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SOPHISTICATED INVESTORS AND MARKET EFFICIENCY: EVIDENCE FROM A NATURAL EXPERIMENT

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Sophisticated Investors and Market Efficiency: Evidence from a Natural Experiment
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ABSTRACT

We study how sophisticated investors, when faced with changes in information environment, adjust their information acquisition and trading behavior, and how these changes in turn affect market efficiency. We find that, after exogenous reductions of analyst coverage due to closures of brokerage firms, hedge funds scale up information acquisition. They trade more aggressively and earn higher abnormal returns on the affected stocks. Moreover, the participation of hedge fund significantly mitigates the impairment of market efficiency caused by coverage reductions. Our results show a substitution effect between sophisticated investors and public information providers in facilitating market efficiency in a causal framework.

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Information plays a key role for the efficiency of security markets and the real economy (e.g., Hayek, 1945; Fama, 1965). The information environment is continuously evolving at both the market and firm levels. For example, Regulation Fair Disclosure and the Dodd-Frank Act in the U.S. and the MiFID II in Europe have had wide-ranging impacts on how information is transmitted in the marketplace. In addition, substantial variation exists across firms regarding how and what information is disseminated into the market. Over the past four decades, institutional investors have become the dominant player in the U.S. financial markets (e.g., French, 2008). Hedge funds, in particular, represent the (arguably) most sophisticated investors (e.g., Brunnermeier and Nagel, 2004) and they add value to the financial system in a number of ways (e.g., Brown, Kacperczyk, Ljungqvist, Lynch, Pedersen, and Richardson, 2009). Motivated by these observations, we attempt to address the following questions: How do sophisticated investors alter their behavior in response to changes of information environment? And how do their actions in turn affect market efficiency?

Understanding sophisticated investors' reactions to changes of information environment is important for at least three reasons. First, it speaks directly to how sophisticated investors trade and profit from information advantage (e.g., Grossman and Stiglitz, 1980). Second, it sheds light on the way markets incorporate information that is not accessible to all participants (e.g., Fama, 1970). Third, it helps us better understand the interactions between different types of information processors (e.g., sell-side analysts and hedge funds) in financial markets.

The impacts of changes of information environment on sophisticated investor behavior are theoretically ambiguous. On one hand, sophisticated investors will have a greater comparative advantage when information available to other market participants becomes noisier. Thus, faced with a more opaque information environment, sophisticated investors may have greater incentives to acquire information and trade in security markets. On the other hand, if sophisticated investors are concerned about adverse selection in trading, they may trade less actively when the information environment becomes murky. Thus, how changes of information environment affect sophisticated investors is ultimately an empirical question.

It is, however, a challenging task to empirically investigate the above relation. There is a reverse causality problem as the activities of sophisticated investors can change firms' information environment. For example, institutional investors may demand that firms change their disclosure policies. Moreover, there is likely to be an omitted variable problem. For example, when there are important corporate events, such as mergers and acquisitions, the coverage decisions of sell-side analysts and the trading activities of sophisticated investors can change simultaneously.

To overcome these endogeneity challenges, we exploit a natural experiment: the exogenous reductions of sell-side analysts due to closures and mergers of brokerage firms (Hong and Kacperczyk, 2010; Kelly and Ljungqvist, 2012). As documented in Kelly and Ljungqvist (2012), such closures and mergers are driven by adverse regulatory changes and unfavorable business conditions in the equity research industry, instead of the prospects of the affected stocks.[1] Thus, closure and merger-related coverage reductions provide credible exogenous shocks to firms' information environment. We study how hedge funds, as a proxy for sophisticated investors, respond to the coverage reductions by adjusting their information acquisition and trading activities. We also examine the changes in hedge funds' profitability on the affected stocks and the impacts of their activities on market efficiency.

We assemble our sample by merging several datasets covering brokerage closures, hedge fund stock holdings, EDGAR Internet search traffic, analyst coverage, earnings conference call transcripts, as well as stock prices and characteristics. Our hedge fund holdings data are obtained from quarterly 13F filings in which hedge fund companies are identified by manually matching 13F institutions' names with a list of hedge fund

[1] Similar changes to the equity research industry are taking place in Europe currently. The Markets in Financial Instruments Directive (MiFID II) regulation, effective in the European Union (EU) on January 3, 2018, bans the usage of soft dollar commissions and requires institutional investors to pay banks and brokers directly for research. This policy will affect the equity research industry, leading to changes in information environment. For details of MiFID II, see the website of the European Securities and Markets Authority (ESMA) https://www.esma.europa.eu/policy-rules/mifid-ii-and-mifir.

company names compiled from several commercial hedge fund databases (Lipper TASS, HFR, CISDM, Bloomberg, Barclay Hedge, and Morningstar) and other online sources.

Our analyses generate four sets of main findings. First, after exogenous reductions of analyst coverage, stock price efficiency significantly decreases for the affected stocks. To quantify stock market efficiency, we use the post earnings announcement drift (PEAD), a phenomenon that prior research has shown to be related to mispricing (e.g., Ball and Brown, 1968; Bernard and Thomas, 1989). As robustness checks, we also employ variance-ratio-based market efficiency measures (Lo and MacKinlay, 1988) and the price informativeness measure of Bai, Philippon, and Savov (2016). All the three measures provide consistent results.

Second, hedge funds trade more aggressively on the affected stocks around earnings announcements after coverage reductions. Relative to unaffected stocks, abnormal hedge fund holdings of the affected stocks become significantly more sensitive to standardized unexpected earnings (SUE). More precisely, the abnormal holdings of hedge funds are larger (smaller) prior to positive (negative) earnings announcements after coverage reductions. These changes in hedge funds' trading activities are more pronounced when the information environment of the affected stocks is more opaque and when the exited analysts are of higher quality prior to coverage reductions. In addition, hedge fund profitability from the affected stocks increases after coverage reductions, especially for their purchases (i.e., increases in stock holdings).

Third, we provide evidence that sophisticated investors scale up their information acquisition after coverage reductions. We show that buy-side analysts from hedge funds are more likely to participate in earnings conference calls (i.e., asking at least one question during the call) for firms that experience coverage reductions. Moreover, by exploiting a novel dataset of EDGAR Internet search traffic, we find that the search volume for the affected firms increases significantly following the coverage reductions. Importantly, the increase in search volume is especially pronounced from the IP addresses that are more likely to come from hedge funds based on geographic information.

Finally, conditional on high levels of hedge fund participation after coverage reductions, the impairment of market efficiency is mitigated for the affected stocks, and in fact, the net change in measures of market efficiency is indistinguishable from zero. This finding is robust to all the three measures of market efficiency (i.e., PEAD, variance ratios, and price informativeness). Our evidence suggests that, when the information environment becomes murky, increased hedge fund participation helps to facilitate market efficiency.

Overall, our results reveal a substitution effect in information provision between sophisticated investors and public information providers. Information acquisition is costly even for sophisticated investors (e.g., Grossman and Stiglitz, 1980). When more analysts provide information, the gain from costly information acquisition becomes smaller and thus sophisticated investors may choose to participate less. When fewer analysts are at work and the information environment becomes more opaque, sophisticated investors have incentive to increase their market participation due to larger information advantage. Therefore, sophisticated investors' decisions on information acquisition depend on the amount of information supplied by other information providers (such as sell-side analysts), which implies substitution among information processors.

In our analyses, we use hedge funds to proxy for sophisticated investors. In practice, other types of institutional investors can actively participate in the market as well. To gain additional insight, we look at trading patterns of non-hedge-fund institutions (mutual funds, banks, insurance companies, investment advisors, and others). We find that these institutions exhibit little change in their trading activities in reaction to analyst reductions. In particular, their holdings of the affected stocks do not appear to be more informative after the shock to the information environment.

Our paper makes several contributions to the literature. First, our study adds to the research on the relation between information environment and sophisticated investors. Kacperczyk and Seru (2007) show that more skilled fund managers rely less on public information produced by sell-side analysts. Complementing their findings, we show that hedge funds scale up information acquisition and trade more aggressively after exogenous exits of analysts. Our findings are also consistent with Griffin and Xu (2009), who find that hedge funds prefer opaque stocks that are less analyzed, plausibly to enjoy larger information advantage. In addition, our results are in accordance with theoretical studies that predict a substitution effect between the acquisition of private information and the supply of public information (e.g., Verrecchia, 1982; Diamond, 1985; Goldstein and Yang, 2017, 2018). To our best knowledge, our paper is the first to document such a substitution effect empirically in a causal framework.

The substitution effect we document has relevancy for policy decisions. It implies that policies designed to increase the supply of public information can potentially crowd out sophisticated investors' acquisition of private information. Thus, if there is a positive (negative) externality associated with private information acquisition by sophisticated investors relative to public information production, our findings point to a subtle side effect of regulations that raise (lower) requirements for public information provision. Examples of potential externalities include herding in information acquisition (e.g., Froot, Scharftein, and Stein, 1992; Devenow and Welch, 1996) and effects on market quality (e.g., Stein, 1987; Kacperczyk, Nosal, and Sundaresan, 2018). A detailed analysis of potential externalities is an interesting question for future research.

Second, our paper contributes to the literature on the role of sophisticated investors (in particular, hedge funds) in market efficiency, as raised in a theoretical context by Stein (2009). Existing research shows that hedge funds exploit security mispricing and improve market efficiency (e.g., Akbas, Armstrong, Sorescu, and Subrahmanyam, 2015; Cao, Chen, Goetzmann, and Liang, 2016; Cao, Liang, Lo, and Petrasek, 2016). Aragon and Strahan (2012) find that negative shocks to funding liquidity of hedge funds reduces market liquidity of the assets they trade, a topic also studied by Nagel (2012). In this paper, we present new evidence that in the presence of exogenous shocks to public information provision, hedge funds substitute sell-side analysts in facilitating market efficiency by trading on acquired information. In a broad sense, our study is related to Lo (2017) who describes how adaptation to environment changes influences economic agents' behavior and market efficiency.

Finally, our paper contributes to the literature on the role of sell-side analysts in information production and market efficiency (e.g., Brennan, Jegadeesh, and Swaminathan, 1993; Womack, 1996; Hong, Lim, and Stein, 2000; Barber, Lehavy, McNichols, and Trueman, 2002; Jegadeesh, Kim, Krische, and Lee, 2004; Hong and Kacperczyk, 2010; Loh and Stulz, 2011). We find that market efficiency is impaired after exogenous reductions of sell-side analysts, suggesting that sell-side analysts contribute to price discovery. Our study is also related to Wu (2016) who shows that, after closures of brokerage firms, corporate insiders earn higher abnormal returns on the affected stocks. Unlike sophisticated investors, however, corporate insiders have access to private information at no cost, and their decision is simply whether to trade on private information or not. In addition, insiders whose trading volume is much smaller than that of institutional investors are less likely to have substantial impacts on market efficiency.

The rest of the paper is organized as follows. Section I describes the data. Section II presents our main results. In Section III, we perform additional analyses and robustness checks. Finally, Section IV provides some concluding remarks.

I. Data

A. Closures of Brokerage Firms

The dataset of analyst reductions in this paper is the same as the one in Kelly and Ljungqvist (2012). The reductions of analyst coverage result from a total of 43 closures and mergers (21 stand-alone closures and 22 mergers) of research departments of various brokerage firms between 2000 and 2008, which leads to 4,429 coverage reductions affecting 2,180 different stocks.[2] The data extend the sample of Hong and Kacperczyk (2010) which only contains merger-related coverage reductions.

[2] The data come from three sources: the coverage table of Reuters Estimates; the I/B/E/S stop file; and termination notices sent to brokerage clients, which can be retrieved from Investext.

As documented in Kelly and Ljungqvist (2012), it is unfavorable market changes that have driven the closures and mergers of research departments. Given the difficulty in keeping research reports as private information, brokerage firms usually provide them to clients free of charge. As a result, research departments have been heavily subsidized by revenue from other businesses including trading activities ("soft dollar commissions"), market making, and investment banking. Since the early 2000s, however, these revenue sources experienced severe challenges: soft dollar commissions were criticized by the Securities and Exchange Commission (SEC) and institutional clients; market making revenue shrank due to fierce competition for order flow; and new regulations (e.g., the 2003 Global Settlement) made it difficult to use investment banking revenue to subsidize research. Facing such adverse economic conditions, many brokerage firms exited the equity research industry.

Previous studies show that closure and merger-related coverage reductions are not driven by private information of firm prospects. Coverage reductions have no predictive power over future earnings of the affected stocks (Hong and Kacperczyk, 2010; Kelly and Ljungqvist, 2012). Moreover, these coverage reductions increase information asymmetry and make firms' information environment more opaque (Kelly and Ljungqvist, 2012; Johnson and So, 2017). Consequently, closure and merger-related reductions of analyst coverage generate credible exogenous variation to firms' information environment, which allows us to examine the impacts of the information environment on the behavior of sophisticated investors in a causal framework.

Our analysis uses difference-in-differences methods. Following Kelly and Ljungqvist (2012), we match each treated firm with up to five control firms that do not experience coverage reductions one year before and after the termination dates of the treated firm. We require the control firms to be in the same Fama-French 48 industry and in the same Fama-French size and book-to-market quintiles as the treated firms. If more than five candidate firms exist, we choose those that are closest to the treated firm in terms of the average bid-ask spreads that measure the level of information asymmetry prior to coverage reductions.

We merge I/B/E/S data with the coverage reduction data, and keep the earnings announcements for the treated and control firms two years before and two years after the coverage reductions. We focus on treated firms with five or fewer analysts prior to coverage reductions so that the drop of one analyst will have nontrivial impacts on firms' information environment. The merged dataset consists of 372 treated firms and 631 control firms, and spans 1997 to 2010. Table 1 presents the summary statistics prior to coverage reductions. We find that firm characteristics and various outcome variables are comparable between the treated firms and the control firms prior to coverage reductions, suggesting that the matching procedure is reasonable.[3] Later in Section III, we examine the dynamic effects of the coverage reductions using a regression analysis. We find that the impacts of coverage reductions are only present post treatment, providing further support for the parallel trend assumption in the difference-in-differences setting.

[Insert Table 1 about here]

B. Hedge Fund Stock Holdings

Our data of hedge fund stock holdings are constructed following Brunnermeier and Nagel (2004), Griffin and Xu (2009), and Cao, Chen, Goetzmann, and Liang (2016). The data are assembled by manually matching the Thomson Reuters 13F institutional holdings data with a comprehensive list of hedge fund company names.[4] The list of hedge fund company names comes from the union of six hedge fund databases, namely Lipper TASS, HFR, CISDM, Bloomberg, Barclay Hedge, and Morningstar. Hedge funds were exempt from registering with the SEC over our sample period.[5] However, hedge fund

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[3] The only exception is firm size, which has a mean value of $358 ($290) million for the treated (control) firms. All of our analyses control for firm size.

[4] The 13F data cover long positions only, since short positions are not required by the SEC to be disclosed. To study the impacts of hedge fund short positions on market efficiency surrounding analyst coverage reductions, we use the aggregate short interest at a proxy. According to Goldman Sachs (2010), 85% of all equity short positions going through their brokerage house come from hedge funds.

[5] The Dodd-Frank Act, effective since 2012, requires large hedge fund management companies to register with the SEC.

management companies managing more than $100 million are required to file quarterly disclosures of their holdings of stock positions greater than 10,000 shares or $200,000 in market value.

Since the 13F filings data do not indicate which institutions are hedge fund companies, we identify hedge fund companies through a three-step procedure. As the first step, 13F institutions are matched with the list of company names from the six hedge fund databases. Second, among the matched institutions, we assess whether hedge fund management is their primary business. We check whether they are registered with the SEC. Since registration with the SEC is only necessary when conducting non-hedge fund businesses (e.g., mutual fund management), those institutions unregistered with the SEC are included as hedge funds in our sample, following Brunnermeier and Nagel (2004). On the other hand, if a matched institutional investor has registered with the SEC and thus filed Form ADV, we follow Brunnermeier and Nagel (2004) and Griffin and Xu (2009) to include it only if the following two criteria are both satisfied: over 50% of its investment is listed as "other pooled investment vehicle" (private investment companies, private equity, and hedge funds) or over 50% of its clients are high-net-worth individuals, and the adviser charges performance-based fees. In the third step, to address the concern that some hedge fund companies may not report to any database voluntarily, we manually check the company websites and other online sources for the unmatched 13F institutions to decide whether they are hedge fund companies. The final sample covers 1,279 hedge fund management companies over the period 1997-2010.

For each stock in our sample, we compute its quarterly hedge fund holdings as the number of shares held by all hedge fund companies at the end of the quarter divided by the total number of shares outstanding. If the stock is not held by any hedge fund company, its holdings are set to zero. We define abnormal hedge fund holdings as the current quarter holdings minus the average holdings in the past four quarters. Although abnormal hedge fund holdings are correlated with changes in hedge fund ownership from the one quarter to the next, they better capture quarterly variation in hedge fund trading activities relative to the trend. For comparison purposes, we also compute the holdings from other types of institutional investors (including mutual funds, banks, insurance companies, and others). We refer to their stock holdings as non-hedge fund holdings in our paper.

C. Participation of Buy-Side Analysts in Earnings Conference Calls

The data of conference call transcripts come from the FD (Fair Disclosure) Wire database provided by LexisNexis. The sample provides broad coverage for companies listed in the S&P 1500 index and the Russell 2000 index from 2001 onward. The conference call transcripts list analysts who ask at least one question during the call, together with their affiliations. Following Jung, Wong and Zhang (2017), we identify buy-side analysts by matching the analyst affiliations to the names of institutional investors in the Thomson Reuters 13F filings. We further categorize buy-side analysts into hedge fund analysts and non-hedge fund analysts based on the hedge fund names in our hedge fund holdings data.

D. EDGAR Internet Search Volume

The SEC assembles information on the web search traffic for EDGAR filings covering the period from February 2003 onward.[6] Each log entry provides: (1) the IP address of the requesting user, with the final (fourth) octet of the IP address replaced with a unique set of three letters, (2) the date and time of the request, (3) the CIK of the company that filed the request form, and (4) a link to the particular filing. Recent work (e.g., Drake, Roulstone, and Thornock, 2015) has described this dataset in detail.

We merge the EDGAR Internet search traffic data with the coverage reduction data. To test whether investors acquire more information from EDGAR after exogenous reductions of analyst coverage, we compute the monthly search volume for the treated firms and the matched control firms two years before and after the reductions of analyst

[6] The EDGAR log file data are available from https://www.sec.gov/dera/data/edgar-log-file-data-set.html

coverage.[7] We also compute the search volume for individual types of firm filings, including 10-K, 10-Q, 8-K, insider filings (Forms 3, 4, and 5), and other types of filings.

To further test whether sophisticated investors are more likely to increase their information acquisition via EDGAR after the reductions of analyst coverage, we merge the IP addresses in the EDGAR Internet search traffic data with a geolocation IP database (IP2Location™), which provides geographic information (e.g., country, state, city, zip code, latitude, and longitude) associated with each IP addresses. Based on the first three octets of the IP addresses in the SEC data, we match 89% IP addresses (78% of the visits) to unique latitude/longitude pairs (accurate to 0.1 km × 0.1 km). The latitude and longitude associated pairs with the matched IP addresses are invariant to the values of the final (fourth) octets of the IP addresses. For each matched IP address located in the U.S., we further compute its geographical distance to the nearest hedge fund based on its latitude/longitude pair and the physical addresses of hedge funds collected from the SEC 13F filings. We sort web visits to the EDGAR server into two groups based on the distance. For each distance group, we compute the monthly search volume two years before and after the coverage reductions.

E. Short Interest, Analyst Forecasts, Earnings Guidance, and Other Data Sources

We also employ short interest data in our analysis since hedge funds routinely hold short positions in stocks. Short interest data are from the Compustat Short Interest file, which reports monthly short interest for stocks listed on the NYSE, AMEX, and NASDAQ. Because the Compustat Short Interest file only started coverage on NASDAQ stocks from 2003, we supplement the Compustat data with the short interest data obtained from the NASDAQ exchange. Short interest data have been widely used in prior research to examine the impacts of short selling on stock prices (e.g., Asquith, Pathak, and Ritter, 2005; Diether, Lee, and Werner, 2008).

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[7] Search requests for the EDGAR data can come from automated webcrawlers rather than human beings. Following Drake, Roulstone, and Thornock (2015), we filter out automated webcrawlers using two criteria: (1) no more than five requests per minute per IP address, and (2) no more than 1,000 requests per day per IP address. We exclude the IP addresses that access more than five filings in a minute or more than 1,000 filings during the day.

Finally, we also use data from several other standard sources. Stock returns data are from the Center for Research in Security Prices (CRSP). Accounting data are from Compustat. In addition, analyst forecasts data and earnings guidance data are from I/B/E/S.

II. Main Results

A. The Impacts of Exogenous Reductions of Analyst Coverage on Market Efficiency

We start our analyses by examining the impacts of coverage reductions on market efficiency. We use three different measures for market efficiency: post earnings announcement drift (PEAD), variance ratios (Lo and MacKinlay, 1988), and price informativeness (Bai, Philippon, and Savov, 2016). All three measures provide coherent results. We describe the findings with the PEAD measure in this section and present the results using the other two measures in Section III.

It is well known that sell-side analysts provide information to stock markets. Analysts routinely forecast key results of corporate earnings, engage in conference calls, and interpret the information content of earnings releases. These activities often facilitate price discovery. Brennan, Jegadeesh, and Swaminathan (1993) find that stocks followed by more analysts tend to experience faster price adjustment to new information. Zhang (2008) shows that the magnitude of PEAD reduces significantly when analysts promptly update their forecasts after earnings releases. We hypothesize that the magnitude of PEAD will increase after exogenous reductions of analysts. To test this hypothesis, we perform the following difference-in-differences regression:

$$
\begin{aligned}
CAR\_d1\_dn_{it} = {} & \alpha_i + \alpha_t + \beta_1 Treat_{it} \times Post_{it} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} + \beta_3 Post_{it} \\
& \times SUE_{it} + \beta_4 SUE_{it} + \beta_5 Treat_{it} \times Post_{it} + \beta_6 Treat_{it} + \beta_7 Post_{it} \\
& + \gamma' Controls + \varepsilon_{it},
\end{aligned}
$$

where $CAR\_d1\_dn_{it}$ denotes the return drift after quarterly earnings announcements. It is measured as the cumulative abnormal return from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios.[8] α_i is the firm fixed effects, and α_t is the year-month fixed effects. SUE is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts.[9] $Treat$ is a dummy variable that equals one for firms that experience exogenous reductions of analyst coverage and zero otherwise. $Post$ is a dummy variable that equals one for quarters after the reductions of analyst coverage. In addition, the control variables include natural log of market capitalization ($LnSize$), natural log of the book-to-market ratio ($LnBEME$), natural log of the debt-to-equity ratio ($LnLev$), and lagged two-month returns prior to the earnings announcements ($Ret2mPrior$). We include earnings announcements two years before and two years after the reductions of analyst coverage. We condition our analysis on treated firms with five or fewer analysts prior to the reductions of analyst coverage, because otherwise the decrease of one out of many analysts would be unlikely to have material impacts on a firm's information environment.[10]

[Insert Table 2 about here]

Table 2 presents the results of the difference-in-differences regressioins. As the coefficient of interest, β_1 captures the changes of PEAD after exogenous reductions of analyst coverage. Consistent with our hypothesis, β_1 is significantly positive across different specifications of fixed effects, suggesting that the magnitude of PEAD increases significantly after coverage reductions. According to the regressions (columns 3 and 6) with both firm fixed effects and year-month fixed effects, the sensitivity to SUE increases

[8] Our stock return data come from CRSP. In CRSP, return at a given date t is computed based on the close prices of day t and t-1. For earnings releases that take place in after-hours, we compute the nth day return after earnings using the (n+1)th day return in CRSP.

[9] According to Livnat and Mendenhall (2006), institutional trading reacts more to analyst consensus-based earnings surprises rather than time series-based earnings surprises. Thus, we compute quarterly SUE relative to the analyst forecast consensus. However, our inference is unchanged when we use time-series based earnings surprises (i.e., we use the standard deviation from the time series of earnings surprises as the denominator to compute SUE). In addition, our results hold when we use lagged stock prices as the denominator to compute SUE.

[10] Our results are robust to other cutoff choices (such as 4 and 6) for the number of analysts prior to the coverage reductions.

by 0.24 for the PEAD in a two-day window, while the sensitivity to SUE increases by 0.34 for the drift in a four-day window. For one standard deviation change in SUE (4.13 in our sample), the drop of one analyst leads to 1.0 (0.24 × 4.13) percentage-point additional drift in the two-day window, and 1.4 (0.34 × 4.13) percentage-point additional drift in the four-day window. In addition, the impacts of coverage reductions on PEAD are robust in longer time horizons. As reported in Table IA.1 in the Internet Appendix, after coverage reductions, we observe a more pronounced PEAD in various time horizons ranging from one month to one year. These results suggest that analyst coverage reductions causally lead to impairment of market efficiency.

To examine whether the increase in PEAD is present for both positive and negative earnings announcements, we categorize earnings announcements into three groups: top 25% SUE, middle 50% SUE, and bottom 25% SUE. Table IA.2 reports the results. PEAD increases significantly by 1.50 (1.37) percentage points in the four-day window for the top (bottom) 25% SUE, whereas it changes by only 0.08 percentage point (statistically insignificantly) for the middle 50% SUE. These results confirm that, after exogenous reductions of analyst coverage, PEAD increases for both positive and negative earnings surprises.

B. Changes of Hedge Fund Holdings and Profitability

After exogenous reductions of analyst coverage, firms' information environment becomes murkier (Kelly and Ljungqvist, 2012). While investors who rely on analysts to obtain information find it harder to access information, sophisticated investors with resources and skills to acquire information independently may have greater comparative advantage over other investors. Thus, we hypothesize that hedge funds, as a group of sophisticated investors, will trade more aggressively on the affected stocks to exploit the increased information advantage. To test this hypothesis, we examine the changes of abnormal hedge fund holdings (i.e., hedge fund holdings in a quarter minus the average hedge fund holdings of the past four quarters) using the following regression:

$$
\begin{aligned}
Ab\_Holdings_{it} \\
&= \alpha_i + \alpha_t + \beta_1 Treat_{it} \times Post_{it} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} \\
&+ \beta_3 Post_{it} \times SUE_{it} + \beta_4 SUE_{it} + \beta_5 Treat_{it} \times Post_{it} + \beta_6 Treat_{it} \\
&+ \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{it}.
\end{aligned}
$$

$Ab\_Holdings_{it}$ is abnormal hedge fund holdings at the most recent quarter end prior to quarterly earnings announcements.[11] β_1, as the coefficient of interest, captures the changes of the sensitivity of hedge fund holdings to SUE. Since SUE on the right-hand-side is not public information at the time when $Ab\_Holdings_{it}$ is measured, β_1 represents the changes of hedge fund holdings that are likely driven by private information acquired by hedge funds. The other variables are defined in the previous subsection.

[Insert Table 3 about here]

As shown in columns (1)–(3) of Table 3, β_1 is significantly positive, suggesting that hedge fund holdings become more sensitive to unexpected earnings after coverage reductions. According to the specification with both firm fixed effects and year-quarter fixed effects, the sensitivity of abnormal hedge fund holdings to SUE increases by 0.091. For a one standard deviation increase in SUE (4.13 in our sample), the drop of one analyst leads to 0.38 (0.091 × 4.13) percentage-point increase in abnormal hedge fund holdings, which is roughly 1/8 of the standard deviation of abnormal hedge fund holdings. These results are consistent with the hypothesis that hedge funds trade more aggressively due to increased information advantage.

We also examine the changes of abnormal hedge fund holdings for positive, neutral, and negative earnings announcements. Table IA.3 in the Internet Appendix presents the results. Abnormal hedge fund holdings prior to positive earnings (top 25% SUE) increase by 0.62 percentage point after the reductions of analyst coverage, while abnormal hedge fund holdings prior to negative earnings (bottom 25% SUE) decrease by 0.45 percentage point. The increase of abnormal hedge fund holdings is statistically

[11] Here, hedge fund holdings are at the aggregate level, as we sum up the holdings of individual hedge funds on the same stocks.

significant, while the decrease of abnormal hedge fund holdings is not. The relatively weak result for negative earnings is not surprising because the hedge fund holdings data only cover long positions. While we can observe hedge funds' divestiture of their existing long positions, we do not observe their potential increase of short positions in response to negative earnings.

As a comparison with hedge funds, we examine the stock holdings of other types of institutional investors (such as mutual funds, banks, and insurance companies). Unlike hedge funds, their holdings of the affected stocks do not appear to be more information-driven after analyst coverage reductions. Columns (4)–(6) of Table 3 present the results for the aggregate holdings of non-hedge fund institutions. We find no evidence that these institutions as a whole exhibit an increase in the sensitivity of their holdings to SUE after coverage reductions. Specifically, abnormal holdings of non-hedge funds do not increase (decrease) more prior to positive (negative) earnings after coverage reductions. Table IA.4 in the Internet Appendix further breaks non-hedge fund institutions down to each individual type. None of them shows a significant change in their trading behavior with respect to the affected stocks after coverage reductions.

[Insert Table 4 about here]

To better understand the changes of hedge fund trading activities following coverage reductions, we explore the heterogeneity across the affected stocks and across the exited analysts. Table 4 reports the results. Hedge funds trade more aggressively on the affected stocks when such stocks have smaller size, higher idiosyncratic volatility, and higher bid-ask spreads (see Panel A). These findings are consistent with Griffin and Xu (2009), who find that hedge funds prefer opaque stocks in which they have larger information advantage. In addition, as Panel B of Table 4 shows, hedge funds trade more aggressively on the affected stocks when the exited analysts are of higher quality (measured by their historical forecast accuracy and years of experience on the affected stocks) and when the exited analysts have less workload (measured by the number of stocks they cover right before their exits). These results suggest that hedge funds participate more actively in the affected stocks when there is larger information loss caused by coverage reductions.

We further test whether the profitability of hedge funds increases on the affected stocks after coverage reductions. Since we do not observe individual transactions of hedge funds, we estimate hedge funds' profitability based on their aggregate holdings. We infer the trading direction of hedge funds on a given stock in quarter t based on the change of their aggregate holdings from quarter t-1 to quarter t. An increase (decrease) of the holdings implies hedge fund purchases (sales) during quarter t. We then use difference-in-differences regressions to test the changes of hedge fund profitability after coverage reductions. The outcome variable is stocks' abnormal returns from quarter end t to quarter end t+1 (i.e., three-month holding period), benchmarked by the returns of the corresponding DGTW portfolios (Daniel, Grinblatt, Titman, and Wermers, 1997; Wermers, 2003).[12]

[Insert Table 5 about here]

Panel A of Table 5 presents the regression results. Column (1) shows the three-month cumulative abnormal return on the affected stocks following hedge fund purchases increases by 2.53 percentage points. This increase in profitability is more pronounced among the stocks with larger hedge fund purchases (colume 2). These results suggest that hedge funds earn high abnormal returns from the affected stocks after coverage reductions when they increase their holdings. When hedge funds decrease their holdings, there is no significant changes in profitability after coverage reductions, probably because we do not observe hedge funds' short positions. Our findings are consistent with prior research showing that hedge funds exploit mispricing and earn risk-adjusted returns (e.g., Brown, Goetzmann, and Ibbotson, 1999; Kosowski, Naik, and Teo, 2007; Fung, Hsieh, Naik, and Ramadorai, 2008; Jagannathan, Malakhov, and Novikov, 2010; Titman and Tiu, 2011; Agarwal, Jiang, Tang, and Yang, 2013).

[12] Our results are robust to other holding periods, such as one month and six months.

We also examine the changes in the profitability for non-hedge funds (Panel B of Table 5). When non-hedge funds increase their holdings, the three-month cumulative abnormal return on the affected stocks increases by 1.1 percentage points but this change is statistically insignificant. This result suggests that non-hedge funds as a whole benefit little from the affected stocks after coverage reductions.

C. Information Acquisition of Hedge Funds

We conjecture that sophisticated investors will scale up their information acquisition after the reductions of analyst coverage, which leads to more aggressive trading behavior and higher profitability. In this subsection, we provide direct evidence on the changes of information acquisition of sophisticated investors. In particular, we show that, after the coverage reductions, hedge funds participate more actively in earnings conference calls and they appear to increase web search through the SEC's EDGAR database.

C.1 Information Acquisition via Earnings Conference Calls

Recent studies have shown that buy-side analysts actively participate in earnings conference calls (Call, Sharp, Shohfi, 2017; Jung, Wong and Zhang, 2017). Moreover, institutional investors trade a company's stock more heavily when their buy-side analysts participate in the conference call of this company (Jung, Wong and Zhang, 2017). Thus, conference call participation is a potential channel of information acquisition for institutional investors.

We examine the changes of the participation of buy-side analysts in conference calls. We find that hedge funds are more likely to participate in the conference calls (i.e., asking at least one question) of the affected stocks following coverage reductions. As Panel A of Table 6 shows, the probability of hedge fund participation increases significantly by 5.2 percentage points (columns 1–2). This magnitude is economically significant as the average probability of hedge fund participation is 15.4% in our sample. The results are similar when we examine the number of hedge fund analysts participating in conference calls (columns 3–4). Buy-side analysts from non-hedge funds, however, exhibit no significant change in their participation in conference calls (Panel B of Table 6).

[Insert Table 6 about here]

C.2 Information Acquisition via EDGAR Internet Search

Besides participating in earnings conference calls, investors can acquire information from other channels. In particular, they can access the SEC's EDGAR database that contains mandatory filings from all public firms.[13] Although the EDGAR filings are publicly available to all investors, sophisticated investors can employ their information processing skills to form profitable trading strategies based on the information acquired from EDGAR.[14]

We exploit a novel dataset on Internet search traffic for EDGAR filings, assembled by the SEC and covering the period from February 2003 onward, to examine the investors' information acquisition behavior surrounding the coverage reductions. We find that the search volume for the filings of the treated firms increases significantly following the coverage reductions. As shown in Panel A of Table 7, the EDGAR Internet search volume of the treated firms increases by 11.4% after the drops of analyst coverage, suggesting that investors as a whole scale up their information acquisition when less public information is available. We further break down our analysis to different types of EDGAR filings (10-K, 10-Q, 8-K, insider filings, and others). The increase in web traffic concentrates on insider filings. These results are consistent with previous studies showing that analysts communicate with company management and provide processed information to the public (e.g., Soltes, 2014; Brown, Call, Clement, and Sharp, 2015).

[13] Domestic public companies were phased in to EDGAR filing over a three-year period, ending May 6, 1996. Foreign companies are required to file their documents via EDGAR starting from November 4, 2002.

[14] In concurrent work, Chen, Cohen, Gurun, Lou, and Malloy (2017) and Crane, Crotty, and Umar (2018) find that the EDGAR Internet search activities of sophisticated investors are associated with their trading performance.

After the exits of sell-side analysts, investors pay closer attention to insider filings as a channel to learn private information from company management.

[Insert Table 7 about here].

Do sophisticated investors scale up their information acquisition more than other investors? To shed light on this question, we identify the geographic information (e.g., country, state, city, zip code, latitude, and longitude) of the requesting users by merging the EDGAR log file data with a commercial geolocation IP address database. Although the last (fourth) octets of the IP addresses are masked in the EDGAR log file, we are able to match more than 78% of user requests to unique pairs of latitude/longitude using the first three octets of the IP addresses in the EDGAR log file. The latitude and longitude pairs associated with the matched IP addresses are invariant to the values of the final (fourth) octets of the IP addresses. If sophisticated investors are more likely to enhance their information acquisition following a reduction in the supply of public information, we expect a larger increase in the search volume from the IP addresses that are more likely to come from sophisticated investors. To test this prediction, we perform three sets of analyses, the results of which collectively support our hypothesis.

First, we run the difference-in-differences regressions separately for each state in the U.S. We find that the states with highest percentage increase in their search volume of insider filings are the states with largest presence of sophisticated investors (see Figure IA.1 in the Internet Appendix).[15]

Next, we compute the distance from the geographic location of each U.S.-based IP address to its nearest hedge fund. Based on this distance, we separate the IP addresses into two groups (above and below the median value), and then construct monthly web search volume for these two groups. Consistent with our hypothesis, the increase in the EDGAR Internet search volume mainly comes from the IP addresses whose distance to

[15] The states in the top quintile sorted by the difference-in-differences coefficients are: New York, California, Texas, Illinois, New Jersey, Massachusetts, Colorado, Pennsylvania, Connecticut, and Arizona.

the nearest hedge funds is below the median value, as shown in Panels B and C in Table 7.

Finally, we group the IP addresses based on zip codes and compute the distance from each zip code to its nearest hedge fund. We then examine the relation between this distance and the changes of web search volume after coverage reductions, using the following regression:

$$Ln(ESV_{zit} + 1) = \alpha_i + \alpha_t + \beta_1 Treat_{it} \times Post_{it} \times ln(Distance_z + 1) + \beta_2 Treat_{it} \times Post_{it} + \beta_3 ln(Distance_z + 1) + \beta_4 Post_{it} \times ln(Distance_z + 1) + \beta_5 Treat_{it} \times ln(Distance_z + 1) + \beta_6 Treat_{it} + \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{zit}.$$

Here, ESV_{zit} is the EDGAR Internet search volume for insider filings from zip code z to firm i in month t. $Distance_z$ is the distance from zip code z to its nearest hedge fund. As shown by Table IA.5 in the Internet Appendix, the coefficient β_2 is positive and statistically significant, suggesting that investors from the zip codes where at least one hedge fund locates increase their search volume for insider filings after coverage reductions. The coefficient β_1 is negative and statistically significant, suggesting that the increase in search volume becomes smaller when the zip codes are more distant from hedge funds. Combining the estimates of β_1 and β_2, we find that the net increase in Internet search volume for insider filings is indistinguishable from zero if a zip code is 20 kilometers away from its nearest hedge fund.

Taken together, these results provide evidence that sophisticated investors such as hedge funds scale up their information acquisition when public information providers such as sell-side analysts exit the financial market.

D. Impacts of Hedge Funds on Market Efficiency

We have shown that, after exogenous coverage reductions, hedge funds tend to trade more aggressively on the affected stocks and earn higher abnormal returns. We now investigate whether hedge fund activities can in turn facilitate market efficiency. We present results from the analyses with PEAD as a measure of market efficiency in this subsection, and later in Section III we verify our results using variance ratios (Lo and MacKinlay, 1988) and price informativeness (Bai, Philippon, and Savov, 2016) as alternative market efficiency measures.

Using abnormal hedge fund holdings at the nearest quarter end prior to earnings announcements as a proxy for hedge fund participation, we perform the following regression to examine the impacts of hedge fund participation on PEAD:

$$\begin{aligned} CAR\_d1\_dn_{it} = {} & \alpha_i + \alpha_t + \beta_1 Treat_{it} \times Post_{it} \times D(HF^{++})_{it} \times SUE_{it} + \beta_2 Treat_{it} \times Post_{it} \\ & \times SUE_{it} + \beta_3 Treat_{it} \times D(HF^{++})_{it} \times SUE_{it} + \beta_4 Treat_{it} \times SUE_{it} + \beta_5 Post_{it} \\ & \times D(HF^{++})_{it} \times SUE_{it} + \beta_6 Post_{it} \times SUE_{it} + \beta_7 D(HF^{++})_{it} \times SUE_{it} \\ & + \beta_8 SUE_{it} + \beta_9 Treat_{it} \times Post_{it} \times D(HF^{++})_{it} + \beta_{10} Treat_{it} \times Post_{it} \\ & + \beta_{11} Treat_{it} \times D(HF^{++})_{it} + \beta_{12} Treat_{it} + \beta_{13} Post_{it} \times D(HF^{++})_{it} \\ & + \beta_{14} Post_{it} + \beta_{15} D(HF^{++})_{it} + \gamma' Controls + \varepsilon_{it}. \end{aligned}$$

Here, $D(HF^{++})_{it}$ is a dummy variable that equals one if the abnormal aggregate hedge fund holdings for stock *i* at the nearest quarter end prior to earnings announcements t are in the top quartile of the abnormal hedge fund holdings among all stocks at that particular quarter end.

Table 8 presents the results with β_1 and β_2 as the coefficients of interest. The coefficient β_2 is positive and statistically significant, suggesting that, in the absence of high levels of hedge fund participation, the sensitivity of PEAD (measured by CAR_d1_dn) to SUE increases significantly after coverage reductions. Conditional on high levels of hedge fund participation, however, the increase in the sensitivity of PEAD to SUE becomes smaller, indicated by the negative and significant coefficient β_1. In fact, with high levels of hedge fund participation, the net changes in the magnitude of PEAD after coverage reductions are not significantly different from zero. That is, the sum of β_1 and β_2 is statistically indistinguishable from zero (see the last row of Table 8). Our findings suggest that hedge fund participation is able to restore the impaired market efficiency caused by coverage reductions.

[Insert Table 8 about here].

We further test the impacts of hedge fund participation on PEAD for positive, neutral, and negative earnings announcements. Table IA.6 in the Internet Appendix reports the results. We find that PEAD increases significantly following both positive and negative earnings announcements in the absence of high levels of hedge fund participation. With high levels of hedge fund participation, however, the increase in PEAD disappears following both positive and negative earnings announcements.

Since our hedge fund data come from 13F filings that only contain long positions of institutional investors, the analysis so far has only captured high levels of hedge fund participation through their long positions. To examine the impacts of sophisticated investors on market efficiency to a more complete extent, we also investigate the role of short sellers, about 80% of whom are hedge funds (e.g., Goldman Sachs, 2010). We measure short seller participation around earnings releases using the abnormal short interest at the nearest quarter end prior to earnings announcements. Similar to hedge funds, we find that short seller participation also helps to restore the impaired market efficiency caused by coverage reductions (see Table 9). Our findings are consistent with previous studies showing that short selling contributes to market efficiency (e.g., Asquith, Pathak, and Ritter, 2005; Nagel, 2005; Diether, Lee, and Werner, 2008; Boehmer and Wu, 2012).

[Insert Table 9 about here]

III. Additional Analyses and Robustness Tests

A. Number of Analysts Prior to Coverage Reductions

Our analyses so far have focused on firms with five or fewer analysts prior to the coverage reductions. The rationale is that the reduction of one analyst would have material impacts on such firms relative to those followed by a large number of analysts prior to coverage reductions. We provide explicit evidence to support this rationale in this subsection.

[Insert Table 10 about here]

We first repeat our analysis regarding the impacts of coverage reductions on PEAD for treated firms with six or more analysts. Panel A of Table 10 presents the results. Consistent with our rationale, the impacts of coverage reductions on PEAD are insignificant for treated firms followed by six or more analysts. Next, we test the impacts of hedge fund participation on PEAD. As shown in Panel B of Table 10, there is no change in hedge funds' impacts on PEAD after coverage reductions in treated firms with six or more analysts. Finally, we examine the impacts of coverage reductions on investors' information acquisition for treated firms with six or more analysts. As reported in Table IA.8 in the Internet Appendix, the web traffic to the EDGAR server for such firms shows no sign of increase after coverage reductions.

B. Alternative Measures of Earnings Surprises

Following the literature, we have used SUE to proxy for earnings surprises. Hong and Kacperczyk (2010) find that the optimism biases of analysts, arising from conflicts of interest, increase after coverage reductions due to reduced peer competition. This effect could bias the coefficient estimates in some of our previous analyses related to SUE (e.g., the coefficient on Treat×Post×SUE), because the quality of SUE as a measure of earnings surprises can be compromised.[16]

To mitigate this concern, we use the abnormal return on earnings announcement dates (CAR_d0) as an alternative measure of earnings surprises. By examining the stock market reactions to analyst recommendations, Agarwal and Chen (2008) show that marginal investors can rationally discount analysts' optimism stemming from the

[16] Note that we obtain similar results (see Tables IA.2, IA.3, IA.6, IA.7 in the Internet Appendix) using the alternative specifications based on the dummy variables capturing positive, neutral, and negative SUEs (i.e., D(SUE^{++}), D(SUE^{0}), and D(SUE^{--})). These variables only depend on the relative ranking of SUEs and thus are less likely to be affected by the optimism biases of analysts.

conflicts of interest with investment banking and brokerage businesses.[17] Since the market reaction to earnings announcements reflects the opinion of marginal investors, CAR_d0 should be less subject to the optimism biases of analysts and better reflect earnings surprises. We replace SUE with CAR_d0 and repeat our main analyses, and our inference is unchanged by using this alternative measure.

Panel A of Table IA.9 in the Internet Appendix shows that the sensitivity of PEAD to CAR_d0 increases significantly after coverage reductions.[18] For one standard deviation change in CAR_d0 (8.32% in our sample), the drift in the two-day post earnings window increases by 0.77 percentage point while the drift in the four-day post earnings window increases by 0.84 percentage point. Furthermore, we reexamine the impacts of hedge fund holdings on PEAD using CAR_d0 to proxy for the unexpected information content. We again find that high levels of hedge fund participation mitigate the increase of PEAD significantly after coverage reductions, as reported in Panel B of Table IA.9.

C. Alternative Measures of Market Efficiency

Besides PEAD, we use two alternative measures of market efficiency: the variance ratios proposed by Lo and MacKinlay (1988), and the price informativeness measure of Bai, Philippon, and Savov (2016). Consistent with the results with PEAD reported in Section II, we find that: (1) the reductions of analyst coverage impair market efficiency; and (2) high levels of hedge fund participation help to restore the impaired market efficiency.

[Insert Table 11 about here]

[17] Malmendier and Shanthikumar (2007) find that large investors can discount the recommendations from biased analysts affiliated with the underwriters.

[18] The abnormal return is benchmarked by the portfolio returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. For an after-hours earnings release, CAR_d0 is the return of the next trading day in the CRSP data.

Following Boehmer and Kelley (2009), we use the deviation of variance ratios from one, |1-VR(n,m)|, as a measure of market efficiency, where VR(n,m) is the ratio of the quote midpoint return variance over *m* days to the return variance over *n* days, both divided by the number of the days. If prices follow a random walk, the deviation should be zero. Larger magnitude of this deviation reveals weaker market efficiency.[19] Panel A of Table 11 shows that |1-VR(n,m)| increases significantly after coverage reductions. Importantly, this increase is mitigated by high levels of hedge fund participation, as presented in Panel B of Table 11. Our inference is robust to the choice of time horizons for measuring variance ratios such as VR(1, 5), VR(1, 10), VR(1, 20), VR(2, 5), VR(2, 10), and VR(2, 20).

[Insert Table 12 about here]

As another alternative measure of market efficiency, we employ the price informativeness measure of Bai, Philippon, and Savov (2016). This measure attempts to capture the extent to which stock prices predict future cash flows, and it has recently been used in Farboodi, Matray, and Veldkamp (2017) and Kacperczyk, Sundaresan, and Wang (2018). Following Kacperczyk, Sundaresan, and Wang (2018), we use a difference-in-differences regression approach to examine the change in price informativeness in our setting. Table 12 presents the results. We find that price informativeness decreases significantly following coverage reductions. This result is both statistically and economically significant (columns 1–2). Moreover, high levels of hedge fund participation significantly mitigate the reduction of price informativeness (columns 3–4 in Table 12).

D. Dynamic Effects of Coverage Reductions

Identification in the difference-in-differences approach builds on the parallel trend assumption. In this subsection, we validate this assumption by examining the dynamic

[19] Because both positive and negative deviations of variance ratios from one represent stock price movement departing from a random walk, we use |1-VR(n,m)| to measure market efficiency.

effects of coverage reductions. We find no evidence of pre-trends, and the observed dynamic pattern reinforces the regression results.

[Insert Figure 1 about here]

Figure 1 plots the dynamic effects of coverage reductions on the main outcome variables studied in our paper. The point estimates are obtained from modified difference-in-differences regressions, in which we replace the *Post* dummy with a series of dummy variables that represent different time windows relative to coverage reductions (see the note of Figure 1 for details). The error bars represent 90% confidence intervals.

Consistent with the previous regression results, we find that after coverage reductions, the magnitude of PEAD increases (Panel A) and variance ratio deviates more from one (Panel B). Hedge funds scale up their information acquisition by participating more in earnings calls (Panel C) and potentially increasing their web search of the EDGAR database (Panel D). Hedge funds trade more aggressively (Panel E) and earn higher abnormal returns on the affected stocks (Panel F). These changes of the outcome variables all appear to occur right after the reductions of analyst coverage. Importantly, there is no sign of pre-trends prior to coverage reductions.

E. Testing Alternative Explanations for the Impacts of Hedge Funds on Market Efficiency

We have shown that hedge fund participation after coverage reductions helps to restore the impaired market efficiency. In our setting, coverage reductions exogenously shock the information environment, which allows us to study the relation between information environment and the activities of sophisticated investors in a causal framework. Because coverage reductions do not shock hedge fund activities directly, we cannot claim a causal relation between hedge fund activities and the changes of market efficiency. However, as discussed below, typical endogeneity concerns such as reverse causality and omitted variables have a limited role in explaining our findings.

One might argue that a reverse causality may explain the relation between hedge fund participation and the improvement of market efficiency. That is, improved market efficiency attracts hedge funds to participate. However, as shown previously in our Table 4 and Griffin and Xu (2009), hedge funds actually prefer more opaque stocks (e.g., those with small firm size, high idiosyncratic volatility, and large bid-ask spreads), plausibly because they can enjoy greater information advantage. Thus, this finding is at odds with the reverse causality argument.

Next, could omitted variables explain the documented relation? We find that hedge fund participation is associated with greater improvement of market efficiency of the treated stocks relative to the control stocks after coverage reductions. Thus, for any omitted variable to explain this finding, it needs to be affected by the coverage reductions as well. Otherwise, it would not generate a difference between the treated and control firms in terms of the relation between hedge fund participation and market efficiency.[20] Below we discuss two possible omitted variables that can be potentially affected by coverage reductions. We show that they do not appear to explain our results.

The first omitted variable we consider is the participation of activist hedge funds. It is possible that after coverage reductions, activist hedge funds deem themselves able to add greater value to the affected firms whose information environment has become murkier.[21] It is well known that activist hedge funds can improve the productivity and operating efficiency of the target firms (e.g., Brav, Jiang, Partnoy, and Thomas, 2008; Bebchuk, Brav, and Jiang, 2015; Brav, Jiang, and Kim, 2015). Thus, their positive impacts on firm operation may lead to improvement of market efficiency for the target firms. To

[20] For example, a stock's membership status to the S&P 500 index can be an omitted variable that affects both hedge fund participation and market efficiency simultaneously. Suppose that reductions of analyst coverage do not affect the index membership status, and then this omitted variable cannot explain the difference between the treated and control firms in terms of the relation between hedge fund participation and market efficiency.

[21] Chen, Harford, and Lin (2015) find that corporate governance deteriorates after exogenous reductions of analyst coverage. Since activist hedge funds can add value through improving corporate governance of the target firms (e.g., Brav, Jiang, Partnoy, and Thomas, 2008), it is possible that activist hedge funds may target more at the affected stocks after coverage reductions.

test this possibility, we exclude observations from treated firms that are target firms of activist hedge funds two years before and two years after the coverage reductions, as well as observations from the matched control firms.[22] As shown in columns (1)–(2) of Table IA.10 in the Internet Appendix, hedge fund participation still mitigates the increase in PEAD even when we focus on the subsample in which the treated firms are not target firms of activist hedge funds. This finding perhaps is not surprising, given that activist hedge funds contribute to a relatively small fraction of total hedge fund stock holdings.[23]

The second omitted variable is firm's voluntary disclosure. Balakrishnan, Billings, Kelly, and Ljungqvist (2014) show that firms provide more timely and informative earnings guidance after exogenous reductions of analyst coverage. They find that this effect is mainly driven by firms with a history of providing earnings guidance ("guiders"). On the other hand, firms with no history of providing earnings guidance ("non-guiders") do not change their voluntary disclosure behavior. If hedge funds selectively trade stocks with earnings guidance, the documented relation between hedge fund participation and the improvement of market efficiency can possibly be explained by voluntary disclosure. To test this possibility, we exclude observations from treated firms with a history of providing earnings guidance, as well as the observations from the matched control firms. As shown in columns 3–4 of Table IA.10, our inference holds in the subsample of the non-guiders, suggesting that voluntary disclosure is unlikely to fully explain our results.

IV. Conclusion

We exploit closures of brokerage firms as an exogenous shock to information environment, to examine how sophisticated investors change their trading behavior on the affected stocks and how these changes in turn affect market efficiency. After coverage reductions, market efficiency is impaired, measured by post earnings announcement drift (PEAD), variance ratios, and price informativeness. Meanwhile, hedge funds enhance

[22] We are grateful to Alon Brav for sharing the data on hedge fund activism.

[23] According to HFR's Hedge Fund Industry Report (2016), the total global assets under management of hedge funds is approximately $3.02 trillion, among which activist hedge funds account for 4.01%.

information acquisition and trade aggressively on the affected stocks. Importantly, high levels of hedge fund participation help to restore the impaired market efficiency.

Our findings have important policy implications. We document a substitution effect between sophisticated investors and public information providers in facilitating market efficiency. Therefore, when considering new policies shaping information environment, policy makers should take into account the substitution among information providers with different incentives and comparative advantage. One example relates to the recent reform of MiFID II in the EU. Future research could explore potential externalities associated with private information acquisition to investigate the welfare implications.

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Figure 1. Dynamic Effects of Coverage Reductions

This figure plots the dynamic effects of coverage reductions on the main outcome variables of this paper. We consider a four-year window, spanning from two years before and two years after the reductions of analyst coverage. The error bars represent 90% confidence intervals. The plotted point estimates $\boldsymbol{\beta_{1,k}}$ come from modified difference-in-differences regressions, in which we replace the *Post* dummy with a series of dummy variables D_k, where D_1, D_2, D_3, D_4, D_5, D_6, and D_7 represent observations in [-1.5 years, 1 year), [1 year, 0.5 year), [0.5 years, 0 year), [0 year, 0.5 year), [0.5 year, 1 year), [1 year, 1.5 years) and [1.5 years, 2 years] relative to coverage reductions, respectively. The omitted time window [-2 years, 1.5 years) serves as the baseline. The regressions used to estimate $\boldsymbol{\beta_{1,k}}$ are listed below. We control for both firm fixed effects and time fixed effects. Standard errors are double clustered at both the firm and time levels.

Panel A: Impacts of exogenous coverage reductions on PEAD

$$CAR\_d1\_dn_{it} = \alpha_i + \alpha_t + \sum_{k=1}^{7} \boldsymbol{\beta_{1,k}}\, Treat_{it} \times D_{it,k} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} + \sum_{k=1}^{7} \beta_{3,k} D_{it,k} \times SUE_{it} + \beta_4 SUE_{it} + \sum_{k=1}^{7} \beta_{5,k} Treat_{it} \times D_{it,k} + \beta_6 Treat_{it} + \sum_{k=1}^{7} \beta_{7,k} D_{it,k} + \gamma' Controls + \varepsilon_{it,k}.$$

Panel B: Impacts of exogenous coverage reductions on variance ratio

$$|1 - VR(1,10)|_{it} = \alpha_i + \alpha_t + \sum_{k=1}^{7} \boldsymbol{\beta_{1,k}} Treat_{it} \times D_{it,k} + \beta_2 Treat_{it} + \sum_{k=1}^{7} \beta_{3,k} D_{it,k} + \gamma' Controls + \varepsilon_{it,k}.$$

Panel C: Impacts of exogenous coverage reductions on hedge fund participation in conference calls

$$Participation_{it} = \alpha_i + \alpha_t + \sum_{k=1}^{7} \boldsymbol{\beta_{1,k}} Treat_{it} \times D_{it,k} + \beta_2 Treat_{it} + \sum_{k=1}^{7} \beta_{3,k} D_{it,k} + \gamma' Controls + \varepsilon_{it,k}.$$

Panel D: Impacts of exogenous coverage reductions on the EDGAR Internet search volume from geographical areas closer to hedge funds for insider filings

$$Ln(ESV_{it} + 1) = \alpha_i + \alpha_t + \sum_{k=1}^{7} \boldsymbol{\beta_{1,k}} Treat_{it} \times D_{it,k} + \beta_2 Treat_{it} + \sum_{k=1}^{7} \beta_{3,k} D_{it,k} + \gamma' Controls + \varepsilon_{it,k}.$$

Panel E: Impacts of exogenous coverage reductions on abnormal hedge fund holdings

$$Ab\_Holdings_{it} = \alpha_i + \alpha_t + \sum_{k=1}^{7} \boldsymbol{\beta_{1,k}}\, Treat_{it} \times D_{it,k} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} + \sum_{k=1}^{7} \beta_{3,k} D_{it,k} \times SUE_{it} + \beta_4 SUE_{it} + \sum_{k=1}^{7} \beta_{5,k} Treat_{it} \times D_{it,k} + \beta_6 Treat_{it} + \sum_{k=1}^{7} \beta_{7,k} D_{it,k} + \gamma' Controls + \varepsilon_{it,k}.$$

Panel F: Impacts of exogenous coverage reductions on the abnormal returns of the stocks purchased by hedge funds

$$CAR_{it} = \alpha_i + \alpha_t + \sum_{k=1}^{7} \boldsymbol{\beta_{1,k}} Treat_{it} \times D_{it,k} + \beta_2 Treat_{it} + \sum_{k=1}^{7} \beta_{3,k} D_{it,k} + \gamma' Controls + \varepsilon_{it,k}.$$

Figure 1 Continued

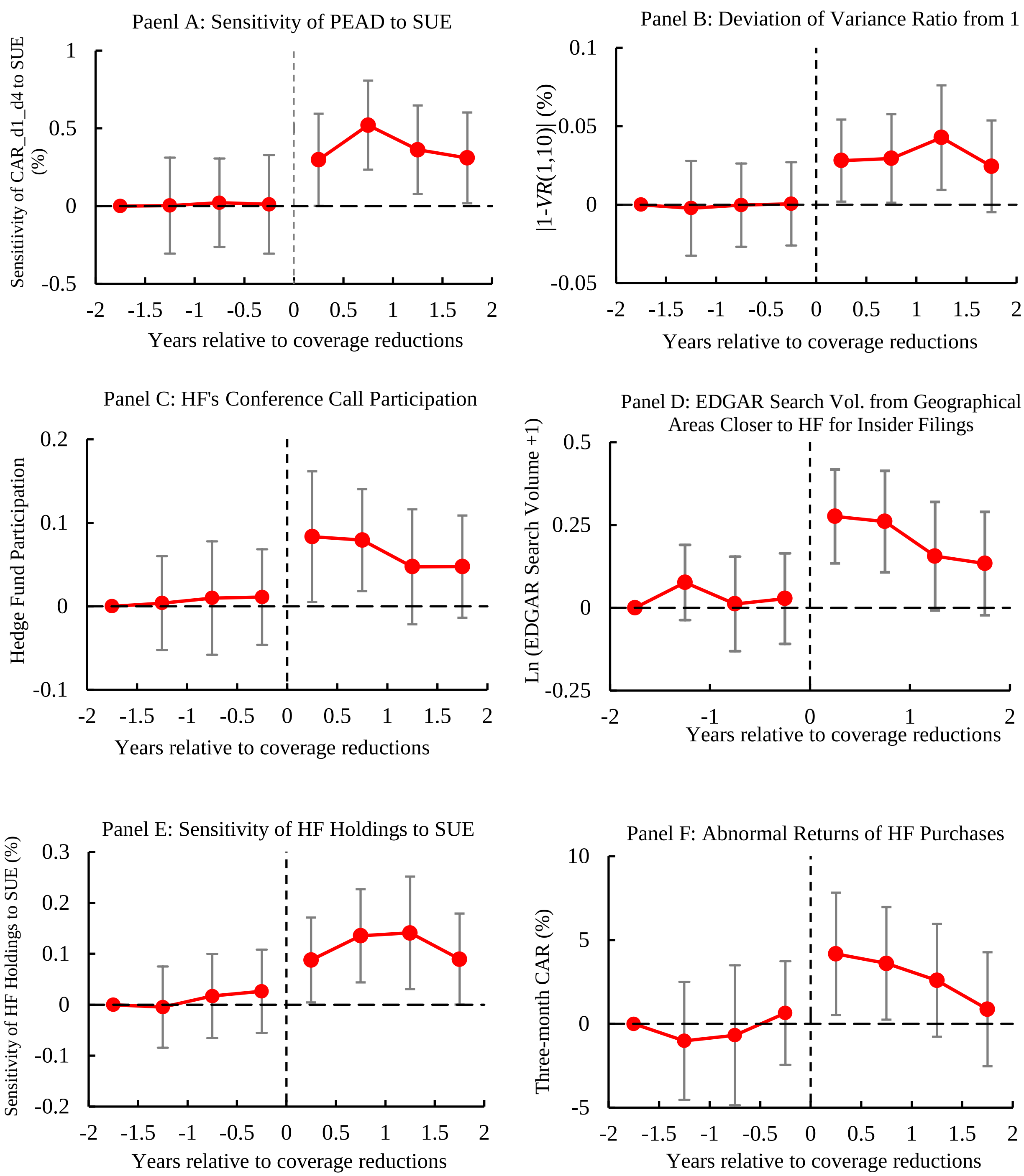

Table 1 Summary Statistics

This table presents summary statistics for both the treated group and the matched control group. Summary statistics are calculated at the firm-quarter level using observations in the two-year period prior to the reductions of analyst coverage. The treated firms are firms that experience closure and merger-related reductions of analyst coverage. Each treated firm is matched with up to five control firms in the same Fama-French 48 industry, Fama-French size and book-to-market quintiles. If more than five candidate firms exist, those with the closest bid-ask spreads before the reductions of analyst coverage are chosen. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. CAR_d0 is the abnormal return (in percent) on the dates of earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. CAR_d1_dn is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. Ab_HF is the abnormal aggregate hedge fund holdings (in percent of shares outstanding) at the nearest quarter end prior to earnings announcements, computed as hedge fund holdings at the current quarter minus the average hedge fund holdings of the past four quarters. Ab_NonHF is the abnormal aggregate non-hedge fund holdings (in percent of shares outstanding) at the nearest quarter end prior to earnings announcements, computed as non-hedge fund holdings at the current quarter minus the average non-hedge fund holdings of the past four quarters. Ab_Short is the abnormal short interest (in percent of shares outstanding) at the nearest quarter end prior to earnings announcements, computed as short interest at the current quarter minus the average short interest of the past four quarters. *LnSize* is the natural log of market capitalization (in $millions) in year t-1; *LnBEME* is the natural log of book-to-market ratio in year t-1; *LnLev* is the natural log of debt-to-equity ratio in year t-1; *Ret2mPrior* is the two-month cumulative raw returns (in percent) prior to earnings announcements. The treated firms are limited to firms that have five or fewer analysts covering the firm prior to coverage reductions. *p*-value compares the mean value between the treated group and the control group. The data span 1997 to 2010.

	Treated Group (372 firms, 2114 earnings announcements)					Control Group (631 firms, 3358 earnings announcements)					
	Mean	SD	5%	50%	95%	Mean	SD	5%	50%	95%	*p*-value
SUE	0.41	4.27	-5.56	0.61	7.50	0.68	4.04	-4.95	0.71	7.50	0.291
CAR_d0 (%)	-0.24	8.50	-13.11	-0.13	12.55	-0.33	8.66	-14.30	-0.20	13.16	0.712
CAR_d1_d1 (%)	0.01	5.06	-6.96	-0.16	7.21	0.00	4.70	-7.11	-0.18	7.51	0.973
CAR_d1_d2 (%)	-0.12	6.46	-9.57	-0.39	9.53	-0.14	6.37	-9.78	-0.28	9.72	0.877
CAR_d1_d3 (%)	-0.43	7.48	-11.72	-0.43	11.31	-0.22	7.38	-11.76	-0.36	11.16	0.313
CAR_d1_d4 (%)	-0.55	8.18	-13.30	-0.55	12.10	-0.21	8.26	-12.68	-0.38	12.97	0.137
Ab_HF (%)	0.42	3.12	-3.51	0.08	5.48	0.51	3.62	-3.91	0.09	6.15	0.377
Ab_NonHF (%)	1.75	9.74	-12.69	1.57	16.14	1.91	16.15	-9.77	1.79	17.68	0.575
Ab_Short (%)	0.22	2.65	-2.91	0.02	4.08	0.30	2.45	-2.69	0.03	3.77	0.269
LnBEME	-0.82	0.92	-2.55	-0.73	0.47	-0.84	0.83	-2.26	-0.76	0.31	0.435
LnSize	5.88	1.15	4.07	5.88	7.81	5.67	1.09	3.89	5.66	7.45	0.002
LnLev	-0.36	1.27	-2.41	-0.27	1.56	-0.41	1.17	-2.33	-0.42	1.36	0.517
Ret2mPrior (%)	1.52	24.72	-39.57	1.83	40.51	2.01	23.92	-35.44	1.87	40.09	0.466

Table 2 Impacts of Exogenous Coverage Reductions on PEAD

This table evaluates changes in the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one for earnings announcements that happen after the reductions of analyst coverage. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$CAR\_d1\_dn_{it} = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} + \beta_3 Post_{it} \times SUE_{it} + \beta_4 SUE_{it} + \beta_5 Treat_{it} \times Post_{it} + \beta_6 Treat_{it} + \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{it}.$$

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR_d1_d2 (%)			CAR_d1_d4 (%)		
Treat × Post × SUE	0.198***	0.253***	0.237***	0.289***	0.348***	0.342***
	[0.054]	[0.058]	[0.058]	[0.067]	[0.074]	[0.074]
Treat × SUE	-0.179***	-0.216***	-0.209***	-0.204***	-0.244***	-0.243***
	[0.044]	[0.050]	[0.050]	[0.049]	[0.057]	[0.057]
Post × SUE	-0.128***	-0.151***	-0.150***	-0.189***	-0.208***	-0.214***
	[0.035]	[0.038]	[0.038]	[0.047]	[0.052]	[0.052]
SUE	0.225***	0.241***	0.245***	0.285***	0.302***	0.307***
	[0.027]	[0.030]	[0.031]	[0.035]	[0.041]	[0.041]
Treat × Post	-0.324	-0.250	-0.328	-0.246	-0.111	-0.172
	[0.248]	[0.250]	[0.251]	[0.325]	[0.333]	[0.340]
Treat	0.155	0.605	0.612	-0.195	0.676	0.737
	[0.184]	[0.435]	[0.440]	[0.250]	[0.548]	[0.561]
Post	0.388**	0.437***	0.368*	0.716***	0.768***	0.501**
	[0.151]	[0.162]	[0.193]	[0.211]	[0.225]	[0.249]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Year-month FE	No	No	Yes	No	No	Yes
Observations	11511	11511	11511	11511	11511	11511
R-squared	0.015	0.131	0.146	0.015	0.135	0.151

Table 3 Hedge Fund Holdings prior to Earnings Announcements

This table evaluates changes in the abnormal stock holdings of hedge funds and non-hedge funds after the reductions of analyst coverage. The dependent variable $Ab\_Holdings_{it}$ is the level of abnormal hedge fund holdings (or non-hedge fund holdings) at the nearest quarter end prior to the quarterly earnings announcements (in percent of shares outstanding). Abnormal hedge fund holdings (or non-hedge fund holdings) at any given quarter are computed as hedge fund holdings (or non-hedge fund holdings) at the current quarter minus the average hedge fund holdings (or non-hedge fund holdings) of the past four quarters. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after the reductions of analyst coverage. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw return (in percent) prior to each quarter. Standard errors, included in brackets, are double clustered at the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$Ab\_Holdings_{it} = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} + \beta_3 Post_{it} \times SUE_{it} + \beta_4 SUE_{it} + \beta_5 Treat_{it} \times Post_{it} + \beta_6 Treat_{it} + \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{it}$$

	(1)	(2)	(3)	(4)	(5)	(6)
	Abnormal HF Holdings (%)			Abnormal Non-HF Holdings (%)		
Treat × Post × SUE	0.073**	0.099***	0.091**	-0.096	-0.131	-0.160
	[0.036]	[0.037]	[0.039]	[0.109]	[0.114]	[0.111]
Treat × SUE	-0.016	-0.038	-0.037	0.099	0.161*	0.167*
	[0.025]	[0.026]	[0.027]	[0.082]	[0.086]	[0.088]
Post × SUE	-0.032	-0.059**	-0.061**	-0.138**	-0.056	-0.044
	[0.025]	[0.026]	[0.026]	[0.063]	[0.068]	[0.067]
SUE	-0.002	0.023	0.024	0.230***	0.097*	0.088
	[0.016]	[0.017]	[0.017]	[0.049]	[0.055]	[0.054]
Treat × Post	-0.013	0.072	0.055	1.386**	1.745***	1.241*
	[0.225]	[0.256]	[0.258]	[0.598]	[0.664]	[0.678]
Treat	-0.079	-0.232	-0.128	-1.091***	-1.326	-0.904
	[0.151]	[0.325]	[0.315]	[0.401]	[0.853]	[0.856]
Post	0.026	-0.095	0.124	0.051	-0.858*	-1.256***
	[0.147]	[0.174]	[0.176]	[0.400]	[0.455]	[0.475]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Year-quarter FE	No	No	Yes	No	No	Yes
Observations	10146	10146	10146	10146	10146	10146
R-squared	0.002	0.169	0.195	0.014	0.126	0.151

Table 4 Heterogeneity in the Changes of Hedge Fund Holdings after Coverage Reductions

This table evaluates the heterogeneity in the changes of hedge fund holdings after the reductions of analyst coverage. In Panel A, we split the sample into two groups based on the affected stocks' firm size, idiosyncratic volatility, and bid-ask spread prior to coverage reductions. In Panel B, we split the sample into two groups based on the exited analysts' historical forecast errors on the affected stocks, their years of experience covering the affected stocks, and the amount of workload measured by the number of stocks they cover prior to their exits. The dependent variable $Ab\_Holdings_{it}$ is the level of abnormal hedge fund holdings (in percent of shares outstanding) at the nearest quarter end prior to the quarterly earnings announcements. Abnormal hedge fund holdings at any given quarter are computed as hedge fund holdings at the current quarter minus the average hedge fund holdings of the past four quarters. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after the reductions of analyst coverage. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw return (in percent) prior to each quarter. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Panel A: Heterogeneity across the affected stocks

	(1)	(2)	(3)	(4)	(5)	(6)
	Abnormal HF Holdings (%)					
Treated Sample	Large Size	Low IVOL	Low Spreads	Small Size	High IVOL	High Spreads
Treat × Post × SUE	0.020	0.048	0.054	0.141**	0.127**	0.144**
	[0.047]	[0.043]	[0.050]	[0.066]	[0.061]	[0.067]
Treat × SUE	0.014	-0.038	0.018	-0.061	-0.036	-0.085
	[0.035]	[0.031]	[0.037]	[0.058]	[0.045]	[0.066]
Post × SUE	-0.075**	-0.040	-0.036	-0.032	-0.051	-0.076*
	[0.033]	[0.029]	[0.036]	[0.044]	[0.045]	[0.044]
SUE	0.016	0.016	0.007	0.043	0.015	0.056**
	[0.023]	[0.022]	[0.026]	[0.026]	[0.030]	[0.026]
Treat × Post	-0.269	-0.068	-0.086	0.353	-0.097	0.182
	[0.356]	[0.308]	[0.340]	[0.374]	[0.383]	[0.399]
Treat	-0.480	-0.421	-0.213	-0.456	-0.773*	1.085
	[0.845]	[0.982]	[0.558]	[0.587]	[0.437]	[0.702]
Post	0.295	0.262	0.066	-0.109	0.077	0.136
	[0.270]	[0.236]	[0.276]	[0.256]	[0.292]	[0.318]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5110	4060	4909	4935	4300	4562
R-squared	0.242	0.286	0.241	0.205	0.209	0.217

Table 4 Continued

Panel B: Heterogeneity across the exited analysts

	(1)	(2)	(3)	(4)	(5)	(6)
	Abnormal HF Holdings (%)					
Treated Sample	Less Accurate Analysts	Less Experienced Analysts	More Occupied Analysts	More Accurate Analysts	More Experienced Analysts	Less Occupied Analysts
Treat × Post × SUE	0.008	0.039	0.040	0.218**	0.147**	0.127**
	[0.052]	[0.048]	[0.051]	[0.102]	[0.062]	[0.059]
Treat × SUE	-0.022	-0.022	0.341	-0.075	-0.088	-0.111
	[0.039]	[0.031]	[0.327]	[0.086]	[0.055]	[0.397]
Post × SUE	-0.031	-0.053*	-0.021	-0.136	-0.090*	-0.053
	[0.036]	[0.030]	[0.040]	[0.123]	[0.051]	[0.038]
SUE	0.009	0.017	-0.039	0.024	0.045	-0.089**
	[0.027]	[0.020]	[0.036]	[0.055]	[0.037]	[0.038]
Treat × Post	0.360	-0.110	-0.461	-0.447	0.563	0.421
	[0.318]	[0.308]	[0.388]	[0.987]	[0.528]	[0.553]
Treat	-0.182	-0.027	0.008	0.076	0.349	0.043*
	[0.389]	[0.465]	[0.026]	[0.087]	[1.398]	[0.022]
Post	-0.104	0.176	-0.111	0.302	-0.098	0.043
	[0.234]	[0.223]	[0.237]	[0.660]	[0.403]	[0.282]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3688	5185	5025	3310	4854	5025
R-squared	0.216	0.201	0.227	0.241	0.215	0.201

Table 5 Profitability of Hedge Funds

This table evaluates changes in the profitability of hedge funds (also non-hedge funds). The dependent variable is stocks' abnormal return (in percent) from quarter end t to quarter end t+1, benchmarked by the corresponding DGTW portfolios. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after the reductions of analyst coverage. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw return (in percent) prior to each quarter. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Panel A: Profitability of hedge funds

	(1)	(2)	(3)	(4)
	Three-month CAR from quarter end t to quarter end t+1 (%)			
Sample	HF Purchases (HF_t - HF_{t-1} > 0)	Large HF Purchases (HF_t - HF_{t-1} > 0.5%)	HF Sales (HF_t - HF_{t-1} < 0)	Large HF Sales (HF_t - HF_{t-1} < -0.5%)
Treat × Post	2.530**	3.731**	-0.184	0.023
	[1.288]	[1.819]	[1.527]	[2.191]
Treat	-1.113	-3.337	-1.811	-0.952
	[1.867]	[2.607]	[2.391]	[3.113]
Post	0.106	1.566	0.133	0.209
	[0.904]	[1.342]	[1.019]	[1.384]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes
Observations	6195	3722	5307	3138
R-squared	0.243	0.308	0.276	0.350

Panel B: Profitability of non-hedge funds

	(1)	(2)	(3)	(4)
	Three-month CAR from quarter end t to quarter end t+1 (%)			
Sample	Non-HF Purchases (NF_t - NF_{t-1} > 0)	Large Non-HF Purchases (NF_t - NF_{t-1} > 1%)	Non-HF Sales (NF_t - NF_{t-1} < 0)	Large Non-HF Sales (NF_t - NF_{t-1} <1%)
Treat × Post	1.084	0.668	-0.521	-0.046
	[1.211]	[1.393]	[1.563]	[1.930]
Treat	0.985	2.267	-0.478	2.334
	[1.921]	[2.247]	[2.373]	[2.869]
Post	-0.360	-0.258	0.556	0.253
	[0.783]	[0.889]	[0.955]	[1.228]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes
Observations	7690	5632	5437	3691
R-squared	0.231	0.251	0.252	0.313

Table 6 Participation of Buy-Side Analysts in Earnings Conference Calls

This table evaluates changes in the participation of buy-side analysts from hedge funds (also non-hedge funds) in earnings conference calls. *Hedge Fund Participation* is a dummy variable that equals one if at least one buy-side analyst from hedge funds asks at least one question during the conference call. *Non-Hedge Fund Participation* is a dummy variable that equals one if at least one buy-side analyst from non-hedge funds asks at least one question during the conference call. *# of Hedge Fund Analysts* is the number of buy-side analysts from hedge funds who ask at least one question during the conference call. *# of Non-Hedge Fund Analysts* is the number of buy-side analysts from non-hedge funds who ask at least one question during the conference call. *Treat* is a dummy variable that equals one for the conference calls of treated firms. *Post* is a dummy variable that equals one if the conference call is held after the reductions of analyst coverage. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw return (in percent) prior to each conference call. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover conference calls two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Panel A: Participation of buy-side analysts from hedge funds

	(1)	(2)	(3)	(4)
	Hedge Fund Participation		Ln(# of Hedge Fund Analysts +1)	
Treat × Post	0.052**	0.052**	0.041**	0.040**
	[0.026]	[0.026]	[0.020]	[0.020]
Treat	-0.011	-0.017	-0.013	-0.018
	[0.037]	[0.035]	[0.029]	[0.029]
Post	-0.028*	-0.011	-0.013	-0.011
	[0.015]	[0.021]	[0.012]	[0.016]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	No	Yes
Observations	5650	5650	5650	5650
R-squared	0.316	0.327	0.322	0.336

Panel B: Participation of buy-side analysts from non-hedge funds

	(1)	(2)	(3)	(4)
	Non-Hedge Fund Participation		Ln(# of Non-Hedge Fund Analysts +1)	
Treat × Post	-0.001	0.005	0.007	0.011
	[0.035]	[0.034]	[0.028]	[0.028]
Treat	-0.001	0.011	-0.016	-0.017
	[0.044]	[0.045]	[0.034]	[0.035]
Post	0.004	0.004	0.009	0.001
	[0.017]	[0.018]	[0.013]	[0.015]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	No	Yes
Observations	5650	5650	5650	5650
R-squared	0.376	0.389	0.383	0.396

Table 7 Information Acquisition via EDGAR

This table evaluates changes in the EDGAR Internet search volume after the reductions of analyst coverage. The SEC has maintained a database that tracks web visits to EDGAR since February 2003. In Panel A, the dependent variable is the natural log of the monthly EDGAR Internet search volume (ESV) for the filings of firm *i* in month *t*. Column (1) includes user requests for all types of EDGAR filings. Columns (2)–(6) include user requests for 10-K, 10-Q, 8-K, insider filings (Forms 3, 4, and 5), and other types of filings, respectively. The SEC also records the IP addresses of the requesting users, with the final (fourth) octet of the IP addresses replaced with a unique set of three letters. We map IP addresses to geolocation information including latitude and longitude. Based on the first three octets of the IP addresses in the SEC data, we match 89% of IP addresses (78% of the total visits) to unique latitude/longitude pairs. The latitude and longitude pairs associated with the matched IP addresses are invariant to the values of the final octet of the IP addresses. For each matched IP address, we then compute its geographical distance to the nearest hedge fund based on its latitude/longitude and the physical addresses of hedge funds collected from 13F filings. We sort the web visits to two groups based on the distance. In Panel B, we construct a monthly EDGAR Internet search volume dataset based on the user requests from U.S. IP addresses whose distance to the nearest hedge fund is shorter than the median distance. In Panel C, we construct a monthly EDGAR Internet search volume dataset based on the user requests from U.S. IP addresses whose distance to the nearest hedge fund is longer than the median distance. The panel data used for the difference-in-differences regressions cover monthly EDGAR Internet search volume for the treated firms and the matched control firms two years before and after the reductions of analyst coverage. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after the reductions of analyst coverage. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw return (in percent) prior to each month. Standard errors, included in brackets, are double clustered at both the firm and month levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The sample period is from February 2003 to December 2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$Ln(ESV_{it}+1) = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} + \beta_2 Treat_{it} + \beta_3 Post_{it} + \gamma' Controls + \varepsilon_{it}.$$

Panel A: Sample constructed based on all U.S. IP addresses

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(EDGAR Internet Search Volume +1)					
Filing Type	All	10-K	10-Q	8-K	Insider	Others
Treat × Post	0.114**	0.004	-0.007	0.074	0.156**	-0.027
	[0.052]	[0.017]	[0.013]	[0.060]	[0.063]	[0.035]
Treat	-0.051	0.098	0.032	0.061	-0.286**	0.032
	[0.072]	[0.147]	[0.102]	[0.203]	[0.138]	[0.122]
Post	-0.115**	-0.036	-0.019	-0.076*	-0.084	-0.033
	[0.044]	[0.045]	[0.043]	[0.044]	[0.057]	[0.020]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25078	25078	25078	25078	25078	25078
R-squared	0.503	0.295	0.459	0.399	0.325	0.169

Table 7 Continued

Panel B: Sample constructed based on user requests from U.S. IP addresses whose distance to the nearest hedge fund is shorter than the median distance

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(EDGAR Internet Search Volume +1)					
Filing Type	All	10K	10Q	8K	Insider	Others
Treat × Post	0.142***	0.002	-0.012	0.046	0.194***	-0.008
	[0.048]	[0.016]	[0.010]	[0.048]	[0.046]	[0.023]
Treat	-0.032	0.009	0.055	-0.038	-0.221**	-0.042
	[0.066]	[0.049]	[0.115]	[0.154]	[0.100]	[0.076]
Post	-0.075*	-0.033	-0.008	-0.017	-0.042	-0.027*
	[0.042]	[0.031]	[0.030]	[0.032]	[0.042]	[0.014]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25078	25078	25078	25078	25078	25078
R-squared	0.454	0.272	0.388	0.330	0.297	0.148

Panel C: Sample constructed based on user requests from U.S. IP addresses whose distance to the nearest hedge fund is longer than the median distance

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(EDGAR Internet Search Volume +1)					
Filing Type	All	10K	10Q	8K	Insider	Others
Treat × Post	0.067	0.002	-0.002	0.049	0.054	-0.015
	[0.050]	[0.015]	[0.011]	[0.048]	[0.046]	[0.023]
Treat	-0.149	0.072	-0.024	-0.053	-0.226	0.028
	[0.091]	[0.121]	[0.048]	[0.201]	[0.201]	[0.079]
Post	-0.084***	-0.021	-0.001	-0.066**	-0.059	-0.012
	[0.031]	[0.032]	[0.034]	[0.028]	[0.039]	[0.013]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25078	25078	25078	25078	25078	25078
R-squared	0.432	0.280	0.375	0.327	0.281	0.145

Table 8 Impacts of Hedge Fund Participation on PEAD

This table evaluates the impacts of hedge fund participation on the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if the earnings announcements happen after the reductions of analyst coverage. D(HF^{++}) is a dummy variable that equals one if the abnormal aggregate hedge fund holdings at the nearest quarter end prior to earnings announcements are in the top quartile of the abnormal hedge fund holdings at that quarter. Abnormal hedge fund holdings at any given quarter are computed as hedge fund holdings at the current quarter minus the average hedge fund holdings of the past four quarters. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR_d1_d2 (%)			CAR_d1_d4 (%)		
Treat × Post × D(HF^{++}) × SUE	-0.477***	-0.552***	-0.598***	-0.400*	-0.473**	-0.543**
	[0.163]	[0.174]	[0.173]	[0.205]	[0.214]	[0.214]
Treat × Post × SUE	0.330***	0.385***	0.384***	0.368***	0.413***	0.432***
	[0.062]	[0.071]	[0.071]	[0.077]	[0.088]	[0.089]
Treat × D(HF^{++}) × SUE	0.215	0.250	0.303*	0.190	0.215	0.276
	[0.145]	[0.158]	[0.157]	[0.165]	[0.175]	[0.174]
Treat × SUE	-0.248***	-0.286***	-0.288***	-0.267***	-0.295***	-0.309***
	[0.051]	[0.062]	[0.062]	[0.061]	[0.069]	[0.070]
Post × D(HF^{++}) × SUE	0.177*	0.157	0.158*	0.131	0.065	0.080
	[0.094]	[0.096]	[0.096]	[0.123]	[0.125]	[0.123]
Post × SUE	-0.153***	-0.159***	-0.166***	-0.192***	-0.182***	-0.198***
	[0.037]	[0.039]	[0.040]	[0.050]	[0.057]	[0.058]
D(HF^{++}) × SUE	-0.088	-0.057	-0.059	-0.084	-0.038	-0.051
	[0.074]	[0.077]	[0.077]	[0.096]	[0.097]	[0.095]
SUE	0.245***	0.257***	0.263***	0.319***	0.333***	0.343***
	[0.030]	[0.032]	[0.033]	[0.044]	[0.050]	[0.051]
Treat × Post × D(HF^{++})	0.604	0.192	0.284	0.902	0.508	0.640
	[0.589]	[0.614]	[0.615]	[0.817]	[0.848]	[0.845]
Treat × Post	-0.612**	-0.485*	-0.544*	-0.688**	-0.601*	-0.637*
	[0.262]	[0.277]	[0.285]	[0.348]	[0.353]	[0.369]
Treat × D(HF^{++})	0.141	0.602	0.501	-0.051	0.452	0.310
	[0.434]	[0.492]	[0.498]	[0.620]	[0.663]	[0.671]
Treat	0.269	0.409	0.357	0.063	0.334	0.298
	[0.207]	[0.435]	[0.427]	[0.295]	[0.528]	[0.547]
Post × D(HF^{++})	0.141	0.324	0.302	-0.206	0.071	-0.003
	[0.337]	[0.361]	[0.365]	[0.476]	[0.504]	[0.501]
Post	0.413***	0.309*	0.416**	0.740***	0.595**	0.599**
	[0.159]	[0.175]	[0.207]	[0.220]	[0.235]	[0.266]
D(HF^{++})	-0.170	-0.362	-0.297	0.077	-0.254	-0.140
	[0.262]	[0.284]	[0.290]	[0.374]	[0.384]	[0.382]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Year-month FE	No	No	Yes	No	No	Yes
Observations	9818	9818	9818	9818	9818	9818
R-squared	0.020	0.150	0.167	0.020	0.150	0.167
Test p-value: $\beta_1 + \beta_2 = 0$	0.317	0.261	0.149	0.856	0.742	0.543

Table 9 Impacts of Short Seller Participation on PEAD

This table evaluates the impacts of short seller participation on the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if the earnings announcements happen after the reductions of analyst coverage. D(SI^{++}) is a dummy variable that equals one if the abnormal short interest at the nearest quarter end prior to earnings announcements is in the top quartile of the abnormal short interest at that quarter. Abnormal short interest at any given quarter is computed as short interest at the current quarter minus the average short interest of the past four quarters. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR_d1_d2 (%)			CAR_d1_d4 (%)		
Treat × Post × D(SI^{++}) × SUE	-0.230*	-0.299**	-0.305**	-0.302*	-0.389**	-0.378**
	[0.127]	[0.137]	[0.135]	[0.172]	[0.189]	[0.188]
Treat × Post × SUE	0.258***	0.318***	0.303***	0.383***	0.457***	0.446***
	[0.067]	[0.070]	[0.069]	[0.081]	[0.088]	[0.087]
Treat × D(SI^{++}) × SUE	0.053	0.089	0.092	0.058	0.072	0.058
	[0.104]	[0.115]	[0.116]	[0.126]	[0.141]	[0.141]
Treat × SUE	-0.200***	-0.239***	-0.236***	-0.238***	-0.280***	-0.279***
	[0.054]	[0.059]	[0.059]	[0.060]	[0.068]	[0.068]
Post × D(SI^{++}) × SUE	0.034	0.017	0.010	0.072	0.091	0.084
	[0.078]	[0.083]	[0.081]	[0.107]	[0.112]	[0.112]
Post × SUE	-0.140***	-0.158***	-0.155***	-0.219***	-0.244***	-0.248***
	[0.042]	[0.046]	[0.044]	[0.058]	[0.066]	[0.065]
D(SI^{++}) × SUE	0.033	0.064	0.062	0.012	0.019	0.021
	[0.061]	[0.066]	[0.065]	[0.078]	[0.083]	[0.083]
SUE	0.223***	0.231***	0.237***	0.292***	0.308***	0.315***
	[0.033]	[0.037]	[0.037]	[0.044]	[0.052]	[0.052]
Treat × Post × D(SI^{++})	0.363	-0.218	-0.238	-0.645	-0.884	-0.921
	[0.609]	[0.630]	[0.646]	[0.838]	[0.850]	[0.862]
Treat × Post	-0.310	-0.142	-0.230	0.007	0.154	0.084
	[0.302]	[0.305]	[0.304]	[0.384]	[0.397]	[0.401]
Treat × D(SI^{++})	-0.091	0.434	0.460	0.635	0.907	0.923
	[0.439]	[0.497]	[0.512]	[0.620]	[0.670]	[0.685]
Treat	0.110	0.447	0.477	-0.385	0.397	0.511
	[0.217]	[0.457]	[0.460]	[0.291]	[0.580]	[0.585]
Post × D(SI^{++})	0.078	0.280	0.398	0.326	0.245	0.368
	[0.379]	[0.389]	[0.398]	[0.488]	[0.487]	[0.494]
Post	0.384**	0.394**	0.283	0.666***	0.751***	0.417
	[0.179]	[0.189]	[0.216]	[0.255]	[0.268]	[0.286]
D(SI^{++})	-0.166	-0.477	-0.536	-0.343	-0.506	-0.562
	[0.306]	[0.327]	[0.335]	[0.388]	[0.405]	[0.414]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Year-month FE	No	No	Yes	No	No	Yes
Observations	11250	11250	11250	11250	11250	11250
R-squared	0.016	0.131	0.145	0.017	0.135	0.150
Test p-value: $\beta_1 + \beta_2 = 0$	0.779	0.867	0.984	0.569	0.677	0.676

Table 10 Number of Analysts Prior to Coverage Reductions

This table evaluates the role of the number of analysts prior to coverage reductions. Panel A examines changes in the magnitude of PEAD after the reductions of analyst coverage. Panel B examines the impacts of hedge fund participation on the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if the earnings announcements happen after the reductions of analyst coverage. D(HF^{++}) is a dummy variable that equals one if the abnormal aggregate hedge fund holdings at the nearest quarter end prior to earnings announcements are in the top quartile of the abnormal hedge fund holdings at that quarter. Abnormal hedge fund holdings at any given quarter are computed as hedge fund holdings at the current quarter minus the average hedge fund holdings of the past four quarters. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and the quarter levels. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Panel A: Impacts of coverage reductions on PEAD

	(1)	(2)	(3)	(4)
	CAR_d1_d2 (%)		CAR_d1_d4 (%)	
Initial # of Analysts	<=5	>=6	<=5	>=6
Treat × Post × SUE	0.237***	-0.017	0.342***	-0.038
	[0.058]	[0.051]	[0.074]	[0.063]
Treat × SUE	-0.209***	0.058	-0.243***	-0.019
	[0.050]	[0.172]	[0.057]	[0.214]
Post × SUE	-0.150***	0.051	-0.214***	0.064
	[0.038]	[0.035]	[0.052]	[0.043]
SUE	0.245***	-0.028	0.307***	-0.025
	[0.031]	[0.032]	[0.041]	[0.042]
Treat × Post	-0.328	-0.149	-0.172	-0.199
	[0.251]	[0.200]	[0.340]	[0.243]
Treat	0.612	0.112***	0.737	0.148***
	[0.440]	[0.023]	[0.561]	[0.029]
Post	0.368*	0.020	0.501**	0.140
	[0.193]	[0.132]	[0.249]	[0.160]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	11511	26372	11511	26372
R-squared	0.146	0.122	0.151	0.130

Table 10 Continued

Panel B: Impacts of hedge fund participation on PEAD

	(1)	(2)	(3)	(4)
	CAR_d1_d2 (%)		CAR_d1_d4 (%)	
Initial # of Analysts	<=5	>=6	<=5	>=6
Treat × Post × D(HF^{++}) × SUE	-0.598***	-0.155	-0.543**	0.027
	[0.173]	[0.125]	[0.214]	[0.154]
Treat × Post × SUE	0.384***	-0.005	0.432***	-0.022
	[0.071]	[0.053]	[0.089]	[0.063]
Treat × D(HF^{++}) × SUE	0.303*	0.183*	0.276	0.075
	[0.157]	[0.094]	[0.174]	[0.110]
Treat × SUE	-0.288***	0.001	-0.309***	0.010
	[0.062]	[0.038]	[0.070]	[0.047]
Post × D(HF^{++}) × SUE	0.158*	0.087	0.080	0.032
	[0.096]	[0.073]	[0.123]	[0.088]
Post × SUE	-0.166***	-0.019	-0.198***	-0.038
	[0.040]	[0.036]	[0.058]	[0.044]
SUE × D(HF^{++})	-0.059	-0.007	-0.051	0.028
	[0.077]	[0.056]	[0.095]	[0.065]
SUE	0.263***	0.121***	0.343***	0.175***
	[0.033]	[0.026]	[0.051]	[0.033]
Treat × Post × D(HF^{++})	0.284	0.301	0.640	0.581
	[0.615]	[0.429]	[0.845]	[0.557]
Treat × Post	-0.544*	0.003	-0.637*	-0.233
	[0.285]	[0.186]	[0.369]	[0.224]
Treat × D(HF^{++})	0.501	-0.366	0.310	-0.524
	[0.498]	[0.361]	[0.671]	[0.441]
Treat	0.357	-0.046	0.298	0.036
	[0.427]	[0.212]	[0.547]	[0.253]
Post × D(HF^{++})	0.302	0.086	-0.003	-0.021
	[0.365]	[0.282]	[0.501]	[0.371]
Post	0.416**	0.061	0.599**	0.236
	[0.207]	[0.139]	[0.266]	[0.166]
D(HF^{++})	-0.297	0.049	-0.140	0.100
	[0.290]	[0.221]	[0.382]	[0.270]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	9818	21329	9818	21329
R-squared	0.167	0.127	0.167	0.133

Table 11 Market Efficiency Measures Based on Variance Ratios

This table evaluates market efficiency using variance ratios. Panel A evaluates changes in market efficiency after the reductions of analyst coverage. Panel B evaluates the impacts of hedge fund participation on market efficiency after coverage reductions. *VR*(n,m) is the ratio of the quote midpoint return variance over *m* days to the return variance over *n* days, both divided by the number of days. We compute quarterly variance ratios two years before and after the reductions of analyst coverage. We sample quote midpoint returns at the appropriate frequencies over a given quarter and compute the variance using overlapping observations. For example, to compute the variance of 20-day returns over a quarter with 63 trading days, we use the 44 returns that are based entirely on days within this quarter. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for quarters after coverage reductions. D(HF^{++}) is a dummy variable that equals one if the abnormal aggregate hedge fund holdings at the prior quarter end are in the top quartile of the abnormal hedge fund holdings at that quarter. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw returns (in percent) prior to each quarter. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The data sample spans 1997 to 2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Panel A: Impacts of coverage reductions on variance ratio

	(1)	(2)	(3)	(4)	(5)	(6)
Variance Ratio	|1-*VR*(1, 5)|	|1-*VR*(1, 10)|	|1-*VR*(1, 20)|	|1-*VR*(2, 5)|	|1-*VR*(2, 10)|	|1-*VR*(2, 20)|
Treat × Post	0.013***	0.030***	0.029***	0.008**	0.019**	0.024*
	[0.004]	[0.008]	[0.010]	[0.003]	[0.009]	[0.013]
Treat	-0.011	-0.034	-0.059*	-0.003	-0.025	-0.030**
	[0.011]	[0.021]	[0.033]	[0.006]	[0.015]	[0.012]
Post	0.000	-0.013*	-0.009	-0.003	-0.012*	-0.005
	[0.004]	[0.006]	[0.011]	[0.003]	[0.006]	[0.008]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16369	16369	16369	16369	16369	16369
R-squared	0.161	0.120	0.102	0.135	0.100	0.094

Panel B: Impacts of hedge funds on variance ratio

	(1)	(2)	(3)	(4)	(5)	(6)
Variance Ratio	|1-*VR*(1, 5)|	|1-*VR*(1, 10)|	|1-*VR*(1, 20)|	|1-*VR*(2, 5)|	|1-*VR*(2, 10)|	|1-*VR*(2, 20)|
Treat × Post × D(HF^{++})	-0.024**	-0.027**	-0.031**	-0.027**	-0.038*	-0.044**
	[0.011]	[0.013]	[0.013]	[0.010]	[0.020]	[0.020]
Treat × Post	0.022**	0.034**	0.044**	0.025**	0.043**	0.052*
	[0.010]	[0.016]	[0.017]	[0.009]	[0.021]	[0.027]
Treat × D(HF^{++})	0.015	0.020*	0.011	0.016*	0.030*	0.017
	[0.009]	[0.011]	[0.013]	[0.008]	[0.017]	[0.021]
Treat	-0.020	-0.023	-0.035*	-0.010	-0.026	-0.068
	[0.012]	[0.016]	[0.018]	[0.008]	[0.030]	[0.043]
Post × D(HF^{++})	0.008	0.014	0.016	0.010	0.016	0.037
	[0.008]	[0.013]	[0.013]	[0.007]	[0.018]	[0.027]
Post	-0.001	-0.007	-0.007	-0.004	-0.019	-0.026
	[0.007]	[0.011]	[0.012]	[0.007]	[0.018]	[0.030]
D(HF^{++})	-0.017**	-0.020**	-0.006	-0.010**	-0.016	-0.010
	[0.007]	[0.008]	[0.011]	[0.005]	[0.012]	[0.016]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13509	13509	13509	13509	13509	13509
R-squared	0.157	0.128	0.109	0.137	0.127	0.096

Table 12 Price Informativeness Measure

This table evaluates market efficiency using the price informativeness measure of Bai, Philippon, and Savov (2016). Columns (1)–(2) examine changes in price informativeness after the reductions of analyst coverage. Columns (3)–(4) examine the impacts of hedge fund participation on price informativeness. $E_{i,t+1}/A_{i,t}$ is the ratio between EBIT of firm i at year *t+1* and total asset at year *t*. $\log(M_{i,t}/A_{i,t})$ is the natural log of the ratio between market capitalization and total asset. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after coverage reductions. $D(HF^{++})$ is a dummy variable that equals one if the abnormal aggregate hedge fund holdings in a given year are in the top quartile of the abnormal hedge fund holdings of that year. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw return (in percent) prior to each year. Standard errors, included in brackets, are double clustered at both the firm and year levels. The sample of this table covers observations two years before and after the reductions of analyst coverage and spans 1997 to 2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)
		$E_{i,t+1}/A_{i,t}$		
Treat × Post × $\log(M_{i,t}/A_{i,t})$	-0.013**	-0.014**	-0.018**	-0.019**
	[0.006]	[0.006]	[0.007]	[0.007]
Treat × Post × $\log(M_{i,t}/A_{i,t})$ × $D(HF^{++})$			0.026*	0.028**
			[0.013]	[0.012]
Treat × $\log(M_{i,t}/A_{i,t})$	-0.004	-0.001	0.003	0.006
	[0.010]	[0.010]	[0.011]	[0.012]
Treat × $\log(M_{i,t}/A_{i,t})$ × $D(HF^{++})$			-0.025	-0.022
			[0.020]	[0.019]
Post × $\log(M_{i,t}/A_{i,t})$	0.007*	0.007	0.009**	0.010*
	[0.004]	[0.004]	[0.004]	[0.005]
Post × $\log(M_{i,t}/A_{i,t})$ × $D(HF^{++})$			-0.011	-0.015
			[0.010]	[0.010]
$\log(M_{i,t}/A_{i,t})$	0.027**	0.025**	0.019*	0.019**
	[0.010]	[0.009]	[0.009]	[0.008]
$\log(M_{i,t}/A_{i,t})$ × $D(HF^{++})$			0.036**	0.038**
			[0.013]	[0.013]
Treat × Post	-0.005	-0.006	-0.002	-0.001
	[0.007]	[0.007]	[0.009]	[0.008]
Treat × Post × $D(HF^{++})$			-0.012	-0.016
			[0.010]	[0.010]
Treat	0.009	0.020	0.010	0.015
	[0.015]	[0.016]	[0.018]	[0.018]
Treat × $D(HF^{++})$			0.003	0.014
			[0.028]	[0.027]
Post	0.009	0.006	0.010	0.007
	[0.007]	[0.006]	[0.007]	[0.007]
Post × $D(HF^{++})$			-0.004	0.001
			[0.007]	[0.007]
$D(HF^{++})$			0.038*	0.021
			[0.017]	[0.016]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Observations	4867	4813	4867	4867
R-squared	0.878	0.880	0.879	0.882

Internet Appendix for

Sophisticated Investors and Market Efficiency: Evidence from a Natural Experiment

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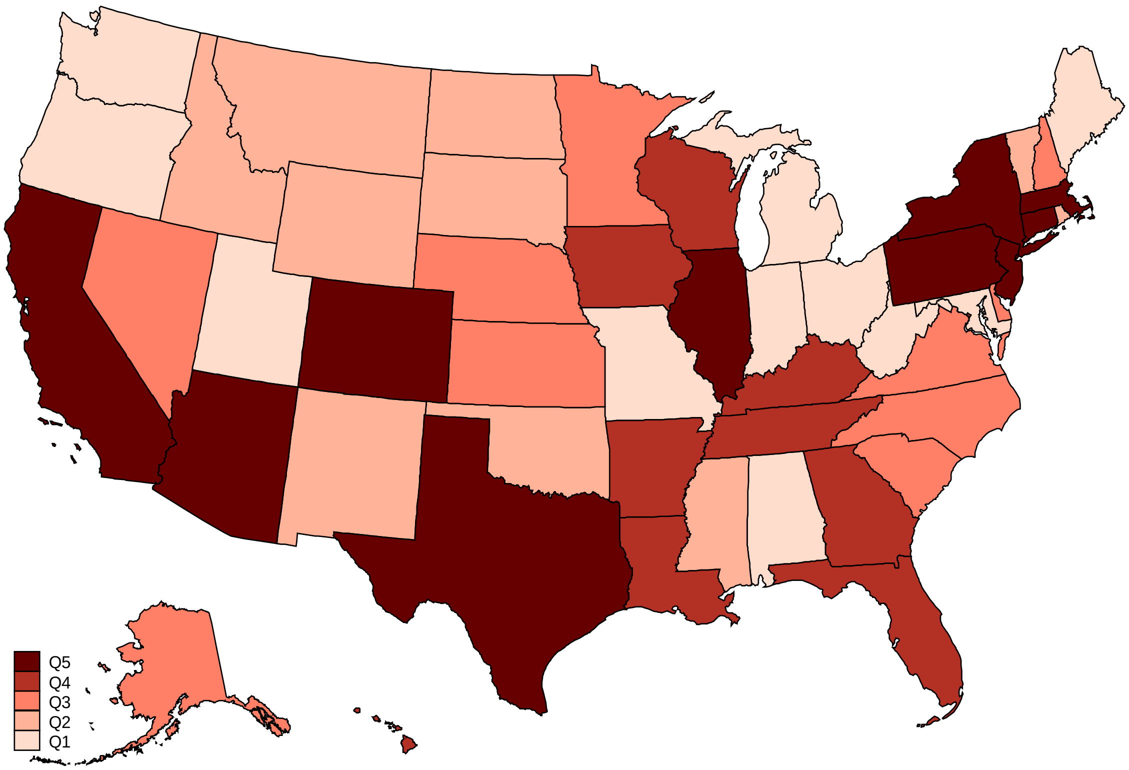
Figure IA.1

Information Acquisition via EDGAR: State-Level Difference-in-Differences Coefficients



We use the following difference-in-differences regression to evaluate changes in the EDGAR Internet search volume for insider filings after the reductions of analyst coverage.

$$Ln(ESV_{it}+1)=\alpha_i+\alpha_t+\boldsymbol{\beta_1}Treat_{it}\times Post_{it}+\beta_2 Treat_{it}+\beta_3 Post_{it}+\gamma' Controls+\varepsilon_{it}.$$

The regression is performed separately for each state. This figure plots the quintiles of the state-level difference-in-differences coefficients. The dependent variable in the difference-in-differences regressions is the natural log of monthly EDGAR Internet search volume (ESV) for insider filings (Forms 3, 4, and 5) of firm *i* in month *t*. The panel data used for the difference-in-differences regressions cover monthly EDGAR Internet search volume for the treated firms and the matched control firms two years before and after the reductions of analyst coverage. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw returns (in percent) prior to each month. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The sample period is from February 2003 to December 2010.

Table IA.1
PEAD with Various Time Horizons

This table evaluates changes in the magnitude of PEAD with various time horizons after the reductions of analyst coverage. The dependent variable $CAR\_d1\_mN_{it}$ is the cumulative abnormal return (in percent) from the first day to the end of Nth month after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one for earnings announcements that happen after the reductions of analyst coverage. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$CAR\_d1\_mN_{it} = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} + \beta_3 Post_{it} \times SUE_{it} + \beta_4 SUE_{it} + \beta_5 Treat_{it} \times Post_{it} + \beta_6 Treat_{it} + \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{it}.$$

	(1) CAR_d0_m1	(2) CAR_d0_m3	(3) CAR_d0_m6	(4) CAR_d0_m9	(5) CAR_d0_m12
Treat × Post × SUE	0.338**	0.484***	0.626**	0.946***	0.970**
	[0.166]	[0.187]	[0.278]	[0.342]	[0.393]
Treat × SUE	-0.253**	-0.400***	-0.527**	-0.550**	-0.597**
	[0.120]	[0.141]	[0.206]	[0.252]	[0.290]
Post × SUE	-0.117	-0.146	-0.225	-0.569***	-0.436*
	[0.099]	[0.110]	[0.175]	[0.219]	[0.256]
SUE	0.669***	0.554***	0.302**	0.216	-0.019
	[0.071]	[0.082]	[0.132]	[0.166]	[0.182]
Treat × Post	-0.114	0.789	0.029	-2.930	-3.473
	[0.654]	[0.785]	[1.470]	[2.089]	[2.631]
Treat	1.256	-0.110	1.561	5.804*	8.709**
	[1.047]	[1.131]	[1.850]	[3.289]	[3.865]
Post	0.483	0.738	1.493*	1.487	0.301
	[0.454]	[0.510]	[0.891]	[1.383]	[1.740]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
Observations	10817	10815	10805	10796	10784
R-squared	0.164	0.182	0.270	0.336	0.385

Table IA.2
Impacts of Exogenous Coverage Reductions on PEAD: Positive and Negative Earnings Announcements

This table evaluates changes in the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one for earnings announcements that happen after the reductions of analyst coverage. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. $D(SUE^{++})$, $D(SUE^{0})$, and $D(SUE^{--})$ are three dummy variables that equal one for earnings announcements with top 25% SUE, middle 50% SUE, and bottom 25% SUE, respectively. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	(1) CAR_d1_d1 (%)	(2) CAR_d1_d2 (%)	(3) CAR_d1_d3 (%)	(4) CAR_d1_d4 (%)
Treat × Post × $D(SUE^{++})$	0.420	0.912**	1.275**	1.498***
	[0.366]	[0.451]	[0.508]	[0.575]
Treat × Post × $D(SUE^{0})$	0.180	0.049	0.126	0.084
	[0.276]	[0.363]	[0.392]	[0.432]
Treat × Post × $D(SUE^{--})$	-1.428***	-1.587***	-1.371**	-1.374*
	[0.415]	[0.544]	[0.660]	[0.743]
Treat × $D(SUE^{++})$	-0.116	-0.461	-0.539	-0.667
	[0.355]	[0.478]	[0.579]	[0.685]
Treat × $D(SUE^{0})$	0.200	0.407	0.621	0.963
	[0.329]	[0.479]	[0.552]	[0.593]
Treat × $D(SUE^{--})$	1.321***	1.434**	1.264*	1.042
	[0.436]	[0.592]	[0.670]	[0.725]
Post × $D(SUE^{++})$	-0.004	-0.427	-0.449	-0.576
	[0.230]	[0.282]	[0.338]	[0.380]
Post × $D(SUE^{0})$	0.173	0.163	0.165	0.223
	[0.181]	[0.242]	[0.275]	[0.305]
Post × $D(SUE^{--})$	0.863***	1.117***	1.405***	1.440***
	[0.264]	[0.325]	[0.393]	[0.448]
$D(SUE^{++})$	0.856***	1.389***	1.654***	1.914***
	[0.208]	[0.268]	[0.320]	[0.355]
$D(SUE^{--})$	-0.659***	-1.030***	-1.029***	-0.840**
	[0.236]	[0.297]	[0.328]	[0.358]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	11511	11511	11511	11511
R-squared	0.145	0.145	0.148	0.150

Table IA.3
Hedge Fund Holdings prior to Earnings Announcements: Positive and Negative Earnings Announcements

This table evaluates changes in the abnormal holdings of hedge funds (also non-hedge funds) after the reductions of analyst coverage. The dependent variable $Ab\_Holdings_{it}$ is the level of abnormal hedge fund holdings (or non-hedge fund holdings) at the nearest quarter end prior to the quarterly earnings announcements (in percent of shares outstanding). Abnormal hedge fund holdings (or non-hedge fund holdings) at any given quarter are computed as hedge fund holdings (or non-hedge fund holdings) at the current quarter minus the average hedge fund holdings (or non-hedge fund holdings) of the past four quarters. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if the earnings announcements happen after the reductions of analyst coverage. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. D(SUE^{++}), D(SUE^{0}), and D(SUE^{--}) are three dummy variables that equal one for earnings announcements with top 25% SUE, middle 50% SUE, and bottom 25% SUE, respectively. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month (day -42 to day -1) cumulative raw return (in percent) prior to each quarter end. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	Abnormal HF Holdings (%)			Abnormal Non-HF Holdings (%)		
Treat × Post × D(SUE^{++})	0.511*	0.631**	0.621**	0.745	0.634	-0.106
	[0.278]	[0.312]	[0.310]	[0.925]	[0.940]	[0.932]
Treat × Post × D(SUE^{0})	0.040	0.166	0.131	1.804*	2.252*	1.796
	[0.274]	[0.298]	[0.296]	[1.062]	[1.170]	[1.221]
Treat × Post × D(SUE^{--})	-0.444	-0.423	-0.447	0.991	1.701*	1.299
	[0.397]	[0.415]	[0.420]	[0.829]	[0.900]	[0.894]
Treat × D(SUE^{++})	-0.231	-0.468	-0.377	-0.795	-0.427	0.033
	[0.185]	[0.347]	[0.335]	[0.707]	[1.095]	[1.132]
Treat × D(SUE^{0})	-0.236	-0.406	-0.306	-0.923	-1.145	-0.756
	[0.195]	[0.345]	[0.340]	[0.727]	[1.086]	[1.092]
Treat × D(SUE^{--})	0.302	0.262	0.375	-1.372**	-2.149**	-1.668*
	[0.274]	[0.406]	[0.399]	[0.650]	[1.004]	[1.003]
Post × D(SUE^{++})	-0.227	-0.373*	-0.168	-0.540	-0.894	-1.202*
	[0.188]	[0.209]	[0.219]	[0.636]	[0.637]	[0.692]
Post × D(SUE^{0})	0.050	-0.100	0.114	-0.358	-1.297	-1.712*
	[0.178]	[0.198]	[0.201]	[0.868]	[0.968]	[0.963]
Post × D(SUE^{--})	0.175	0.061	0.323	1.061**	-0.209	-0.663
	[0.272]	[0.287]	[0.280]	[0.479]	[0.497]	[0.527]
D(SUE^{++})	0.248	0.310*	0.326*	0.844	0.247	0.203
	[0.154]	[0.171]	[0.169]	[0.951]	[1.067]	[1.071]
D(SUE^{--})	0.086	-0.071	-0.086	-1.786***	-0.855	-0.830
	[0.192]	[0.200]	[0.203]	[0.650]	[0.678]	[0.679]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Year-quarter FE	No	No	Yes	No	No	Yes
Observations	10146	10146	10146	10146	10146	10146
R-squared	0.003	0.170	0.196	0.014	0.126	0.151

Table IA.4
Non-Hedge Fund Holdings prior to Earnings Announcements: Breakdown Analyses by Institution Types

This table evaluates changes in the abnormal holdings of different types of non-hedge funds after the reductions of analyst coverage. The dependent variables are the levels of abnormal holdings of different types of non-hedge funds at the nearest quarter end prior to the quarterly earnings announcements (in percent of shares outstanding). Abnormal holdings of a given type of non-hedge fund institutions at any given quarter are computed as the holdings of this type of non-hedge fund institutions at the current quarter minus the average holdings of this type of non-hedge fund institutions in the past four quarters. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after the reductions of analyst coverage. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw returns (in percent) prior to each quarter. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$Ab\_Holdings_{it} = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times SUE_{it} + \beta_2 Treat_{it} \times SUE_{it} + \beta_3 Post_{it} \times SUE_{it} + \beta_4 SUE_{it} + \beta_5 Treat_{it} \times Post_{it} + \beta_6 Treat_{it} + \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{it.}$$

	(1)	(2)	(3)	(4)	(5)
	Abnormal Non-HF Holdings (%)				
Non-HF Type	Banks	Insurance companies	Investment companies (mostly mutual funds)	Investment advisors	Others (e.g., university endowment)
Treat × Post × SUE	-0.001	-0.033	-0.112	-0.007	-0.008
	[0.031]	[0.041]	[0.083]	[0.032]	[0.020]
Treat × SUE	-0.000	0.014	0.145**	0.004	0.004
	[0.023]	[0.040]	[0.064]	[0.024]	[0.012]
Post × SUE	-0.011	0.010	-0.028	-0.005	-0.009
	[0.020]	[0.037]	[0.049]	[0.022]	[0.013]
SUE	0.047***	0.000	0.014	0.018	0.009
	[0.016]	[0.036]	[0.035]	[0.015]	[0.009]
Treat × Post	-0.168	0.281	1.150***	0.006	-0.003
	[0.220]	[0.357]	[0.440]	[0.175]	[0.114]
Treat	-0.135	-0.085	-1.168*	0.475*	0.070
	[0.269]	[0.235]	[0.657]	[0.261]	[0.153]
Post	-0.296**	-0.165	-0.435	-0.242	-0.126
	[0.144]	[0.267]	[0.292]	[0.152]	[0.102]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	10146	10146	10146	10146	10146
R-squared	0.233	0.016	0.235	0.212	0.165

Table IA.5
Information Acquisition via EDGAR: Distance to Hedge Funds Measured at the Zip Code Level

This table evaluates changes in the EDGAR Internet search volume for insider filings after the reductions of analyst coverage. The SEC has maintained a database that tracks web visits to EDGAR since February 2003. It also records the IP addresses of the requesting users, with the final (fourth) octet of the IP addresses replaced with a unique set of three letters. Based on the first three octets of the IP addresses in the SEC data, we match 90% of IP addresses (80% of the total visits) to unique zip codes. The zip codes associated with the matched IP addresses are invariant to the values of the final octet of the IP addresses. For each matched IP address, we compute its geographical distance to the nearest hedge fund based on the latitude/longitude of the zip codes and the physical addresses of hedge funds collected from 13F SEC filings. The dependent variable is the natural log of the monthly EDGAR Internet search volume (ESV) for the insider filings of firm i in month t from zip code z. The data used for the difference-in-differences regressions cover monthly EDGAR Internet search volume for the treated firms and the matched control firms two years before and after the reductions of analyst coverage. We rank all zip codes in the U.S. based on the web traffic volume of each zip code to the SEC EDGAR database. Columns (1)–(6) include ESV from top 10, 20, 30, 50, 100, and 500 zip codes, respectively. The observations are weighted based on the web traffic volume of the corresponding zip codes. If zip code z has zero visit to firm i throughout the sample period, we exclude the observations from zip code z to firm i from the sample. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after the reductions of analyst coverage. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw returns (in percent) prior to each month. Standard errors, included in brackets, are double clustered at both the firm and month levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The sample period is from February 2003 to December 2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$Ln(ESV_{zit}+1) = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times ln(Distance_z + 1) + \boldsymbol{\beta_2} Treat_{it} \times Post_{it} + \beta_3 ln(Distance_z + 1) + \beta_4 Post_{it} \times ln(Distance_z + 1) + \beta_5 Treat_{it} \times ln(Distance_z + 1) + \beta_6 Treat_{it} + \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{zit}.$$

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(EDGAR Internet Search Volume +1)					
Filing Type	Insider	Insider	Insider	Insider	Insider	Insider
Treat × Post × ln(Distance+1)	-0.059**	-0.064**	-0.096**	-0.051**	-0.030**	-0.023**
	[0.029]	[0.028]	[0.038]	[0.020]	[0.012]	[0.010]
Treat × Post	0.185***	0.200***	0.192***	0.141***	0.107**	0.085***
	[0.060]	[0.056]	[0.055]	[0.050]	[0.046]	[0.030]
ln(Distance+1)	-0.067***	-0.049**	-0.053***	-0.030**	-0.024**	-0.012
	[0.023]	[0.020]	[0.018]	[0.013]	[0.012]	[0.010]
Post × ln(Distance+1)	0.028	0.023	0.026	0.011	0.003	-0.002
	[0.027]	[0.022]	[0.019]	[0.016]	[0.014]	[0.011]
Treat × ln(Distance+1)	0.025	-0.002	0.009	-0.016	-0.021	-0.023
	[0.025]	[0.035]	[0.047]	[0.040]	[0.035]	[0.045]
Treat	-0.297**	-0.239**	-0.173*	-0.087	-0.039	-0.021
	[0.118]	[0.091]	[0.091]	[0.074]	[0.072]	[0.097]
Post	-0.011	-0.018	-0.017	-0.037	-0.027	-0.017
	[0.045]	[0.036]	[0.035]	[0.030]	[0.027]	[0.021]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Zip codes included	Top 10	Top 20	Top 30	Top 50	Top 100	Top 500
% of traffic volume	18.6%	26.1%	31.7%	38.7%	49.0%	74.1%
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	105275	188260	252076	380788	550332	925820
R-squared	0.232	0.531	0.480	0.381	0.329	0.274

Table IA.6
Impacts of Hedge Funds on PEAD: Positive and Negative Earnings Announcements

This table evaluates the impacts of hedge fund participation on the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if earnings announcements happen after the reductions of analyst coverage. D(HF^{++}) is a dummy variable that equals one if the abnormal aggregate hedge fund holdings at the nearest quarter end prior to earnings announcements are in the top quartile of the abnormal hedge fund holdings at that quarter. Abnormal hedge fund holdings at any given quarter are computed as hedge fund holdings at the current quarter minus the average hedge fund holdings of the past four quarters. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. D(SUE^{++}), D(SUE^{0}), and D(SUE^{--}) are three dummy variables that equal one for earnings announcements with top 25% SUE, middle 50% SUE, and bottom 25% SUE, respectively. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$\begin{aligned}CAR\_d1\_dn_{it} = {} & \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times D(HF^{++})_{it} \times D(SUE^{++})_{it} + \beta_2 Treat_{it} \times Post_{it} \times D(HF^{++})_{it} \\ & \times D(SUE^{0})_{it} + \boldsymbol{\beta_3} Treat_{it} \times Post_{it} \times D(HF^{++})_{it} \times D(SUE^{--})_{it} + \boldsymbol{\beta_4} Treat_{it} \times Post_{it} \\ & \times D(SUE^{++})_{it} + \beta_5 Treat_{it} \times Post_{it} \times D(SUE^{0})_{it} + \boldsymbol{\beta_6} Treat_{it} \times Post_{it} \times D(SUE^{--})_{it} \\ & + \beta_7 Treat_{it} \times D(HF^{++})_{it} \times D(SUE^{++})_{it} + \beta_8 Treat_{it} \times D(HF^{++})_{it} \times D(SUE^{0})_{it} + \beta_9 Treat_{it} \\ & \times D(HF^{++})_{it} \times D(SUE^{--})_{it} + \beta_{10} Treat_{it} \times D(SUE^{++})_{it} + \beta_{11} Treat_{it} \times D(SUE^{0})_{it} \\ & + \beta_{12} Treat_{it} \times D(SUE^{--})_{it} + \beta_{13} Post_{it} \times D(HF^{++})_{it} \times D(SUE^{++})_{it} + \beta_{14} Post_{it} \\ & \times D(HF^{++})_{it} \times D(SUE^{0})_{it} + \beta_{15} Post_{it} \times D(HF^{++})_{it} \times D(SUE^{--})_{it} + \beta_{16} Post_{it} \\ & \times D(SUE^{++})_{it} + \beta_{17} Post_{it} \times D(SUE^{0})_{it} + \beta_{18} Post_{it} \times D(SUE^{--})_{it} + \beta_{19} D(HF^{++})_{it} \\ & \times D(SUE^{++})_{it} + \beta_{20} D(HF^{++})_{it} \times D(SUE^{0})_{it} + \beta_{21} D(HF^{++})_{it} \times D(SUE^{--})_{it} \\ & + \beta_{22} D(SUE^{++})_{it} + \beta_{23} D(SUE^{--})_{it} + \gamma' Controls + \varepsilon_{it}.\end{aligned}$$

Table IA.6 Continued

	(1) CAR_d1_d1 (%)	(2) CAR_d1_d2 (%)	(3) CAR_d1_d3 (%)	(4) CAR_d1_d4 (%)
Treat × Post × D(HF^{++}) × D(SUE^{++})	-2.002**	-2.977**	-2.747*	-2.143
	[0.923]	[1.252]	[1.453]	[1.568]
Treat × Post × D(HF^{++}) × D(SUE^{0})	-1.013	-0.566	-0.685	-0.901
	[0.644]	[0.869]	[1.048]	[1.194]
Treat × Post × D(HF^{++}) × D(SUE^{--})	1.605*	2.976**	2.900*	4.388***
	[0.902]	[1.187]	[1.481]	[1.656]
Treat × Post × D(SUE^{++})	0.767*	1.390**	1.639***	1.545**
	[0.402]	[0.549]	[0.617]	[0.704]
Treat × Post × D(SUE^{0})	0.430	0.171	0.081	-0.085
	[0.334]	[0.424]	[0.470]	[0.523]
Treat × Post × D(SUE^{--})	-1.948***	-2.426***	-2.184***	-2.617***
	[0.498]	[0.627]	[0.721]	[0.777]
Treat × D(HF^{++}) × D(SUE^{++})	1.304*	2.055*	2.325*	1.691
	[0.781]	[1.127]	[1.290]	[1.426]
Treat × D(HF^{++}) × D(SUE^{0})	1.451***	0.949	1.235	1.017
	[0.478]	[0.667]	[0.854]	[0.934]
Treat × D(HF^{++}) × D(SUE^{--})	-0.286	-0.991	-0.390	-1.313
	[0.675]	[0.907]	[0.985]	[1.098]
Treat × D(SUE^{++})	-0.263	-0.882*	-1.242**	-1.192*
	[0.390]	[0.500]	[0.609]	[0.698]
Treat × D(SUE^{0})	1.404***	1.506**	0.932	1.227
	[0.517]	[0.652]	[0.734]	[0.778]
Treat × D(SUE^{--})	-0.018	0.116	0.012	0.426
	[0.388]	[0.501]	[0.579]	[0.612]
Post × D(HF^{++}) × D(SUE^{++})	1.130**	1.076*	0.460	0.262
	[0.492]	[0.622]	[0.772]	[0.931]
Post × D(HF^{++}) × D(SUE^{0})	0.834**	0.728	1.142**	1.031
	[0.359]	[0.506]	[0.580]	[0.633]
Post × D(HF^{++}) × D(SUE^{--})	-0.312	-0.535	-0.265	-1.614
	[0.616]	[0.736]	[0.891]	[1.009]
Post × D(SUE^{++})	-0.262	-0.463	-0.481	-0.475
	[0.251]	[0.327]	[0.382]	[0.436]
Post × D(SUE^{0})	0.855***	1.202***	1.281***	1.627***
	[0.284]	[0.358]	[0.432]	[0.483]
Post × D(SUE^{--})	0.124	0.194	0.228	0.321
	[0.198]	[0.281]	[0.319]	[0.346]
D(HF^{++}) × D(SUE^{++})	-0.534	-0.706	-0.612	-0.477
	[0.394]	[0.521]	[0.668]	[0.806]
D(HF^{++}) × D(SUE^{0})	-0.835***	-0.605	-0.851*	-0.701
	[0.286]	[0.393]	[0.463]	[0.470]
D(HF^{++}) × D(SUE^{--})	0.268	0.353	0.195	0.828
	[0.446]	[0.565]	[0.649]	[0.708]
D(SUE^{++})	0.826***	1.474***	1.756***	2.040***
	[0.240]	[0.327]	[0.380]	[0.434]
D(SUE^{--})	-0.727***	-1.035***	-1.169***	-1.148***
	[0.255]	[0.332]	[0.362]	[0.389]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	9423	9423	9423	9423
R-squared	0.161	0.165	0.164	0.165
Test p-value: $\beta_1 + \beta_4 = 0$	0.113	0.116	0.342	0.639
Test p-value: $\beta_3 + \beta_6 = 0$	0.653	0.588	0.579	0.221

Table IA.7
Impacts of Short Sellers on PEAD: Positive and Negative Earnings Announcements

This table evaluates the impacts of short seller participation on the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if earnings announcements happen after the reductions of analyst coverage. D(SI^{++}) is a dummy variable that equals one if the abnormal short interest at the nearest quarter end prior to earnings announcements is in the top quartile of the abnormal short interest at that quarter. Abnormal short interest at any given quarter is computed as short interest at the current quarter minus the average short interest of the past four quarters. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. D(SUE^{++}), D(SUE^{0}), and D(SUE^{--}) are three dummy variables that equal one for earnings announcements with top 25% SUE, middle 50% SUE, and bottom 25% SUE, respectively. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$
\begin{aligned}
CAR\_d1\_dn_{it} = {} & \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times D(SI^{++})_{it} \times D(SUE^{++})_{it} + \beta_2 Treat_{it} \times Post_{it} \times D(SI^{++})_{it} \\
& \times D(SUE^{0})_{it} + \boldsymbol{\beta_3} Treat_{it} \times Post_{it} \times D(SI^{++})_{it} \times D(SUE^{--})_{it} + \boldsymbol{\beta_4} Treat_{it} \times Post_{it} \\
& \times D(SUE^{++})_{it} + \beta_5 Treat_{it} \times Post_{it} \times D(SUE^{0})_{it} + \boldsymbol{\beta_6} Treat_{it} \times Post_{it} \times D(SUE^{--})_{it} \\
& + \beta_7 Treat_{it} \times D(SI^{++})_{it} \times D(SUE^{++})_{it} + \beta_8 Treat_{it} \times D(SI^{++})_{it} \times D(SUE^{0})_{it} + \beta_9 Treat_{it} \\
& \times D(SI^{++})_{it} \times D(SUE^{--})_{it} + \beta_{10} Treat_{it} \times D(SUE^{++})_{it} + \beta_{11} Treat_{it} \times D(SUE^{0})_{it} \\
& + \beta_{12} Treat_{it} * D(SUE^{--})_{it} + \beta_{13} Post_{it} \times D(SI^{++})_{it} \times D(SUE^{++})_{it} + \beta_{14} Post_{it} \times D(SI^{++})_{it} \\
& \times D(SUE^{0})_{it} + \beta_{15} Post_{it} \times D(SI^{++})_{it} \times D(SUE^{--})_{it} + \beta_{16} Post_{it} \times D(SUE^{++})_{it} + \beta_{17} Post_{it} \\
& \times D(SUE^{0})_{it} + \beta_{18} Post_{it} \times D(SUE^{--})_{it} + \beta_{19} D(SI^{++})_{it} \times D(SUE^{++})_{it} \\
& + \beta_{20} D(SI^{++})_{it} \times D(SUE^{0})_{it} + \beta_{21} D(SI^{++})_{it} \times D(SUE^{--})_{it} + \beta_{22} D(SUE^{++})_{it} \\
& + \beta_{23} D(SUE^{--})_{it} + \gamma' Controls + \varepsilon_{it}.
\end{aligned}
$$

Table IA.7 Continued

	(1) CAR_d1_d1 (%)	(2) CAR_d1_d2 (%)	(3) CAR_d1_d3 (%)	(4) CAR_d1_d4 (%)
Treat × Post × D(SI^{++}) × D(SUE^{++})	-1.204	-2.057**	-2.404**	-2.531*
	[0.818]	[1.027]	[1.157]	[1.324]
Treat × Post × D(SI^{++}) × D(SUE^{0})	0.246	-0.591	-1.352	-2.106*
	[0.683]	[0.906]	[1.026]	[1.147]
Treat × Post × D(SI^{++}) × D(SUE^{--})	0.858	1.271	1.203	1.808
	[0.997]	[1.178]	[1.381]	[1.630]
Treat × Post × D(SUE^{++})	0.456	1.274**	1.827***	2.141***
	[0.436]	[0.581]	[0.664]	[0.719]
Treat × Post × D(SUE^{0})	0.368	0.462	0.748*	0.919*
	[0.307]	[0.407]	[0.432]	[0.479]
Treat × Post × D(SUE^{--})	-1.599***	-1.829***	-1.663**	-1.816**
	[0.498]	[0.655]	[0.756]	[0.847]
Treat × D(SI^{++}) × D(SUE^{++})	0.582	1.516*	1.510	1.791
	[0.673]	[0.888]	[0.992]	[1.112]
Treat × D(SI^{++}) × D(SUE^{0})	1.112	0.766	1.128	1.231
	[0.803]	[0.934]	[1.018]	[1.243]
Treat × D(SI^{++}) × D(SUE^{--})	-0.551	-0.074	0.559	0.415
	[0.524]	[0.668]	[0.792]	[0.879]
Treat × D(SUE^{++})	-0.065	-0.656	-0.881	-1.076
	[0.371]	[0.563]	[0.682]	[0.779]
Treat × D(SUE^{0})	1.054**	1.272**	1.149	0.916
	[0.474]	[0.640]	[0.714]	[0.777]
Treat × D(SUE^{--})	0.146	0.150	0.245	0.487
	[0.337]	[0.483]	[0.560]	[0.611]
Post × D(SI^{++}) × D(SUE^{++})	0.123	0.477	1.097	0.935
	[0.463]	[0.613]	[0.726]	[0.820]
Post × D(SI^{++}) × D(SUE^{0})	0.558	0.586	0.807	0.793
	[0.387]	[0.517]	[0.581]	[0.658]
Post × D(SI^{++}) × D(SUE^{--})	-0.179	-0.036	-0.406	-0.627
	[0.596]	[0.710]	[0.831]	[0.938]
Post × D(SUE^{++})	-0.074	-0.641*	-0.869**	-1.001**
	[0.281]	[0.359]	[0.438]	[0.488]
Post × D(SUE^{0})	0.944***	1.149***	1.534***	1.643***
	[0.322]	[0.383]	[0.459]	[0.531]
Post × D(SUE^{--})	-0.010	-0.058	-0.136	-0.087
	[0.199]	[0.271]	[0.308]	[0.329]
D(SI^{++}) × D(SUE^{++})	-0.231	-0.434	-0.768	-0.617
	[0.387]	[0.538]	[0.618]	[0.703]
D(SI^{++}) × D(SUE^{0})	-0.338	-0.424	-0.644	-0.572
	[0.301]	[0.434]	[0.484]	[0.540]
D(SI^{++}) × D(SUE^{--})	-0.471	-0.581	-0.391	-0.423
	[0.483]	[0.573]	[0.632]	[0.743]
D(SUE^{++})	0.827***	1.380***	1.821***	2.025***
	[0.259]	[0.349]	[0.413]	[0.456]
D(SUE^{--})	-0.771***	-1.197***	-1.318***	-1.151***
	[0.286]	[0.349]	[0.384]	[0.414]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	9423	9423	9423	9423
R-squared	0.145	0.145	0.148	0.150
Test p-value: $\beta_1 + \beta_4 = 0$	0.295	0.367	0.551	0.731
Test p-value: $\beta_3 + \beta_6 = 0$	0.374	0.570	0.708	0.996

Table IA.8
Information Acquisition via EDGAR: Treated Firms with Six or More Analysts prior to Coverage Reductions

This table evaluates changes in the EDGAR Internet search volume after the reductions of analyst coverage, when treated firms have six or more analysts covering the firm before coverage reductions. The dependent variable is the natural log of the monthly EDGAR Internet search volume (ESV) for the filings of firm *i* in month *t*. Column (1) includes user requests for all types of EDGAR filings. Columns (2)–(6) include user requests for 10-K, 10-Q, 8-K, insider filings (Forms 3, 4, and 5), and other types of filings, respectively. The panel data used for the difference-in-differences regressions cover monthly EDGAR Internet search volume for the treated firms and the matched control firms two years before and after the reductions of analyst coverage. *Treat* is a dummy variable that equals one for observations from treated firms. *Post* is a dummy variable that equals one for observations after the reductions of analyst coverage. Control variables include *LnSize*, *LnBEME*, and *LnLev*, which are defined in Table 1, as well as *Ret2mPrior* which is the two-month cumulative raw returns (in percent) prior to each month. Standard errors, included in brackets, are double clustered at both the firm and month levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The sample period is from February 2003 to December 2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$Ln(ESV_{it}+1) = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} + \beta_2 Treat_{it} + \beta_3 Post_{it} + \gamma' Controls + \varepsilon_{it}.$$

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(EDGAR Internet Search Volume +1)					
Initial # of Analysts	>=6	>=6	>=6	>=6	>=6	>=6
Filing Type	All	10-K	10-Q	8-K	Insider	Others
Treat × Post	0.068	0.025	0.000	0.023	0.011	-0.019
	[0.053]	[0.033]	[0.016]	[0.046]	[0.042]	[0.031]
Treat	-0.118	-0.048	-0.071***	-0.067	-0.046	0.173
	[0.158]	[0.066]	[0.022]	[0.134]	[0.109]	[0.124]
Post	-0.002	0.007	-0.021	0.083**	-0.003	0.028
	[0.040]	[0.022]	[0.024]	[0.037]	[0.037]	[0.029]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31615	31615	31615	31615	31615	31615
R-squared	0.601	0.324	0.429	0.465	0.436	0.218

Table IA.9
Alternative Measures of Earnings Surprises in the PEAD Analyses

Panel A of this table evaluates changes in the magnitude of PEAD after the reductions of analyst coverage. Panel B evaluates the impacts of hedge funds on the magnitude of PEAD after the reductions of analyst coverage. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if earnings announcements happen after the reductions of analyst coverage. CAR_d0 is the abnormal return on the dates of earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. D(HF^{++}) is a dummy variable that equals one if the abnormal aggregate hedge fund holdings at the nearest quarter end prior to earnings announcements are in the top quartile of the abnormal hedge fund holdings at that quarter. Abnormal hedge fund holdings at any given quarter are computed as hedge fund holdings at the current quarter minus the average hedge fund holdings of the past four quarters. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Panel A: Impacts of coverage reductions on PEAD

$$CAR\_d1\_dn_{it} = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times CAR\_d0_{it} + \beta_2 Treat_{it} \times CAR\_d0_{it} + \beta_3 Post_{it} \times CAR\_d0_{it} + \beta_4 CAR\_d0_{it} + \beta_5 Treat_{it} \times Post_{it} + \beta_6 Treat_{it} + \beta_7 Post_{it} + \gamma' Controls + \varepsilon_{it.}$$

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR_d1_d2 (%)			CAR_d1_d4 (%)		
Treat × Post × CAR_d0	0.101***	0.097**	0.092**	0.102*	0.102*	0.101*
	[0.039]	[0.039]	[0.038]	[0.053]	[0.054]	[0.054]
Treat × CAR_d0	-0.042	-0.044	-0.044	-0.062*	-0.074**	-0.079**
	[0.027]	[0.028]	[0.027]	[0.035]	[0.036]	[0.037]
Post × CAR_d0	-0.029	-0.025	-0.026	-0.036	-0.036	-0.040
	[0.020]	[0.021]	[0.021]	[0.026]	[0.027]	[0.027]
CAR_d0	0.036***	0.034**	0.034**	0.057***	0.059***	0.062***
	[0.014]	[0.014]	[0.014]	[0.018]	[0.018]	[0.019]
Treat × Post	-0.041	0.044	-0.010	0.033	0.151	0.113
	[0.211]	[0.206]	[0.209]	[0.287]	[0.285]	[0.302]
Treat	-0.056	0.418	0.415	-0.346*	0.445	0.460
	[0.149]	[0.339]	[0.341]	[0.205]	[0.422]	[0.431]
Post	0.056	0.072	0.026	0.308*	0.374**	0.179
	[0.113]	[0.119]	[0.142]	[0.179]	[0.183]	[0.202]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Year-month FE	No	No	Yes	No	No	Yes
Observations	11511	11511	11511	11511	11511	11511
R-squared	0.006	0.103	0.112	0.005	0.114	0.126

Table IA.9 Continued

Panel B: Impacts of hedge funds on PEAD

$$CAR_{d1_{dn}it} = \alpha_i + \alpha_t + \boldsymbol{\beta_1} Treat_{it} \times Post_{it} \times D(HF^{++})_{it} \times CAR_{d0_{it}} + \boldsymbol{\beta_2} Treat_{it} \times Post_{it} \times CAR_{d0_{it}} + \beta_3 Treat_{it} \times D(HF^{++})_{it} \times CAR_{d0_{it}} + \beta_4 Treat_{it} \times CAR_{d0_{it}} + \beta_5 Post_{it} \times D(HF^{++})_{it} \times CAR_{d0_{it}} + \beta_6 Post_{it} \times CAR_{d0_{it}} + \beta_7 D(HF^{++})_{it} \times CAR_{d0_{it}} + \beta_8 CAR_{d0_{it}} + \beta_9 Treat_{it} \times Post_{it} \times D(HF^{++})_{it} + \beta_{10} Treat_{it} \times Post_{it} + \beta_{11} Treat_{it} \times D(HF^{++})_{it} + \beta_{12} Treat_{it} + \beta_{13} Post_{it} \times D(HF^{++})_{it} + \beta_{14} Post_{it} + \beta_{15} D(HF^{++})_{it} + \gamma' Controls + \varepsilon_{it}.$$

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR_d1_d2 (%)			CAR_d1_d4 (%)		
Treat × Post × D(HF^{++}) × CAR_d0	-0.191**	-0.231***	-0.241***	-0.177	-0.211*	-0.230**
	[0.086]	[0.084]	[0.086]	[0.109]	[0.113]	[0.114]
Treat × Post × CAR_d0	0.172***	0.166***	0.164***	0.160***	0.154**	0.160**
	[0.048]	[0.048]	[0.048]	[0.062]	[0.063]	[0.062]
Treat × D(HF^{++}) × CAR_d0	0.046	0.060	0.069	0.043	0.068	0.079
	[0.061]	[0.063]	[0.064]	[0.083]	[0.089]	[0.089]
Treat × CAR_d0	-0.044	-0.038	-0.040	-0.052	-0.062	-0.070
	[0.034]	[0.034]	[0.034]	[0.044]	[0.044]	[0.044]
Post × D(HF^{++}) × CAR_d0	0.075	0.074	0.075	0.094	0.119*	0.122*
	[0.052]	[0.053]	[0.054]	[0.066]	[0.070]	[0.070]
Post × CAR_d0	-0.041*	-0.025	-0.027	-0.052*	-0.039	-0.043
	[0.023]	[0.024]	[0.024]	[0.030]	[0.031]	[0.031]
D(HF^{++}) × CAR_d0	-0.013	-0.014	-0.014	-0.024	-0.047	-0.049
	[0.038]	[0.039]	[0.039]	[0.054]	[0.057]	[0.057]
CAR_d0	0.054***	0.044**	0.045**	0.080***	0.074***	0.077***
	[0.017]	[0.018]	[0.018]	[0.024]	[0.024]	[0.024]
Treat × Post × D(HF^{++})	-0.185	-0.483	-0.444	0.137	-0.083	0.004
	[0.512]	[0.538]	[0.525]	[0.705]	[0.744]	[0.736]
Treat × Post	-0.239	-0.114	-0.208	-0.288	-0.175	-0.287
	[0.207]	[0.217]	[0.214]	[0.285]	[0.298]	[0.298]
Treat × D(HF^{++})	0.397	0.820*	0.784*	0.127	0.539	0.448
	[0.394]	[0.444]	[0.442]	[0.556]	[0.620]	[0.625]
Treat	-0.012	0.235	0.224	-0.143	0.220	0.296
	[0.153]	[0.347]	[0.350]	[0.223]	[0.428]	[0.448]
Post × D(HF^{++})	0.277	0.344	0.356	-0.121	0.045	0.045
	[0.267]	[0.290]	[0.293]	[0.389]	[0.413]	[0.415]
Post	0.183	0.014	0.039	0.437***	0.234	0.088
	[0.119]	[0.132]	[0.156]	[0.163]	[0.171]	[0.198]
D(HF^{++})	-0.207	-0.359	-0.318	0.017	-0.300	-0.251
	[0.216]	[0.231]	[0.234]	[0.303]	[0.327]	[0.326]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes
Year-month FE	No	No	Yes	No	No	Yes
Observations	9818	9818	9818	9818	9818	9818
R-squared	0.012	0.117	0.126	0.012	0.117	0.128
Test p-value: $\beta_1 + \beta_2 = 0$	0.789	0.378	0.301	0.850	0.549	0.462

Table IA.10
Testing the Alternative Explanations for the Impacts of Hedge Funds on Market Efficiency

This table evaluates the impacts of hedge funds on the magnitude of PEAD after the reductions of analyst coverage in two sub-samples. In columns (1)–(2), we exclude observations from treated firms targeted by activist hedge funds two years before and two years after the coverage reductions, as well as the observations from the matched control firms. In columns (3)–(4), we exclude observations from treated firms with a history of providing earnings guidance, as well as the observations from the matched control firms. The dependent variable $CAR\_d1\_dn_{it}$ is the cumulative abnormal return (in percent) from the first day to the nth day after earnings announcements, benchmarked by the returns of the corresponding Fama-French 5×5 size and book-to-market portfolios. *Treat* is a dummy variable that equals one for earnings announcements from treated firms. *Post* is a dummy variable that equals one if earnings announcements happen after the reductions of analyst coverage. D(HF^{++}) is a dummy variable that equals one if the abnormal aggregate hedge fund holdings at the nearest quarter end prior to earnings announcements are in the top quartile of the abnormal hedge fund holdings at that quarter. Abnormal hedge fund holdings at any given quarter are computed as hedge fund holdings at the current quarter minus the average hedge fund holdings of the past four quarters. *SUE* is quarterly standardized unexpected earnings, computed as the quarter's actual earnings minus the average of the most recent analyst forecasts, divided by the standard deviation of those forecasts. Control variables include *LnSize*, *LnBEME*, *LnLev*, and *Ret2mPrior*, which are defined in Table 1. Standard errors, included in brackets, are double clustered at both the firm and quarter levels. The treated firms are limited to firms that have five or fewer analysts covering the firm before coverage reductions. The data cover earnings announcements two years before and after the reductions of analyst coverage over the period 1997–2010. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

$$\begin{aligned} CAR\_d1\_dn_{it} = {} & \alpha_i + \alpha_t + \beta_1 Treat_{it} \times Post_{it} \times D(HF^{++})_{it} \times SUE_{it} + \beta_2 Treat_{it} \times Post_{it} \times SUE_{it} \\ & + \beta_3 Treat_{it} \times D(HF^{++})_{it} \times SUE_{it} + \beta_4 Treat_{it} \times SUE_{it} + \beta_5 Post_{it} \times D(HF^{++})_{it} \times SUE_{it} \\ & + \beta_6 Post_{it} \times SUE_{it} + \beta_7 D(HF^{++})_{it} \times SUE_{it} + \beta_8 SUE_{it} + \beta_9 Treat_{it} \times Post_{it} \times D(HF^{++})_{it} \\ & + \beta_{10} Treat_{it} \times Post_{it} + \beta_{11} Treat_{it} \times D(HF^{++})_{it} + \beta_{12} Treat_{it} + \beta_{13} Post_{it} \times D(HF^{++})_{it} \\ & + \beta_{14} Post_{it} + \beta_{15} D(HF^{++})_{it} + \gamma' Controls + \varepsilon_{it}. \end{aligned}$$

Table IA.10 Continued

	(1)	(2)	(3)	(4)
	CAR_d1_d2 (%)	CAR_d1_d4 (%)	CAR_d1_d2 (%)	CAR_d1_d4 (%)
Sample	Exclude Treated Firms Targeted by Activist Hedge Funds and the Matched Control Firms		Exclude Treated Firms with a History of Providing Earnings Guidance and the Matched Control Firms	
Treat × Post × D(HF^{++}) × SUE	-0.596***	-0.591**	-0.475**	-0.668**
	[0.213]	[0.253]	[0.215]	[0.301]
Treat × Post × SUE	0.355***	0.450***	0.416***	0.554***
	[0.082]	[0.106]	[0.121]	[0.161]
Treat × D(HF^{++}) × SUE	0.333*	0.303	0.346*	0.457*
	[0.189]	[0.207]	[0.190]	[0.243]
Treat × SUE	-0.293***	-0.326***	-0.388***	-0.383***
	[0.073]	[0.085]	[0.113]	[0.138]
Post × D(HF^{++}) × SUE	0.191*	0.152	0.171	0.289
	[0.115]	[0.149]	[0.152]	[0.205]
Post × SUE	-0.180***	-0.246***	-0.146*	-0.288**
	[0.050]	[0.069]	[0.083]	[0.122]
D(HF^{++}) × SUE	-0.057	-0.020	-0.093	-0.108
	[0.092]	[0.112]	[0.136]	[0.176]
SUE	0.263***	0.346***	0.291***	0.382***
	[0.042]	[0.058]	[0.077]	[0.111]
Treat × Post × D(HF^{++})	0.398	0.047	0.663	0.190
	[0.785]	[0.991]	[0.938]	[1.232]
Treat × Post	-0.403	-0.350	-0.075	0.639
	[0.321]	[0.420]	[0.533]	[0.772]
Treat × D(HF^{++})	0.519	0.869	0.081	0.725
	[0.647]	[0.805]	[0.795]	[1.047]
Treat	0.616	1.122*	1.549**	-0.305
	[0.487]	[0.644]	[0.718]	[1.340]
Post × D(HF^{++})	-0.247	0.094	-1.355**	-1.381
	[0.457]	[0.605]	[0.671]	[0.939]
Post	0.478**	0.484	0.456	0.630
	[0.242]	[0.306]	[0.433]	[0.594]
D(HF^{++})	-0.269	-0.758*	0.546	0.069
	[0.358]	[0.452]	[0.563]	[0.760]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
Observations	8785	8785	4305	4305
R-squared	0.164	0.174	0.181	0.203
Test p-value: $\beta_1 + \beta_2 = 0$	0.168	0.499	0.751	0.644