03-July- 2008; Last Patient Last Visit 08-Jan-09
Pre-assignment Details	Patients who met entry criteria and were experiencing moderate-to-severe pain after removal of at least 2 third molars (at least 1 being partially or completely impacted and of mandibular origin) were allocated to the study. Wash-out period for exclusionary medication was specified in the protocol. Randomization was stratified by baseline pain.

Arm/Group Title	Placebo	Etoricoxib 90 mg	Etoricoxib 120 mg	Ibuprofen 2400 mg	Acetaminophen 2400 mg/Codeine 240 mg
Arm/Group Description	Placebo orally once daily	Etoricoxib 90 mg orally once daily	Etoricoxib 120 mg orally once daily	Ibuprofen 2400 mg (600 mg every 6 hours (Q6h)) orally	Acetaminophen 2400 mg/Codeine 240 mg (600/60 mg Q6h) orally
Period Title: **Overall Study**					
Started	46	191	97	192	62
Completed	45	188	95	189	56
Not Completed	1	3	2	3	6
Reason Not Completed					
Adverse Event	0	1	0	1	3
Lost to Follow-up	0	0	1	1	0
Physician Decision	0	0	0	0	1
Protocol Violation	0	1	0	0	0
Withdrawal by Subject	1	1	1	1	2

Baseline Characteristics

Arm/Group Title	Placebo	Etoricoxib 90 mg	Etoricoxib 120 mg	Ibuprofen 2400 mg	Acetaminophen 2400 mg/Codeine 240 mg	Total
Arm/Group Description	Placebo orally once daily	Etoricoxib 90 mg orally once daily	Etoricoxib 120 mg orally once daily	Ibuprofen 2400 mg (600 mg every 6 hours (Q6h)) orally	Acetaminophen 2400 mg/Codeine 240 mg (600/60 mg Q6h) orally	Total of all reporting groups
Overall Number of Baseline Participants	46	191	97	192	62	588
Baseline Analysis Population Description	[Not Specified]					

Sex: Female, Male Measure Type: Count of Participants | Unit of measure: Participants						
Number Analyzed	46 participants	191 participants	97 participants	192 participants	62 participants	588 participants
Female	25 54.3%	113 59.2%	50 51.5%	115 59.9%	37 59.7%	340 57.8%
Male	21 45.7%	78 40.8%	47 48.5%	77 40.1%	25 40.3%	248 42.2%

Age, Continuous Mean (Standard Deviation) | Unit of measure: years						
Number Analyzed	46 participants	191 participants	97 participants	192 participants	62 participants	588 participants
	21.0 (3.0)	21.8 (3.6)	21.8 (3.5)	21.6 (3.8)	20.5 (2.8)	21.5 (3.5)

Outcome Measures

Expand all / Collapse all

1. Total Pain Relief Score Over the First 6 Hours Post the Initial Day 1 Dose of the Study Medication (TOPAR6)

Type: Primary | Time Frame: Over the first 6 hours post the initial Day 1 dose of the study medication

Description	TOPAR6 was calculated by multiplying the pain relief (PR) score (0- to 4-point Likert scale, with 0=None, and 4=Complete for pain relief) at each time point by the duration (in hours) since the preceding time point, and summing these weighted values up to 6 hours post the initial Day 1 dose. The range of TOPAR6 score is 0 to 24.
Time Frame	Over the first 6 hours post the initial Day 1 dose of the study medication
Analysis Population Description	Full Analysis Set population (all randomized patients who received at least 1 dose of study treatment and had at least 1 post-baseline PR data over the first 6 hours). Observed PR was used up to rescue. Missing data was imputed by linear interpolation at time points before rescue, by last-observation-carried-forward at time points after rescue.

Arm/Group Title	Placebo	Etoricoxib 90 mg	Etoricoxib 120 mg	Ibuprofen 2400 mg	Acetaminophen 2400 mg/Codeine 240 mg
Arm/Group Description	Placebo orally once daily	Etoricoxib 90 mg orally once daily	Etoricoxib 120 mg orally once daily	Ibuprofen 2400 mg (600 mg every 6 hours (Q6h)) orally	Acetaminophen 2400 mg/Codeine 240 mg (600/60 mg Q6h) orally
Overall Number of Participants Analyzed	46	191	97	192	62
Least Squares Mean (Standard Error) | Unit of Measure: Units on a Scale	5.08 (0.86)	16.10 (0.42)	15.73 (0.59)	15.67 (0.42)	11.83 (0.74)

Adverse Events

Time Frame	Adverse experiences were collected from the Pre-surgery/Pre-treatment period through the 14 day safety follow-up period.
Adverse Event Reporting Description	[Not Specified]

Arm/Group Title	Placebo	Etoricoxib 90 mg	Etoricoxib 120 mg	Ibuprofen 2400 mg	Acetaminophen 2400 mg/Codeine 240 mg
Arm/Group Description	Placebo orally once daily	Etoricoxib 90 mg orally once daily	Etoricoxib 120 mg orally once daily	Ibuprofen 2400 mg (600 mg every 6 hours (Q6h)) orally	Acetaminophen 2400 mg/Codeine 240 mg (600/60 mg Q6h) orally

All-Cause Mortality

Arm/Group Title	Placebo	Etoricoxib 90 mg	Etoricoxib 120 mg	Ibuprofen 2400 mg	Acetaminophen 2400 mg/Codeine 240 mg
	Affected / at Risk (%)	Affected / at Risk (%)	Affected / at Risk (%)	Affected / at Risk (%)	Affected / at Risk (%)
Total	--/--	--/--	--/--	--/--	--/--

Serious Adverse Events

Arm/Group Title	Placebo	Etoricoxib 90 mg	Etoricoxib 120 mg	Ibuprofen 2400 mg	Acetaminophen 2400 mg/Codeine 240 mg
	Affected / at Risk (%)	Affected / at Risk (%)	Affected / at Risk (%)	Affected / at Risk (%)	Affected / at Risk (%)
Total	0/46 (0.00%)	0/191 (0.00%)	0/97 (0.00%)	0/192 (0.00%)	0/62 (0.00%)

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Table 1 Descriptive Statistics

Variable	N	Mean	Std Dev	Min	Median	Max
TradingProfit	21,313	0.0004	0.256	-0.7227	-0.0109	0.8176
*PropPhaseII*FDAAA*	21,313	0.2164	0.3914	0	0	1
PropPhaseII	21,313	0.4103	0.4594	0	0	1
ResWin	21,313	0.326	0.4687	0	0	1
FirmSize	21,313	6.4166	2.193	2.6386	5.9679	11.4338
Leverage	21,313	0.1725	0.2274	0	0.0868	1.2423
SalesGrowth	21,313	0.5045	1.4264	-0.9	0.1545	9.6138
BTM	21,313	0.2853	0.2469	-0.3822	0.2358	1.2107
RET	21,313	0.2009	0.701	-0.8327	0.1001	4.1601
ROA	21,313	-0.1041	0.3195	-1.3638	0.0296	0.2914
Bid_Ask	21,313	0.0038	0.0064	0.0003	0.0016	0.0391
log(1+Age)	21,313	2.4506	0.909	0.6931	2.5649	4.0943
log(1+Analysts)	21,313	1.9284	0.6868	0.6931	1.9356	3.3039

Notes: This table contains summary statistics for all variables for the period of my main specification, from 2004 to 2009.

Table 2 Effect of the FDAAA on Insider Trading Profits

	TradingProfit			
	(1)	(2)	(3)	(4)
*PropPhaseII*FDAAA*	-0.0532***	-0.0388***	-0.0589***	-0.0417***
	(-6.97)	(-4.74)	(-7.81)	(-5.05)
PropPhaseII	0.0365***		0.0338***	
	(6.70)		(6.09)	
FDAAA	0.0252***		0.0137***	
	(5.37)		(2.90)	
ResWin			-0.0167***	-0.0082**
			(-4.53)	(-2.28)
FirmSize			-0.0026	0.0676***
			(-1.53)	(8.88)
Leverage			0.0414***	-0.0252
			(4.93)	(-1.16)
SalesGrowth			0.0030**	0.0002
			(2.42)	(0.10)
BTM			0.0033	-0.0187
			(0.41)	(-0.85)
RET			-0.0592***	-0.0720***
			(-22.84)	(-14.14)
ROA			0.0078	0.0018
			(1.07)	(0.10)
Bid_Ask			3.2705***	7.7333***
			(9.07)	(7.89)
log(1+Age)			0.0010	0.0063
			(0.40)	(0.34)
log(1+Analysts)			-0.0196***	-0.0098
			(-4.47)	(-1.08)
Intercept	-0.0158***	-0.0118***	0.0400***	-0.4181***
	(-4.82)	(-3.21)	(4.36)	(-7.85)
Firm Fixed Effects	N	Y	N	Y
Year Fixed Effects	N	Y	N	Y
Adjusted R-square	0.0025	0.1775	0.0455	0.2093
No. of Obs	21,313	21,313	21,313	21,313

This table estimates the difference-in-differences effect of the FDAAA on insider trading profits (*TradingProfit*). Control variables, firm fixed effects, and year fixed effects are included as indicated. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.

Table 3 Test of Parallel Trend Assumption

	TradingProfit
*PropPhaseII*Before*^{3}	-0.0113
	(-1.00)
*PropPhaseII*Before*^{2}	0.0068
	(0.59)
*PropPhaseII*Period*^{0}	-0.0347***
	(-3.08)
*PropPhaseII*After*^{1}	-0.0806***
	(-6.44)
*PropPhaseII*After*^{2}	-0.0180
	(-1.40)
ResWin	-0.0085**
	(-2.37)
FirmSize	0.0653***
	(8.53)
Leverage	-0.0262
	(-1.20)
SalesGrowth	0.0006
	(0.24)
BTM	-0.0163
	(-0.74)
RET	-0.0717***
	(-14.01)
ROA	-0.0079
	(-0.46)
Bid_Ask	7.4209***
	(7.55)
log(1+Age)	0.0099
	(0.53)
log(1+Analysts)	-0.0086
	(-0.95)
Intercept	-0.4103***
	(-7.49)
Firm Fixed Effects	Y
Year Fixed Effects	Y
Adjusted R-square	0.2106
No. of Obs	21,313

This table estimates the dynamic effects of the FDAAA on insider trading profits. PropPhaseII*$Before^{3}$; PropPhaseII *$Before^{2}$; PropPhaseII *$Period^{0}$; PropPhaseII *$After^{1}$; PropPhaseII*$After^{2}$ are the interaction of treatment variable and indicator variables which present period relative to the closure timing. For example, $Before^{2}$ ($After^{2}$) is equal to 1 for year -2 (year +2), i.e., two years before (after) the passage of the FDAAA, and 0 otherwise. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.

Table 4 Cross-Sectional Variation in Effect of the FDAAA on Insider Trading Profits: Investor Uncertainty

	Dependent Variable: TradingProfit			
	(1)	(2)	(3)	(4)
	EX_SUE		*EX_VOLA*	
	Low	High	Low	High
*PropPhaseII*FDAAA*	-0.0141	-0.0489***	-0.0327***	-0.0561***
	(-1.52)	(-3.30)	(-3.22)	(-4.18)
ResWin	-0.0225***	0.0030	-0.0144***	-0.0069
	(-5.29)	(0.52)	(-3.09)	(-1.22)
FirmSize	0.0789***	0.0478***	0.0795***	0.0591***
	(8.31)	(4.30)	(6.41)	(5.74)
Leverage	-0.1711***	0.0342	-0.0642*	-0.0505*
	(-4.64)	(1.26)	(-1.85)	(-1.91)
SalesGrowth	0.0371***	-0.0037	-0.0070**	0.0053*
	(4.88)	(-1.49)	(-1.99)	(1.67)
BTM	-0.0053	-0.0154	0.1163***	-0.0956***
	(-0.15)	(-0.52)	(3.57)	(-3.11)
RET	-0.0670***	-0.0844***	-0.0538***	-0.0840***
	(-7.85)	(-13.05)	(-6.07)	(-13.11)
ROA	0.0030	0.0213	-0.0758**	0.0065
	(0.08)	(1.02)	(-2.09)	(0.33)
Bid_Ask	17.9640***	4.9945***	3.1610	7.6982***
	(6.90)	(4.48)	(1.44)	(6.89)
log(1+Age)	0.0150	-0.0593**	0.0232	0.0014
	(0.48)	(-2.17)	(0.89)	(0.04)
log(1+Analysts)	0.0179*	-0.0173	-0.0231**	-0.0118
	(1.67)	(-1.17)	(-2.07)	(-0.81)
Intercept	-0.6714***	-0.0903	-0.5939***	-0.2937***
	(-6.65)	(-1.34)	(-7.02)	(-3.60)
Firm Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Adjusted R-square	0.1994	0.2210	0.1818	0.2348
No. of Obs	10,163	10,253	10,041	9,967
Difference in Coefficients	-0.035**		-0.023*	
P-Value	0.021		0.082	

This table presents results of the effect of the FDAAA on insider trading profits conditional on investor uncertainty. In columns (1) and (2), I partition the sample based on whether the firm's *EX_SUE* exceeds the year median. In columns (3) and (4), I partition the sample based on whether the firm's *EX_VOLA* exceeds the year median. The empirical p-value for the difference in coefficients is estimated through a bootstrapping procedure with 1,000 repetitions. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.

Table 5 Cross-Sectional Variation in Effect of the FDAAA on Insider Trading Profits: Information Environment

	Dependent Variable: TradingProfit			
	(1)	(2)	(3)	(4)
	Analyst Following		*Institutional Ownership*	
	Highly opaque	Less opaque	Highly opaque	Less opaque
PropPhaseII_FDAAA	-0.0817***	-0.0012	-0.0884***	-0.0192**
	(-4.32)	(-0.14)	(-5.16)	(-1.99)
ResWin	-0.0081	-0.0092**	-0.0098	-0.0112***
	(-1.37)	(-2.26)	(-1.62)	(-2.78)
FirmSize	0.0829***	0.0321***	0.0912***	0.0220**
	(5.30)	(3.17)	(6.14)	(2.08)
Leverage	0.0671	-0.1184***	-0.0384	-0.0290
	(1.37)	(-5.22)	(-0.86)	(-1.18)
SalesGrowth	0.0053*	0.0075**	0.0038	0.0014
	(1.67)	(2.12)	(1.17)	(0.45)
BTM	0.0346	-0.1163***	0.0353	0.0748**
	(1.13)	(-4.34)	(1.16)	(2.49)
RET	-0.0430***	-0.1496***	-0.0312***	-0.1318***
	(-6.37)	(-19.79)	(-4.23)	(-17.75)
ROA	-0.0405	0.0827***	-0.0596**	0.0627***
	(-1.60)	(3.66)	(-2.37)	(2.58)
Bid_Ask	5.7802***	14.5840***	7.1291***	19.5481***
	(5.21)	(3.12)	(6.47)	(5.30)
log(1+Age)	-0.0216	-0.0020	-0.0270	0.1522***
	(-0.70)	(-0.08)	(-0.96)	(4.74)
log(1+Analysts)	-0.0389**	-0.0044	-0.0028	0.0033
	(-2.17)	(-0.32)	(-0.17)	(0.29)
Intercept	-0.3353***	-0.1853**	-0.4661***	-0.5753***
	(-3.73)	(-2.13)	(-4.84)	(-6.24)
Firm Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Adjusted R-square	0.2309	0.2429	0.2367	0.2444
No. of Obs	10,531	10,782	10,617	10,696
Difference in Coefficients	-0.080***		-0.069***	
P-Value	<0.001		<0.001	

This table presents results of the effect of the FDAAA on insider trading profits conditional on investor uncertainty. In columns (1) and (2), I partition the sample based on whether the firm's *Analyst following* exceeds the year median. In columns (3) and (4), I partition the sample based on whether the firm's *Institutional ownership* exceeds the year median. The empirical p-value for the difference in coefficients is estimated through a bootstrapping procedure with 1,000 repetitions. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.

Table 6 Cross-Sectional Variation in Effect of the FDAAA on Insider Trading Profits: The Characteristics of Clinical Results

	Dependent Variable: TradingProfit					
	(1)	(2)	(3)	(4)	(5)	(6)
	Detail_Infor		*Completion_Degree*		*Submit_Time*	
	Low	High	Low	High	Early	Late
PropPhaseII_FDAAA	0.1807***	-0.0978*	0.1158	-0.0590**	-0.1912*	-0.0503
	(3.47)	(-1.80)	(1.58)	(-1.98)	(-1.95)	(-0.65)
ResWin	-0.0153	0.0015	-0.0052	-0.0161**	-0.0063	-0.0408***
	(-1.49)	(0.19)	(-0.66)	(-2.29)	(-0.71)	(-3.74)
FirmSize	0.1140***	0.0751***	0.0663***	0.0862***	0.0577*	-0.0513
	(4.00)	(2.83)	(3.27)	(4.47)	(1.92)	(-1.26)
Leverage	-0.0486	-0.0294	-0.0650	-0.0884**	-0.0845	0.0355
	(-0.68)	(-0.63)	(-1.17)	(-2.24)	(-0.91)	(0.53)
SalesGrowth	-0.0295**	-0.0023	-0.0153**	0.0069	0.0227	0.0136*
	(-2.47)	(-0.38)	(-2.18)	(1.26)	(1.47)	(1.78)
BTM	-0.2563***	0.1478**	-0.1292***	0.0102	0.0069	0.3195***
	(-2.84)	(2.54)	(-2.91)	(0.19)	(0.06)	(5.13)
RET	-0.1301***	0.0015	-0.1008***	-0.0915***	-0.0805***	-0.0275**
	(-8.80)	(0.09)	(-9.32)	(-9.03)	(-3.65)	(-2.22)
ROA	0.1166***	-0.0898**	0.0444	-0.0635**	-0.0066	0.0680
	(2.65)	(-2.25)	(1.20)	(-2.15)	(-0.13)	(1.07)
Bid_Ask	17.5378***	-0.2985	10.8047***	14.0106***	7.6884	15.8121***
	(5.27)	(-0.10)	(4.73)	(4.89)	(1.47)	(3.60)
log(1+Age)	0.1845**	0.2845***	0.0043	0.0606	-0.1341	-0.1245
	(2.29)	(4.71)	(0.07)	(1.39)	(-1.36)	(-1.51)
log(1+Analysts)	0.0651*	-0.1308***	-0.0293	-0.0908***	-0.1462***	0.2109***
	(1.90)	(-4.63)	(-1.24)	(-3.63)	(-3.06)	(4.89)
Intercept	-1.1825***	-0.8311***	-0.3146*	-0.4732***	0.2840	0.1143
	(-5.20)	(-4.18)	(-1.94)	(-4.42)	(0.99)	(0.34)
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Adjusted R-square	0.2555	0.3137	0.1873	0.2729	0.2506	0.2777
No. of Obs	3216	3498	4864	5244	2309	2593
Difference in Coefficients	0.278***		0.175***		0.278*	
P-Value	*<0.001*		*<0.001*		*0.067*	

This table presents results of the effect of the FDAAA on insider trading profits conditional on characteristics of clinical results. In columns (1) and (2), I partition the sample based on whether the firm's *Detail_Infor* exceeds the year median. In columns (3) and (4), I partition the sample based on whether the firm's *Completion_Degree* exceeds the year median. In columns (5) and (6), I partition the sample based on whether the firm's *Submit_Time* exceeds the year median. The empirical p-value for the difference in coefficients is estimated through a bootstrapping procedure with 1,000 repetitions. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.

Table 7 Additional Test in Effect of the FDAAA on Insider Trading Profits: Routine Trades and Non-routine Trades

	Dependent Variable: TradingProfit	
	(1)	(2)
	Routine trades	*Non-routine trades*
PropPhaseII_FDAAA	-0.0467	-0.0409***
	(-1.05)	(-4.90)
ResWin	0.0138	-0.0099***
	(0.51)	(-2.73)
FirmSize	0.0169	0.0662***
	(0.25)	(8.65)
Leverage	-0.4183***	-0.0151
	(-3.75)	(-0.69)
SalesGrowth	-0.0093	-0.0005
	(-0.37)	(-0.23)
BTM	0.1232	-0.0191
	(0.64)	(-0.85)
RET	-0.2406***	-0.0725***
	(-8.55)	(-14.08)
ROA	-0.0785	0.0184
	(-0.65)	(1.09)
Bid_Ask	-10.2734	7.5725***
	(-0.91)	(7.50)
log(1+Age)	0.4246**	-0.0016
	(2.51)	(-0.09)
log(1+Analysts)	-0.1075*	-0.0054
	(-1.83)	(-0.58)
Intercept	-0.9354**	-0.3963***
	(-2.20)	(-7.30)
Firm Fixed Effects	Y	Y
Year Fixed Effects	Y	Y
Adjusted R-square	0.7238	0.2095
No. of Obs	438	20,767

This table presents results of the impact of the FDAAA on insider trading profits when there is heterogeneity in insider trade characteristics. In columns (1) and (2), I categorize insider trades as routine or non-routine trades respectively. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.

Table 8 Additional Results: Trade Size and Trade Frequency

Dependent Variable	*Trade Size*	*Trade Frequency*
	(1)	(2)
PropPhaseII_FDAAA	1.1516	-0.0462
	(0.47)	(-1.62)
ResWin	2.5735**	-0.0341**
	(2.26)	(-2.53)
FirmSize	-2.0433	-0.0436*
	(-0.91)	(-1.79)
Leverage	1.6592	-0.0706
	(0.34)	(-1.22)
SalesGrowth	0.1784	0.0046
	(0.31)	(0.82)
BTM	9.7138*	-0.0149
	(1.66)	(-0.30)
RET	2.6673**	0.0404***
	(2.32)	(3.39)
ROA	-1.2550	-0.1420***
	(-0.26)	(-2.99)
Bid_Ask	126.2352	3.5056
	(0.39)	(1.30)
log(1+Age)	-2.0421	-0.0580
	(-0.33)	(-0.98)
log(1+Analysts)	-8.7269***	0.0854***
	(-3.16)	(3.06)
Intercept	45.1248***	1.5706***
	(2.71)	(8.41)
Firm Fixed Effects	Y	Y
Year Fixed Effects	Y	Y
Adjusted R-square	0.1962	0.1401
No. of Obs	21,313	21,313

This table presents results of the impact of the FDAAA on trade size and trade frequency. In columns (1) and (2), I use *Trade Size* and *Trade Frequency* as dependent variable. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.

Table 9 Robustness Tests

	Dependent Variable: TradingProfit						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	90 days	120 days	Purchases	Sales	Financial Crisis	Effective Date	New Treat
PropPhaseII_FDAAA	-0.0232**	-0.0397***	-0.1072***	-0.0319***	-0.0518***	-0.0436***	-0.0342***
	(-1.99)	(-3.91)	(-3.98)	(-4.11)	(-4.88)	(-4.40)	(-4.80)
ResWin	0.0017	-0.0056	0.0008	-0.0057*	-0.0170***	-0.0043	-0.0084**
	(0.33)	(-1.26)	(0.07)	(-1.71)	(-4.31)	(-1.09)	(-2.32)
FirmSize	0.0663***	0.0658***	0.0193	0.0517***	0.0510***	0.0725***	0.0655***
	(6.00)	(6.81)	(0.80)	(6.74)	(4.86)	(8.55)	(8.65)
Leverage	0.0592*	0.0157	-0.3197***	-0.0160	-0.0801***	0.0322	-0.0324
	(1.89)	(0.61)	(-5.29)	(-0.81)	(-2.72)	(1.36)	(-1.50)
SalesGrowth	0.0089***	0.0068**	-0.0108**	-0.0013	0.0098***	0.0011	0.0004
	(2.73)	(2.41)	(-2.17)	(-0.50)	(3.63)	(0.38)	(0.17)
BTM	-0.0394	-0.0792***	-0.2363***	0.0318	-0.0652**	-0.0260	-0.0222
	(-1.34)	(-3.14)	(-5.49)	(1.43)	(-2.03)	(-1.07)	(-1.00)
RET	-0.0922***	-0.0799***	0.1310***	-0.1365***	-0.1124***	-0.0575***	-0.0728***
	(-12.95)	(-13.18)	(10.74)	(-27.91)	(-17.53)	(-10.35)	(-14.27)
ROA	-0.0615**	-0.0391*	-0.0673*	-0.0213	0.0403*	-0.0057	0.0015
	(-2.45)	(-1.81)	(-1.86)	(-1.15)	(1.84)	(-0.30)	(0.09)
Bid_Ask	8.4287***	7.5810***	3.2859**	2.6435	9.9213***	6.1466***	7.7039***
	(6.03)	(6.33)	(2.41)	(1.59)	(3.60)	(5.61)	(7.86)
log(1+Age)	0.0552**	0.0253	0.0808*	0.0281	-0.1279***	0.0510**	0.0059
	(2.03)	(1.10)	(1.72)	(1.46)	(-4.21)	(2.48)	(0.32)
log(1+Analysts)	-0.0268**	-0.0258**	-0.0807***	0.0285***	0.0407***	-0.0211**	-0.0090
	(-2.08)	(-2.35)	(-3.32)	(3.18)	(3.41)	(-2.08)	(-1.00)
Intercept	-0.5020***	-0.4137***	-0.0313	-0.4454***	-0.0740	-0.5350***	-0.4038***
	(-6.41)	(-6.30)	(-0.21)	(-7.89)	(-0.90)	(-9.11)	(-7.66)
Firm Fixed Effects	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y
Adjusted R-square	0.1724	0.1947	0.3826	0.3134	0.2606	0.2351	0.2092
No. of Obs	21,313	21,313	3,978	17,335	14,598	17279	21,313

This table presents results of the robustness tests for main results. In columns (1) and (2), I use alternative variables to measure insiders' trading profits. In columns (3) and (4), I group insider trading by buying and selling. In columns (5), I exclude observations during the financial crisis (i.e., 2008 and 2009). In columns (6), I exclude observations in 2007. In Columns (7), I define the treatment variable in this paper more strictly. The numbers indicated in parentheses below the coefficients represent the t-values derived from heteroskedasticity-consistent standard errors, which are clustered at both the transaction date and firm level. The significance levels are denoted by *, **, and ***, representing 10%, 5%, and 1% significance, respectively.