Mandatory Short Disclosures: An Information Story

ABSTRACT

Requiring short sellers to disclose positions could discourage market participation, thus harming price efficiency ("constraint effect"). However, it could also provide a new source of value-relevant information to the market, thus improving price efficiency ("information effect"). The two effects counteract each other, rendering it difficult to empirically capture each distinctly. Prior literature has provided evidence of the constraint effect while leaving the information effect unexplored. I identify a setting during which the information effect dominates, the earnings announcement, and document the implications of this effect: lower information asymmetry and uncertainty, greater pre-announcement information acquisition, and more efficient incorporation of earnings news following its release. I study EU regulatory changes in a staggered difference-in-differences design. This paper's findings provide insights for the ongoing debate on short disclosure regulation in the US, providing credence to the argument of its advocates that mandatory short disclosures provide valuable information.

I. INTRODUCTION

There have been calls for the US Securities Exchange Commission (SEC) to mandate real-time public disclosures of short positions exceeding certain size thresholds (henceforth, short disclosures). Advocates of such a policy claim that mandatory short disclosures would provide valuable information to market participants, thus improving price efficiency. Meanwhile, critics purport that the requirement to disclose would constrain short selling activity, thereby harming price efficiency. In sum, a policy mandating short disclosures could, at the same time, introduce a new source of information to the market ("information effect") and curtail the contributions of short sellers to the price discovery process by constraining their activities ("constraint effect"). The extant literature examining short disclosure policies documents that the constraint effect indeed harms price efficiency by reducing short selling activity. However, there has been little

discussion on the information effect. In this paper, I examine short disclosure policies from an information economics perspective. Specifically, I ask the question: what are the implications of the information effect, if any, of short disclosure policies?

Due to the counteracting nature of the two effects, it is challenging to empirically capture the information effect separately from the constraint effect. Furthermore, the findings of prior literature suggest that the constraint effect usually dominates the information effect, masking the latter (Jones, Reed, and Waller 2016). I posit that the information effect is systematically stronger during the earnings announcement period. The release of earnings news is generally followed by large stock price movements, so short sellers have strong incentives to align their positions with upcoming earnings news. Prior literature has found evidence consistent with this, showing that short activity leading up to the announcement date is related to the earnings surprise (Christophe, Ferri, and Angel 2004). Further, by investigating the information effect in the context of earnings announcements, my tests capture short selling that is driven by fundamental accounting information rather than by higher order beliefs. I hence operationalize my study of the information effect by examining how short disclosure policies affect market behavior around earnings announcements.

As this paper investigates the merits of a *proposed* policy, it is limited by the unavailability of US data. I thus turn towards the experiences of EU countries, who implemented short disclosure policies at different points in time. While certainly an imperfect comparison, the EU setting allows me to gather empirical inferences for insight into policymaking in the US. Between 2008 and 2011, France, Spain, and the UK implemented varying, yet similar, short disclosure policies. In 2012, the EU Regulation on Short Selling (henceforth, the Regulation) superseded these policies and harmonized short disclosure rules across all EU countries, requiring timely public disclosures of

large short positions. As a testament to the importance of the earnings announcement period, I find that the frequency of short disclosures made in accordance with these policies increases towards and peaks at the announcement week, as depicted in Figure 1[1].

Stereotypically, short sellers take positions in securities they believe to be overvalued and make a profit when the prices of these securities subsequently fall. Short sellers are thought to be sophisticated market players in possession of value-relevant information, superior information processing skills, or both. The empirical evidence suggests that they anticipate upcoming negative news, including disappointing earnings announcements (Christophe, Ferri, and Angel 2004) and are exceptionally adept at analyzing publicly available information (Engelberg, Reed, and Ringgenberg 2012). There is little doubt that short sellers influence the price discovery process, contributing positively to price efficiency (Boehmer, Jones, and Zhang 2008; Saffi and Sigurdsson 2011; Boehmer and Wu 2013).

Given the critical role short sellers play in the price discovery process, it is unsurprising that there is no shortage of voices in the debate on whether or not to implement a short disclosure policy. On one side of the debate is the constraint effect, which argues that imposing disclosure requirements on short sellers constrains their activities, thereby reducing the efficiency with which prices impound negative information. The academic literature has delivered direct evidence of the constraint effect: Jones et al. (2016) find that short disclosure policies reduce short interest and price informativeness in the EU; Duong, Huszár, and Yamada (2015) find similar results in Japan.

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[1] The short disclosures counted in Figure 1 result from the EU Regulation on Short Selling and all prior policies it superseded. The 12 European countries included in the count are: Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. A disclosure is made: (1) when a position reaches the public disclosure threshold, (2) when there is a significant increase in the size of the position, and (3) when the position falls below the public disclosure threshold. The increasing trend and peak at week 0 in Figure 1 is unchanged when I only count disclosures of (1) and (2).

On the other side of the debate is the argument of the information effect, left relatively unexplored by the academic literature. To the extent that short disclosures are informative, the market would benefit from a new source of information, encouraging timelier incorporation of value-relevant information into prices. Short disclosures would also alleviate the current asymmetry in disclosure rules, as currently only significant positions on the long side need to be disclosed in the US. Yet, these possibilities are conditional on short disclosures being informative, and whether this is the case is ex-ante unclear. While short sellers are generally thought to be informed traders, *uninformed* short selling also exists. These short positions, usually taken as part of hedging strategies, are made without regard for whether the securities are overvalued. The difficulty of disentangling informed from uninformed short selling in short disclosures may be one reason why prior literature is yet unable to document the implications of the information effect. This paper attempts to fill this gap in the literature.

I take advantage of the staggered implementation of short disclosure regulation across the EU, including its eventual harmonization under the Regulation. I follow Jones et al. (2016) in constructing a staggered difference-in-differences research design around four regulatory changes and examine the differential treatment effect between "regulated" earnings announcements (i.e., those that are made under a short disclosure regulation) and those that are "unregulated". For each of the four events, earnings announcements in the pre-event period are compared to those in the post-event period. In this way, the research design studies two-way differences: (i) by regulation status, and (ii) by event time.

Approximately 11.4 percent of regulated earnings announcements in my sample are targeted by short disclosures in the month prior. These earnings announcements are more likely to announce bad news and experience lower immediate post-announcement returns. Furthermore,

earnings news remains a significant determinant of whether or not the earnings announcement is targeted by short disclosures, beyond proxies for the costs and benefits to short sellers of disclosing.

As a testament to the information effect of short disclosure policies, I find declines in bid-ask spreads, the Amihud (2002) measure of price impact, and return volatility. These effects are significant in both the pre- and post-announcement windows, suggesting that short disclosure regulations reduce the level of information asymmetry and uncertainty around earnings announcements. Furthermore, short disclosure regulations encourage pre-announcement information acquisition, leading to more subdued reactions when earnings news is eventually released and less post-earnings announcement drift. This improvement in price efficiency is strongest for earnings announcements of bad news by firms operating in weak information environments. I also find some evidence that active institutional investors alter their behavior in the face of short disclosure regulations, suggesting a channel through which information in short disclosures is dispersed through the market.

This paper makes several contributions to the academic literature and the policy discussion regarding short disclosures. It contributes to the fundamental accounting question of how markets use firm-external sources of information to hone their prediction and interpretation of earnings (Amiram, Owens, and Rozenbaum 2016). It also contributes to the literature on the key role that information intermediaries play in a firm's information environment and, in particular, on short sellers as intermediaries of accounting information (Beyer et al. 2010; Pownall and Simko 2005). This paper also offers a different perspective from prior research on short disclosure regulation. While the focus of prior research has been on the constraint effect, this paper presents evidence of the information effect and its capital market consequences.

The remainder of the paper is organized as follows. Section 2 develops hypotheses. Section 3 details the sample and sources of data. Sections 4 through 6 discuss analyses and results. Section 7 concludes.

II. HYPOTHESIS DEVELOPMENT

The Dodd-Frank Act of 2010 directed the SEC to study the "feasibility, benefits, and costs of" requiring the real-time reporting of significant short positions. The SEC published its report in 2014, in which it acknowledged that requiring short sellers to disclose their significant positions comes with both potential benefits and risks, as short disclosures "could help … price efficiency and hence capital formation [but] could also facilitate copycat an order anticipation strategies" (US Securities and Exchange Commission 2014). Ultimately, short disclosure regulation was not introduced in the US. Yet, the debate did not cease.

The Constraint Effect

The main argument put forth by opponents of short disclosure regulation is that disclosure requirements would discourage short sellers from participating fully in the market, thereby harming price efficiency. Indeed, Jones et al. (2016) find that the Regulation and its predecessors reduced short interest and price informativeness. By disclosing their positions, short sellers risk exposing proprietary information about their trading strategies. Other traders may exploit a short seller's disclosure by replicating the trades disclosed, either before the informed short seller is able to finish building the position (front-running) or after (free-riding) [2]. Thus, short disclosures may

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[2] Short sellers conduct costly research to find overvalued firms and seek to build short positions large enough to compensate for their research efforts. Building a short position can take time – usually longer than building a similar position on the long side – since shares from willing lenders must first be procured. A short seller who is forced to disclose a position risks spurring a decline in the stock price before he finishes building the position, which would cause his profits to diminish.

discourage short sellers from expressing fully their views. Consistent with this, Jank, Roling, and Smajlbegovic (2021) find that short sellers who are subject to short disclosures actively conceal their trades by limiting the size of their positions beneath the mandatory public disclosure threshold.

The Regulation also requires short sellers to identify themselves by name, pushing the repercussions of disclosure beyond pecuniary to personal. Short sellers may be vulnerable to direct attacks from the firms against which they place their bets (Lamont 2012) or even experience threats to personal safety. In response to an alleged bill produced by the Nasdaq and NYSE to force disclosure standards on short sellers, John Hempton of Bronte Capital writes: "the Bill is a threat to my physical safety" (Hempton 2018).

The Information Effect

In 2015, the Nasdaq and NYSE formally petitioned the SEC to require the real-time public disclosure of short positions exceeding certain size thresholds (King and Cudahy 2015; Knight 2015). Both exchanges claim that current US disclosure requirements are unbalanced; significant long positions must be disclosed but short ones are not[3]. Without short disclosures, the Nasdaq argues, "stocks will continue to be buffeted by rumor, speculation and innuendo, and companies, investors and the market will continue to be deprived of important information" (Knight 2015). Two other formal petition letters to the SEC followed those filed by the exchanges: one by the Biotechnology Innovation Organization in 2016 (Esham 2016) and one by MiMedx, a biopharmaceutical company targeted by short sellers, in 2017 (Petit 2017). The general argument

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[3] Under current SEC rules, positions exceeding 5% of the voting class of the company's shares must be reported with a Schedule 13D or 13G. Additionally, institutional investment managers with $100 million or more under management must file a 13F on a calendar quarter basis.

in these letters is that increased transparency would provide valuable information to the market and improve price efficiency.

There is theoretical support for this argument. Short sellers take positions in firms they believe to be overvalued. However, without a catalyst to correct prices downwards, the market's beliefs may remain unchanged and hence stock price unchanged. Disclosures may act as such a catalyst, spurring other market participants to update their beliefs of firm value downwards. As one New Yorker article, quoting the prominent short seller William Ackman, puts it:

> 'What short sellers do is identify the problem, because they're economically incentivized to do so. But if you don't tell anyone about it, you know, nothing necessarily is going to happen.' (Kolhatker, 2017)

There are anecdotes of short sellers using disclosure as a strategy to induce price movement. Certain firms, such as Muddy Waters, specialize in such a strategy, taking short positions in stocks they identify as overvalued and publishing free research reports. Ljungqvist and Qian (2016) find that these "short-sale campaigns" can spur a decline of 7.5 percent in the targeted firm's stock price. In a mandatory disclosure setting, regulators could provide credibility and dissemination, with less costly effort from the short seller. Short disclosures are also often reported in the popular media, further extending the reach of information dissemination[4].

Yet, it remains unclear whether the information effect should exist at all. Prior literature examining the Regulation has met difficulty in documenting its existence and hence its implications. While voluntary disclosures are sent out deliberately as a negative signal by short sellers, mandatory disclosures are not so explicit. The market must deduce the motives of the

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[4] Some examples include Citadel's bet against Ryanair (https://www.theguardian.com/business/2019/apr/03/billionaires-hedge-fund-bets-60m-shares-in-ryanair-will-fall), Crispin Odey's bet against Wirecard (https://www.bloomberg.com/news/articles/2019-02-01/hedge-fund-bear-odey-hits-another-home-run-with-wirecard-wager), and George Soros' bet against Aston Martin (https://www.telegraph.co.uk/business/2018/11/17/george-soros-places-20m-bet-against-aston-martin/).

disclosing short seller and whether the position is driven by informed or uninformed short selling. For example, this ambiguity is illustrated in the Financial Times' reportage of Mr. Dalio of Bridgewater's short positions, which he was forced to disclose under the Regulation:

> It remains unclear whether Mr Dalio's trade, although certainly "big", is actually a short at all [as] … the bets against European companies may actually be hedged against a corresponding position, meaning the popular interpretation that Mr Dalio is "short Europe" is incorrect. (Johnson 2018)

Furthermore, short sellers could choose to skirt the disclosure threshold. Prior literature has shown that short sellers strategically build positions to a size right under the Regulation's public disclosure threshold and that these secretive positions experience stronger negative returns than publicly disclosed ones (Jank, Roling, and Smajlbegovic 2021). Altogether, these reasons are perhaps why prior literature has yet to document the implications of the information effect.

The Earnings Announcement Period

While the information effect is the main argument in support of short disclosure policies and has been documented anecdotally, it has scarcely been studied academically. There are several possibilities for why the information effect has yet to be fully captured in empirical work, among them that: (1) the constraint and information effects counteract each other thereby masking the latter, and (2) the information effect is subdued by the public disclosure of uninformed short positions resulting from trading strategies unrelated to specific short bets.

I posit that these two issues are less prominent during the earnings announcement period, as it is a high-information period associated with heightened market activity and attention. During this period, market participants actively seek information, and short disclosures may be a novel source of information receiving heightened scrutiny during this period. Furthermore, short sellers have strong incentives to align their positions with upcoming earnings news since the release of such news can trigger significant price movement. The extant literature shows that short sellers are

particularly active leading up to the earnings announcement and that they have some success in anticipating earnings news (Berkman and Mckenzie 2012; Christophe, Ferri, and Angel 2004). The post-earnings announcement period is also of particular interest to short sellers, who gain much of their trading advantage from their superior abilities in processing public information (Engelberg, Reed, and Ringgenberg 2012). Figure 1 plots the count per week of short disclosures made to regulators from January 2007 through December 2015 in the 12 EU countries from which I obtain my sample, with week zero being the week during which the earnings announcement date falls. The frequency of short disclosures steadily increases until it peaks at the week of the announcement and subsequently sharply falls, consistent with the notion that short sellers view the earnings announcement period as particularly important.

III. SETTING AND DATA

The EU Regulation on Short Selling

The EU implemented mandatory real-time reporting of significant short positions with its EU Regulation on Short Selling (N236/2012)[5]. The Regulation was published in the Official Journal of the EU on March 24, 2012 and came into force on November 1, 2012. Short sellers who amass a significant position in an EU-listed stock are required to disclose the position with, at most, a one-day delay. The disclosure is made privately to the local securities regulator if the position is greater than or equal to 0.2 percent of share capital or publicly through the regulator's

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[5] In addition to the requirement to disclose significant short positions, the Regulation also introduced a prohibition on naked short selling. This confounding event could impinge on this study's ability to clearly identify the information effect of short disclosures. This issue is mitigated in two ways. Firstly, naked short selling bans were already in place in several EU countries prior to the implementation of the Regulation. For example, Germany imposed a ban on 10 of its financial stocks on May 18, 2010; Italy imposed a similar ban on all stocks on November 11, 2011. Hence, the Regulation did not necessarily change the legality of naked short selling in an EU-listed stock. Secondly, I study not only the Regulation, but also the earlier implementation of similar short disclosure policies in France and Spain. This allows me to bolster the identification strategy by studying multiple policy change "events", all introducing similar short disclosure requirements.

website if greater than or equal to 0.5 percent of share capital. The short seller must also disclose to the regulator every 0.1 percent increase from the original position, and any such disclosure is also publicly disclosed if the position at any time exceeds the 0.5 percent threshold. A final disclosure is required when the position falls below the 0.5 percent public disclosure threshold. The calculation of position size nets long from short positions, and calculations must include derivative agreements.

The information required in a short disclosure includes: the name of the targeted firm, the size of the net short position, the date the position was established, the date of disclosure, and either the name of the individual short seller or the name of the short selling firm. The requirement to disclose applies to stocks listed in the EU, regardless of where the short seller is domiciled. Each securities regulator in the EU maintains an easily and freely accessible database of (public) short disclosures on its website and updates this database on a daily or more frequent basis[6].

Staggered Implementation, Eventual Harmonization

Several EU member states instituted short disclosure regulations of their own prior to the introduction of the Regulation in 2012. The UK Financial Services Authority (FSA) moved first, requiring disclosures of short positions in stocks undergoing rights issuances in 2008. In 2009, the FSA extended these disclosure requirements to capture short positions in financial stocks. The French *autorité des marches financiers* (AMF) and Spanish *Comisión Nacional del Mercado de Valores* (CNMV) also began requiring disclosures of significant short positions in financial stocks in 2009. Spain's CNMV and France's AMF expanded their disclosure rules to capture all stocks in June of 2010 and February of 2011, respectively[7]. In 2012, the Regulation replaced these

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[6] The European Securities and Markets Authority (ESMA) provides a list of links to these websites. Access to this list is available at https://www.esma.europa.eu/sites/default/files/library/ssr_websites_ss_procedures.pdf.
[7] There were minor variations in the short disclosure policies introduced prior to the Regulation. The UK required public disclosure of positions exceeding 0.25 percent of share capital and did not require disclosure of positions

existing rules and harmonized short disclosure requirements across all EU member states. Appendix B provides a graphical representation of the timeline of this staggered implementation of policies.

Preliminary Sample Construction

My sample consists of annual earnings announcements made by firms listed on the exchanges of 12 European countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. I begin with all announcements from January 2007 through 2015. I collect fiscal-year-end dates and their corresponding earnings announcement dates from FactSet, requiring the announcement to be made no later than 180 calendar days after the fiscal year end. While IBES also provides announcement dates and is frequently the source of such data for studies sampling US firms, irregularities with these IBES data have been documented for European firms. Acker and Duck (2009) compare IBES with hand-collected announcement dates for a sample of UK companies and find a 24.5 percent error rate. I find that FactSet provides wide coverage and relatively high accuracy[8]. The announcement date in FactSet is the date that earnings news impacts trading; announcements made during after-market hours are adjusted to the next trading day.

I remove earnings announcements by firms with American Depository Receipts and that have multi-share structures. Furthermore, I remove any announcements that are made under a short selling ban, the dates of which are collected from Beber and Pagano (2013) and online searches

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below that. France had similar requirements, though the threshold for disclosure was higher at 0.5 percent. Spain required public disclosure of positions exceeding 0.5 percent of share capital and private disclosure of positions exceeding 0.2 percent of share capital.

[8] If the actual announcement date is not available, FactSet provides an estimated announcement date. An example of such an estimation is taking the fiscal period end date, adding two months, and reporting the closest Wednesday. As using these estimated dates would introduce measurement error in my sample, I remove all announcements with estimated dates. I keep only announcements with dates that are flagged by FactSet as the date the announcing firm actually publishes its results. I also verify by hand a random sample of 100 announcement dates from FactSet with the Factiva database and online searches and find this sample to be free of errors.

for news articles and press releases from securities regulators. For an announcement to enter my sample, I require non-zero trading volume in the 11-day window centered on the announcement date. Lastly, I require non-missing announcement-day returns, and actual and analyst-forecasted earnings data. The resulting sample consists of 9,088 earnings announcements by 1,573 unique firms from 2007 through 2015.

Sources of Data

Short selling data. I rely on Markit for daily short selling data: (1) shares on loan, (2) shares available as lending supply, (3) short utilization, and (4) a cost of borrowing score[9]. Short utilization is a measure of short selling that accounts for both demand and supply, calculated as the fraction of (1) over (2). The cost of borrowing score is a Markit-created discrete measure running from one through ten, with ten signifying high cost of short selling. I adjust the Markit dataset for a three-day settlement lag; values at date t in my sample are adjusted to reflect values at date $t+3$ in the Markit dataset.

Short disclosure data. I obtain data on short sellers' mandatory public disclosures from the websites of local securities regulators. The data include the identity of the short seller, the security being shorted and its ISIN, the size of the position, and the position and public disclosure dates. With these data, it is possible to track the progression of each holding, from the first opening disclosure to the final disclosure that signifies the position size has fallen below the disclosure threshold of 0.5 percent.

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[9] These variables are the European analogues of the Markit data for "beneficial owner on loan quantity" (*BOLQ*), "beneficial owner inventory quantity" (*BOIQ*), "utilization rate" (*Utilization*), and "daily cost of borrowing score" (*DCBS*) used by Beneish, Lee, and Nichols (2015) in their sample of US firms.

Ownership data. I download active and index ownership as a fraction of total ownership from FactSet and match these data to the quarter in which the announcement date falls[10]. FactSet classifies holdings as institutional if the owner is designated by FactSet as a buy-side or sell-side firm. Institutions are further classified by their investment style; any institution that is not classified as "index" is labelled "active".

Earnings data. Actual, non-GAAP earnings per share (EPS) data and summary information on analysts' forecasts are taken from IBES. I obtain the number, mean, and standard deviation of forecasts measured at the last IBES statistical period before the announcement date, and only if it is made within 180 days of the announcement date, and translate IBES values to US dollars using the US Federal Reserve Board's H.10 release of foreign exchange rates.

Stock/Firm data. I obtain stock returns and prices, index returns, trading volumes, outstanding share counts, book-to-market values, market values, and bid-ask spreads from Datastream[11]. I also obtain the country of listing and one-digit FTSE Russell Industry Classification Benchmark (ICB) from Datastream.

Construction of Key Variables

I use two measures of earnings news: actual earnings per share (*EPS*) and unexpected earnings per share (*SUE*), both standardized by price averaged over the [-65,-61] window relative

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[10] FactSet collects non-North American ownership information for companies with market capitalizations greater than $50 million and for holdings greater than or equal to 0.1 percent of shares outstanding. The data are mostly obtained from local regulators, stock exchanges, and news sources. Reported changes in holdings are updated in the database within two business days.

[11] I make some adjustments to the Datastream data. I remove bid and ask prices if the bid price is equal to or exceeds the ask price, and I remove book-to-market if it is less than or equal to zero. Additionally, to address concerns raised by Ince and Porter (2006) regarding returns data in Datastream, I remove returns identified as erroneous per the procedures followed by Jank et al. (2021) and Jones et al. (2016). Both papers follow the same procedure, and I do the same. I delete returns greater than 200%, and delete two-day returns if either day's return exceeds 100% but the cumulative return is less than 20%.

to the announcement date[12]. The results are not sensitive to the choice of this window. The numerator of *SUE* is calculated as actual EPS less the mean analyst consensus EPS. I calculate the cumulative abnormal return, $CAR(t_1,t_2)$, as the daily local index-adjusted return cumulated over trading days t_1 through t_2. Here, as is the case for all other variables I calculate by summarizing daily data, I require at least three-quarters of the observations to be non-missing.

$Amihud(t_1,t_2)$ and $Spread(t_1,t_2)$ are the Amihud (2002) measure of price impact and the quoted bid-ask spread, respectively, averaged over the $[t_1,t_2]$ window around the announcement date. The Amihud measure is the absolute abnormal return on a given day divided by the dollar volume of trades in millions on that same day. The daily bid-ask spread is calculated as the ask less the bid price, scaled by the midpoint between the two. I measure raw (market-adjusted) return volatility as the standard deviation of raw (market-adjusted) returns, in percentage terms, over the $[t_1,t_2]$ window around the announcement date. The purpose of specifying the window over which to measure these variables is to separately study the effect of short disclosure regulation prior to and following the release of earnings news.

In some instances, institutional ownership can exceed 100 percent, and I thus winsorize all ownership variables at this threshold[13]. I trim my earnings announcement-level measures of Amihud, spread, return volatility, book-to-market, share turnover, and short selling volume at the top 1 percent. Finally, I take the natural logarithm of the market capitalization of the firm.

Table 1 provides pooled summary statistics for the earnings announcements from January 2007 through December 2015 that survive the sample attrition process. The average pre-

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[12] During my sample period, not all firms announced earnings on a quarterly basis because of the differing mandated reporting frequency across the EU. I hence average over the [-65,-61] window to estimate the stock price at the end of the last quarter for all firms.

[13] This could occur due to an overlap in institutions' disclosure timings, leading to a double counting of ownership. Additionally, shares sold short could be counted twice, firstly by the original lender and then by the buyer of the shares on the other side of the short trade.

announcement level of short interest is 9.2 percent. Short utilization is slightly higher at 11.2 percent as short supply is, on average, less than 100 percent. Although my sample is drawn from 12 European countries, the distribution of *SUE* is comparable to that in Livnat and Mendenhall (2006), who study US earnings announcements[14].

IV. EARNINGS ANNOUNCEMENTS TARGETED BY SHORT DISCLOSURES

I begin my analysis by examining earnings announcements that are targeted by short disclosures[15]. I narrow my focus to announcements that are made under a short disclosure regulation since those made outside of such a regulation cannot, by definition, be targeted by short disclosures.

Announcement Returns in the Presence of Short Disclosures

Prior literature has documented that short sellers are able to anticipate bad news, such as public revelations of financial misconduct (Karpoff and Lou 2010), analyst downgrades (Christophe, Ferri, and Hsieh 2010), and negative announcement returns (Christophe, Ferri, and Angel 2004). I examine whether pre-announcement short disclosures also contain predictive information for post-announcement returns. This analysis examines jointly the information content of short disclosures as well as the market's ability to impound the available information, if any. I estimate the following model:

$$CAR(0,+1)_{ijkt} = \beta_0 + \beta_1 Disclosure_{ijkt} + \beta_2 X_{ijkt} + \varepsilon_{ijkt}. \tag{1}$$

The outcome variable $CAR(0,+1)_{ijkt}$ is the abnormal return cumulated from the day of the announcement to the day after by firm i in industry j and country k, and in year t. $Disclosure_{ijkt}$ is

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[14] Livnat and Mendenhall (2006) report the 25th, 50th, and 75th percentiles for *SUE* as -0.006, 0.002, and 0.007, respectively. The corresponding values for my sample are -0.005, 0.000, and 0.005.

[15] I do not include short disclosures that indicate a short position has fallen below the disclosure threshold since these are unlikely to signal to the market a similar indication as other types of short disclosures.

an indicator denoting whether or not an announcement is targeted by a short disclosure in the month prior. X_{ijkt} is a vector of other covariates.

Table 3 reports a consistent result across several specifications: earnings announcements targeted by short disclosures experience lower announcement returns. This result holds after controlling for the level of pre-announcement short interest, as well as for book-to-market and firm size, with the point estimate being 1.1 percent. In the rightmost two columns, I specify the following in Equation (1) to allow for country, industry, and year fixed effects:

$$\beta_0 = \theta_j + \delta_k + \tau_t.$$

The main finding remains unchanged. While the magnitude of β_1 may seem small, it is surprising it exists at all, as it suggests that the market has a slight underreaction to pre-announcement short disclosures.

Determinants of Announcements with Short Disclosures

Though there is some evidence that pre-announcement short disclosures are followed by lower post-announcements returns, it remains an empirical question as to whether anticipated earnings news is a driver of short disclosures. I examine this question with the following logit model:

$$Disclosure_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 x_{it} + \varepsilon_{it}. \tag{2}$$

Here, x_{it} is a measure of earnings news and takes on a value in {*EPS*, *SUE*, *Q1SUE*},where *Q1SUE* indicates that *SUE* falls in the lowest quintile for the year. Since short sellers bet on the downside, I expect results to be stronger for *Q1SUE* than for continuous measures of earnings news. X_{it} is a vector of potential determinants of short disclosures around announcements besides earnings news. A short seller's decision to cross the public disclosure threshold is a tradeoff between its costs and benefits, and I attempt to capture this here. To represent the costs, I include

the level of institutional ownership and pre-announcement bid-ask spreads, which are all strongly related to short supply and the costs of short selling (Saffi and Sigurdsson 2011; Reed 2013). I also include share turnover, as highly traded stocks may be easier to short. To represent the potential benefits, I include return volatility and book-to-market. Return volatility captures uncertainty ahead of announcements, and prior literature has found evidence that short sellers' voluntary disclosures target firms with higher uncertainty (Zhao 2017). Book-to-market captures the appeal of growth versus value stocks to short sellers. Short sellers may target growth stocks, especially around earnings announcements, as the profit potential may be greater than value stocks when earnings news is bad (Skinner and Sloan 2002).

I also include market capitalization, though it is ex-ante unclear how it would relate to short disclosures. On the one hand, smaller firms tend to have less short supply (Saffi and Sigurdsson 2011), thus leading to higher costs of disclosure. On the other hand, smaller firms have less pre-announcement information impounded into prices and are slower to incorporate earnings information in the post-announcement period (Foster, Olsen, and Shevlin 1984; Atiase 1985), thereby leading to greater opportunities for short sellers to identify mispricing. Lastly, I include *DisclosureOld*, an indicator variable that takes on a value of 1 if the firm was the target of at least one short disclosure in the period between last year's and two years' ago earnings announcements. This variable is meant to capture time-invariant observable and unobservable characteristics of the announcing firm that are related to short sellers' decisions to cross the public disclosure threshold. In the last specification, I replace *Disclosure* with *Open*, which narrows the disclosures to only those that communicate the opening of a new significant short position and should send the strongest negative signal.

Table 3 reports the results of estimating Equation (2). Proxies for the costs of disclosure load as expected in the model. Institutional ownership, liquidity, and turnover are associated with a greater likelihood of an earnings announcement being targeted by short disclosures. Book-to-market does not load significantly, though I find that disclosures are more likely with greater market volatility. *DisclosureOld* is significantly positive, suggesting the presence of time-invariant firm characteristics that are related to short sellers' decisions to cross the public disclosure threshold. Moreover, the results suggest that earnings news, measured by *EPS*, *SUE*, and *Q1SUE*, is a significant determinant of short disclosures, even before it is released. In summary, the evidence is consistent with short disclosures containing predictive information relevant to the earnings announcement[16].

V. EFFECTS OF SHORT DISCLOSURE REGULATION

Studying the information effect of short disclosures is not altogether straightforward due to issues related to selection into the treatment – earnings announcements that have drawn the public scrutiny of short sellers are likely to be fundamentally different from those that have not. These issues are particularly concerning in a study of the information effect of short disclosure regulation since the modus operandi of short sellers is to identify overvalued firms, which typically have higher information asymmetry and uncertainty, and lower price efficiency. Additionally, to the extent that the market is aware that a regulation mandating short disclosures is in effect, the *absence* of short disclosures could also provide information that affects the market's anticipation or interpretation of earnings news.

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[16] In untabulated results, I find similar results for short disclosures in the month after the earnings announcement date, suggesting that they are not only predictive but also reactive.

Staggered Difference-in-Differences Model

To mitigate the concerns raised above, I follow Jones et al. (2016) in taking advantage of the various regulatory changes across the EU to create a staggered difference-in-differences design. I examine four regulatory change "events": (1) *Event 1,* the introduction of short disclosure requirements for significant short positions in Spanish financial firms on September 22, 2008; (2) *Event 2,* the extension of these disclosure requirements to Spanish non-financial firms on June 10, 2010; (3) *Event 3,* the extension of disclosure requirements to all French non-financial firms on February 1, 2011; and (4) *Event 4,* the implementation of the Regulation on November 1, 2012. I exclude the 2008 regulatory changes in the UK and France, as they coincide with short selling bans that were in effect in these countries. In fact, any earnings announcement made under a short selling ban is removed from the sample.

These four events form the basis of the difference-in-differences sample, where the pre-event period is defined as the calendar year prior to each event date and the post-event period is the year following. Furthermore, I remove any observations that overlap with another event and require a balanced panel[17]. Therefore, to be included in the difference-in-differences sample, a firm must have a documented earnings announcement in both the pre- and post-event periods of at least one event. Appendix C provides greater clarity on the construction of this difference-in-differences sample.

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[17] Take *Event 2* as an example. The post-event period begins in June of 2010, when disclosure rules were implemented for Spanish non-financials, and ends one year later in June of 2011. During this post-event period, French non-financials also experienced a change in short disclosure requirements on February 1, 2011 (*Event 3*). Earnings announcements made by French non-financials after February 1, 2011 are thus excluded from the post-event period of *Event 2*.

Formally, I estimate the difference-in-differences model below to examine the effect of short disclosure regulation on the outcome variable y_{ijksv} for an earnings announcement by firm i in industry j and country k during the pre-event ($v = 0$) or post-event ($v = 1$) period of event s:

$$y_{ijksv} = \beta_1 Regulated_{ijksv} + \beta_2 Post_{ijksv} + \beta_3 Regulated \times Post_{ijksv}$$
$$+\beta_4 X_{ijksv} + \theta_j + \delta_k + \gamma_s + \varepsilon_{ijksv} \qquad (3a)$$

$Regulated_{ijksv}$ is an indicator variable that takes on a value of 1 if significant short positions in the announcing firm are subject to disclosure requirements. $Post_{ijksv}$ indicates whether the announcement is made in the pre- or post-event period of event s, and hence is 1 (0) when v is 1 (0). The main coefficient of interest, β_3, captures the incremental effect of short disclosure regulation on y_{ijksv}. I also include a vector of controls X_{ijksv} when appropriate. The four events are studied simultaneously in one equation with event fixed effects. I also include country-of-listing and industry fixed effects, and I cluster standard errors at the firm level.

For each of the four events, the "treatment" group thus consists of the earnings announcements of firms for which the status of short disclosure rules changes. The "control" group consists of those for which there is no change. Over the course of the four events, as more and more firms in different countries and industries are brought under short disclosure rules, the number of earnings announcements for which *Regulated* takes on a value of 1 increases. Table 4 illustrates this concept, enumerating the announcements that enter the difference-in-differences sample by event and country of listing.

Information Asymmetry and Uncertainty

Whether or not short disclosures convey value-relevant information that the market impounds into prices is ex-ante unclear. I begin by empirically studying the effect, if any, of short disclosure regulation on information asymmetry and uncertainty. Information asymmetry is defined here as the imbalance of information between short sellers and other market participants.

Information uncertainty is defined as in Zhang (2006): "the ambiguity with respect to the implications of new information for a firm's value". To the extent that short sellers possess information beyond what is already available to the market and reveal this information in short disclosures, information asymmetry should decline. Furthermore, this effect should be stronger in the pre- rather than post-announcement period, when earnings is yet to be revealed. Information uncertainty should decline as well, as the market's interpretation of firms' earnings news should be sharpened by the additional information contained in short disclosures. To proxy for information asymmetry, I use the Amihud (2002) measure of price impact, which captures how prices move in response to trading activity, and quoted bid-ask spreads[18]. I proxy for information uncertainty with raw and market-adjusted return volatility following Zhang (2006)[19].

Table 5 reports the results from estimating Equation (3a), controlling for *SUE*. The findings on price impact and quoted spread suggest a decrease in information asymmetry. Looking at estimates of β_3, there is approximately a 0.15 basis point reduction in spread, equivalent to 9.01 percent of its standard deviation, in the pre-announcement period. As expected, I find stronger results in the pre- rather than post-announcement period, as it is likely that short disclosures resolve more information asymmetry before earnings news is definitively released. Table 5 also suggests that short disclosure regulation reduces information uncertainty around earnings announcements. In both the days leading up to and following the announcement date, there is a reduction in return volatility in the range of 0.21 to 0.32 percent.

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[18] While traditional measures of the bid-ask spread are noisy proxies of information asymmetry (Stoll 1989), price impact is more likely to capture its liquidity effects, as suggested by the classical models in the theoretical literature (Brennan and Subrahmanyam 1996), and the Amihud (2002) measure has been shown to be a good proxy for price impact (Goyenko, Holden, and Trzcinka 2009).

[19] The theoretical basis for this empirical proxy is contained in the work of Ross (1989), who suggests that return volatility represents information volatility.

Information Efficiency

The works of Ball and Brown (1968) and Beaver (1968), and the ensuing stream of literature have established that earnings announcements are significant information events that are closely anticipated and dissected by the market. There is evidence to suggest that the market begins to impound earnings information even prior to its release. Yet, there is also evidence to suggest that the full extent of earnings information is not incorporated immediately into prices but gradually through a post-earnings announcement drift (Bernard and Thomas 1989). If these disclosure regulations positively affect information efficiency, I expect greater anticipation of earnings news in pre-announcement prices. In turn, if a larger portion of earnings information is already impounded into prices prior to its release, the immediate reaction to the information (i.e., the earnings response coefficient (ERC)) should be more subdued, or less of a "surprise" to the market[20]. Additionally, if short disclosures are a new source of information that helps the market process earnings information more efficiently after its release, I expect greater price discovery in the post-announcement period, resulting in reduced post-earnings announcement drift (PEAD).

I modify Equation (3a) to allow for a three-way interaction:

$$y_{ijksv} = \beta_1 Regulated_{ijksv} + \beta_2 Post_{ijksv} + \beta_3 x_{ijksv} + \beta_4 W_{ijksv}$$
$$+\beta_5 Regulated_{ijksv} \times Post_{ijksv} \times x_{ijksv}$$
$$+\theta_j + \delta_k + \gamma_s + \varepsilon_{ijksv} \tag{3b}$$

W_{ijksv} is a vector of all of the possible two-way interactions created from $Regulated_{ijksv}$, $Post_{ijksv}$, and x_{ijksv}. In effect, Equation (3b) is a staggered difference-in-differences model that allows for the treatment effect to vary by x_{ijksv}. The coefficient of interest is thus β_5, and it represents the incremental effect (to regulated versus unregulated announcements in post- versus pre-event

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[20] This notion is consistent with the theoretical underpinnings of the price jump ratio developed in Weller (2018).

periods) of short disclosure regulation on the relationship between by x_{ijksv} and the outcome variable y_{ijksv}.

I begin by examining the effect of short disclosure regulation on pre-announcement information acquisition. Specifically, I examine how returns in the days leading up to the announcement behave with regards to upcoming earnings news. I take x_{ijksv} to be the market-adjusted return cumulated over the 20-trading-day window[21] prior to the announcement date and y_{ijksv} to be a measure of earnings news. In the context of Equation (3b), a higher value of β_5 suggests that regulated earnings announcements in post-event periods experience pre-announcement returns that are more anticipative of earnings news. The results, as tabulated in Panel A of Table 6 indicate just this. The significantly positive estimates of β_5 provide some evidence that short disclosure regulation encourages greater pre-announcement information acquisition.

To examine the effect of short disclosure regulation on the post-announcement period, I again estimate Equation (3b), though this time taking x_{ijksv} to be earnings news and y_{ijksv} to be abnormal returns cumulated over a post-announcement window. This thus empirically captures the extent to which the market reacts to earnings information after its release. Panel B of Table 6 reports the results for various return windows. The leftmost column suggests that short disclosure regulation reduces the ERC. This finding, coupled with the findings in Panel A, is consistent with the market better anticipating upcoming earnings information and hence reacting less strongly to it when it is released. Estimates of β_5 for longer-term post-announcement windows also provide strong evidence of a reduction in the PEAD, suggesting greater price discovery with respect to

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[21] Using a 10-trading-day, rather than a 20-trading-day, window yields similar results. The 20-trading-window was chosen to be consistent with the analyses and results of Section IV, which defined earnings announcements targeted by short disclosures as those announcements that are preceded by a negative-signaling short disclosure in the month (approximately 20-trading-day window) prior to the announcement date.

earnings information in the week, month, and three months following the announcement date[22]. Overall, the results are consistent with short disclosure regulation encouraging greater information efficiency in both the pre- and post-announcement periods.

VI. ADDITIONAL ANALYSES

Institutional Ownership Around Announcements

I explore a potential channel through which information in short disclosures is dispersed through the market. Ljungqvist and Qian (2016) show that voluntary disclosures of short positions cause spikes in institutional selling. I estimate Equation (3b) to examine the effect of short disclosure regulation on institutional ownership, allowing the treatment effect to vary by *Q1SUE*. Since short disclosures send out negative signals, the effect on institutional trading behavior should be concentrated on the downside. On the other hand, there is little reason for why short disclosure regulations should cause institutional owners to reduce holdings in good news earnings announcements. Table 7 provides evidence that firms announcing the lowest quintile of earnings for the year, *Q1SUE*, experience a decline in active ownership of approximately 4.8 percent[23], suggesting that active ownership is shifted away from poor-performing earnings announcements. Unsurprisingly, there is no significant effect on passive index ownership.

Heterogeneity in Treatment Effect

Table 8 examines three potential sources of cross-sectional heterogeneity in short disclosure regulation's effect on information efficiency. The first of these, displayed in Panel A, is earnings news. Since short sellers profit from the downside, the effect of short disclosure

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[22] In untabulated results, I find that, while there is some evidence of a return reversal in the longer post-announcement window (as the sum of the effects on *SUE* is negative), this effect is not significantly different from zero.

[23] This is the sum of the coefficients on *Regulated × Post* and *Regulated × Post × Q1SUE*.

regulations should be stronger around announcements of bad, rather than good, earnings news. For each year, I partition my sample of earnings announcements into quintiles based on *EPS* or *SUE*, with quintile 1 (5) representing bad (good) news announcements, and estimate Equation (3b). Additionally, to test that the differences are indeed statistically significant, I report *t*-statistics of estimates of the following term, which is added to Equation (3b) to allow the effect of short disclosure regulation to vary with the partitioning variable D_{ijksv}:

$$\beta_6 Regulated_{ijksv} \times Post_{ijksv} \times SUE_{ijksv} \times D_{ijksv}$$

In Panel A, I define D_{ijksv} as *Q1EPS* (*Q1SUE*), an indicator variable that takes on a value of 1 if *EPS* (*SUE*) falls in the bottom quintile for the year. The results are consistent with short disclosure regulation having an asymmetric effect concentrated on bad news.

In Panel B, I examine heterogeneity arising from the existing information environment as Pownall and Simko (2005) posit that the effect of short sellers on information efficiency should be conditional on the overall information environment of the firm. I use analyst following and the Amihud ratio as proxies for the information environment, and again examine the top and bottom quintiles of each. I expect the information effect to be higher when the information environment is weaker, i.e., when analyst following is low or when the Amihud ratio is high, and vice versa, and the results are consistent with this notion.

Lastly, I examine heterogeneity based on the difficulty of short selling. I examine the effect of short disclosure regulation by quintiles of short interest and supply, with quintile 1 indicating low short interest or supply and suggesting high difficulty of short selling. Additionally, following Beneish, Lee, and Nichols (2015), I define announcements for which *BorrowCost* is three or greater as being difficult to short[24]. It is ex-ante unclear how the difficulty of short selling could

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[24] Prior literature, including the one cited in-text, has classified stocks for which Markit's Daily Cost of Borrowing Score (DCBS) is three or greater as "special", i.e., difficult to borrow. I follow this classification here.

introduce heterogeneity in the treatment effect. By disclosing, a short seller faces the risk of imitators rushing in with copycat trades, thereby driving up the cost and difficulty of short selling, and stocks that are inherently difficult to short are more susceptible to this issue. On the other hand, a disclosure of a position in a stock that is difficult to short may send a stronger signal than one in a stock that is easier to short, thereby attracting more attention and reaction. Panel C reports the results. While there is some evidence that the treatment effect is concentrated in difficult-to-short announcements, the mixed results of β_6 do not make it possible for me to draw statistically sound inferences.

VII. CONCLUSION

In the special yet important and recurrent setting of the earnings announcement period, the information effect of short disclosure regulations prevails over the constraint effect. A focus on the announcement period thus allows me to document the capital market consequences of the information effect. I find that short disclosures are predictive of upcoming earnings news and that announcements preceded by short disclosures experience lower post-announcement returns. Using a staggered difference-in-differences research design to examine the causal effects of short disclosure regulations, I find evidence in support of the information effect. In the days leading up to and following earnings announcements, information asymmetry and uncertainty fall with the implementation of short disclosure regulation. Pre-announcement returns become more attuned to upcoming news and post-earnings announcement drift declines. Furthermore, the effect of short disclosure regulation on information efficiency is strongest around announcements of bad earnings news by firms with weak information environments.

Prior literature examining the effects of introducing short disclosure regulation have focused on the constraint effect and have had little success in documenting the implications of the information effect. Meanwhile, the information effect has been the primary argument put forth by advocates of short disclosure regulations. This paper documents the existence of the information effect around the earnings announcement period and its capital market consequences. If anything, the findings of this paper provide further evidence of the importance of the earnings announcement period.

The SEC studied the feasibility, costs, and merits of mandatory short reporting in 2014. Henceforth, no short disclosure regulation was introduced in the US. However, the Nasdaq, NYSE, and several US companies continue to seek such a regulation from the SEC. While prior literature has documented the negative effects of such a policy, I find that short disclosures can reveal valuable information, encouraging information efficiency. There certainly are both costs and benefits to mandating short disclosures and future research can perhaps suggest a more targeted, rather than sweeping, approach to related policymaking.

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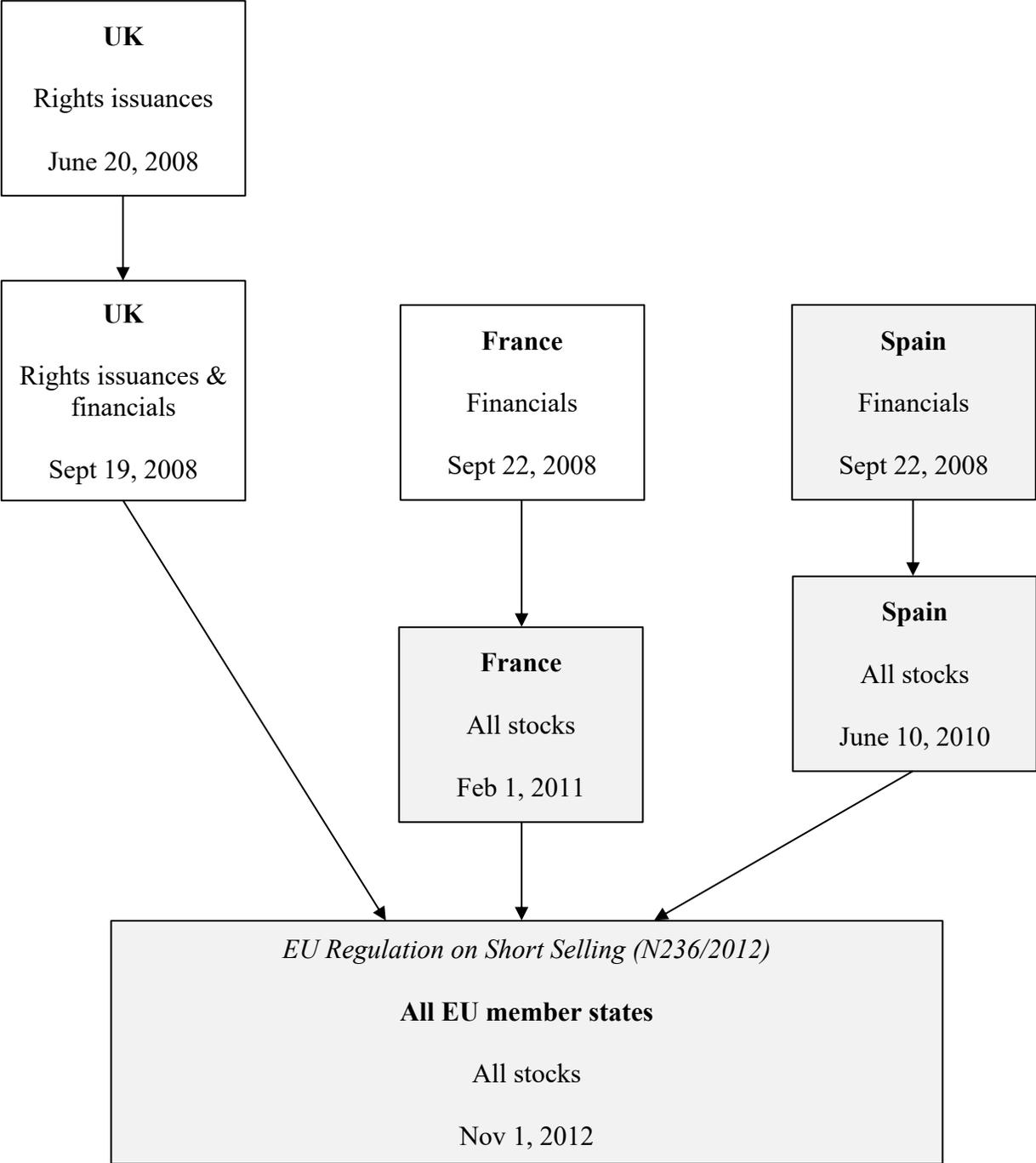Zhao, Wuyang. 2017. "Activist Short-Selling." University of Toronto.

Appendix A: Variable Definitions

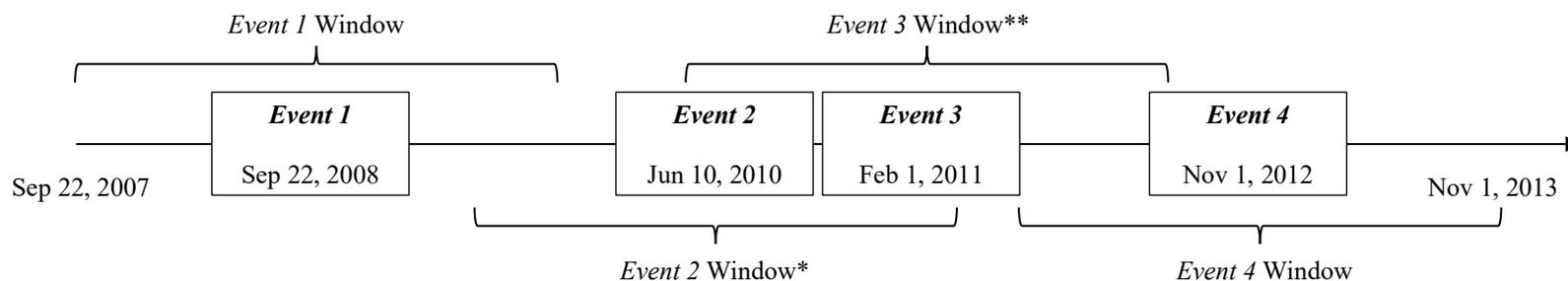| Variable	Definition and Data Source
Active	Active institutional ownership as a fraction of total ownership for the calendar month and year of the corresponding earnings announcement (FactSet: *OS_GRP_HLDR_PCTOS*)
AdjVol(t_1,t_2)	Adjusted return volatility, calculated as the standard deviation of market-adjusted returns (in %) over the [t_1,t_2] window around the earnings announcement date (Datastream: *RI, LI*)
Amihud(t_1,t_2)	Amihud (Amihud, 2002) measure of price impact, calculated as the absolute value of the market-adjusted return divided by the dollar volume of shares traded in millions, averaged over the [t_1,t_2] window around the earnings announcement date (Datastream: *RI, LI, UVO, UP*)
BorrowCost	Markit's Daily Cost of Borrowing Score, which is a discrete score from 1 to 10, with 1 representing low cost of borrowing and 10 representing high cost of borrowing, averaged over the [-5,+5] window around the earnings announcement date (Markit: *DCBS*)
BTM	Book-to-market value averaged over the [-5,-1] window around the earnings announcement date (Datastream: *MTBV*)
CAR(t_1,t_2)	Cumulative abnormal return, calculated as the market-adjusted return cumulated over the [t_1,t_2] window around the earnings announcement date (Datastream: *RI, LI*)
DisclosureOld	Indicator variable taking on a value of 1 if the firm is a target of at least one short disclosure in the period between its prior year's annual earnings announcement and two years' ago annual earnings announcement, and 0 otherwise (Regulators' websites)
EPS	Actual EPS scaled by the estimated last quarter stock price (average stock price over [-65,-61] trading days before the earnings announcement date) (IBES: *ACTUAL*; Datastream: *UP*)
Index	Ownership by index funds as a fraction of total ownership for the calendar month and year of the corresponding earnings announcement (FactSet: *OS_GRP_HLDR_PCTOS*)
InstOwn	Shares held by institutional investors as a fraction of shares on float (FactSet: *OS_SEC_FLT_INST_PCT*)
ln(MV)	Natural logarithm of market value in US dollars, averaged over the

	[-5,-1] window around the earnings announcement date (Datastream: *MV*)
NumEst	Analyst following, calculated as the number of analysts' estimates in IBES (IBES: *NUMEST*)
RawVol(t_1,t_2)	Raw return volatility, calculated as the standard deviation of raw returns (in %) over the [t_1,t_2] window around the earnings announcement date (Datastream: *RI, LI*)
ShortInterest	Level of short interest, calculated as the number of shares on loan divided by the number of shares outstanding, averaged over the [-5,+5] window around the earnings announcement date (Markit: *BOOLQ*; Datastream: *NOSH*)
Spread(t_1,t_2)	Quoted bid-ask spread in basis points, averaged over the [t_1,t_2] window around the earnings announcement date, where the bid-ask spread is calculated as the ask price less the bid price, all scaled by the midpoint between the two (Datastream: *PA, PB*)
SUE	Standardized unexpected earnings, calculated as the most recent mean consensus analyst EPS forecast less actual EPS, scaled by the estimated last quarter stock price (average stock price over [-65,-61] trading days before the earnings announcement date) (IBES: *ACTUAL, MEANEST*; Datastream: *UP*)
Supply	Supply of shares available for lending, calculated as the number of shares available for lending scaled by shares outstanding, averaged over the [-5,+5] window around the earnings announcement date (Markit: *BOIQ*; Datastream: *NOSH*)
Turn	Volume of shares traded scaled by shares outstanding, averaged over the [-5,-1] window around the earnings announcement date (Datastream: *UVO*, *NOSH*)
Utilization	Short selling utilization, defined as the number of shares on loan divided by the number of shares available for lending, averaged over the [-5,+5] window around the earnings announcement date (Markit: *UTIL_Q*)

Appendix B: Staggered Introduction of Short Disclosure Regulation

```
┌─────────────────┐
│       UK        │
│                 │
│ Rights issuances│
│                 │
│  June 20, 2008  │
└─────────────────┘
        │
        ▼
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│       UK        │   │     France      │   │      Spain      │
│                 │   │                 │   │                 │
│ Rights issuances│   │   Financials    │   │   Financials    │
│  & financials   │   │                 │   │                 │
│                 │   │  Sept 22, 2008  │   │  Sept 22, 2008  │
│  Sept 19, 2008  │   └─────────────────┘   └─────────────────┘
└─────────────────┘           │                     │
        │                     ▼                     ▼
        │             ┌─────────────────┐   ┌─────────────────┐
        │             │     France      │   │      Spain      │
        │             │                 │   │                 │
        │             │   All stocks    │   │   All stocks    │
        │             │                 │   │                 │
        │             │   Feb 1, 2011   │   │  June 10, 2010  │
        │             └─────────────────┘   └─────────────────┘
        │                     │                     │
        ▼                     ▼                     ▼
┌───────────────────────────────────────────────────────────────┐
│        EU Regulation on Short Selling (N236/2012)             │
│                                                               │
│                   All EU member states                        │
│                                                               │
│                      All stocks                               │
│                                                               │
│                     Nov 1, 2012                               │
└───────────────────────────────────────────────────────────────┘
```

Appendix C: Difference-in-Differences Sample

Event 1 Window — Sep 22, 2007 — Event 1, Sep 22, 2008

Event 3 Window**

Event 2, Jun 10, 2010 — Event 3, Feb 1, 2011 — Event 4, Nov 1, 2012 — Nov 1, 2013

Event 2 Window*

Event 4 Window

* With the exception of French non-financials, which end on Jan 31, 2011
** With the exception of Spanish non-financials, which begin on Jun 10, 2010

	Event Date	Treatment Group	Control Group	Sample Consists of:	
				Earnings Announcements After	Earnings Announcements Before
Event 1	Sep 22, 2008	Spanish financials	All other sample firms	Sep 22, 2007	Sep 22, 2009
Event 2	Jun 10, 2010	Spanish non-financials	All other sample firms	Jun 10, 2009	Jan 31, 2011 for French non-financials and Jun 10, 2011 for all others
Event 3	Feb 1, 2011	French non-financials	All other sample firms	Jun 10, 2010 for Spanish non-financials and Feb 1, 2010 for all others	Feb 1, 2012
Event 4	Nov 1, 2012	All sample firms not subject to an existing short disclosure regulation	French firms, Spanish firms, and UK financials	Nov 1, 2011	Nov 1, 2013

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Figure 1: Frequency of Short Disclosures by Week
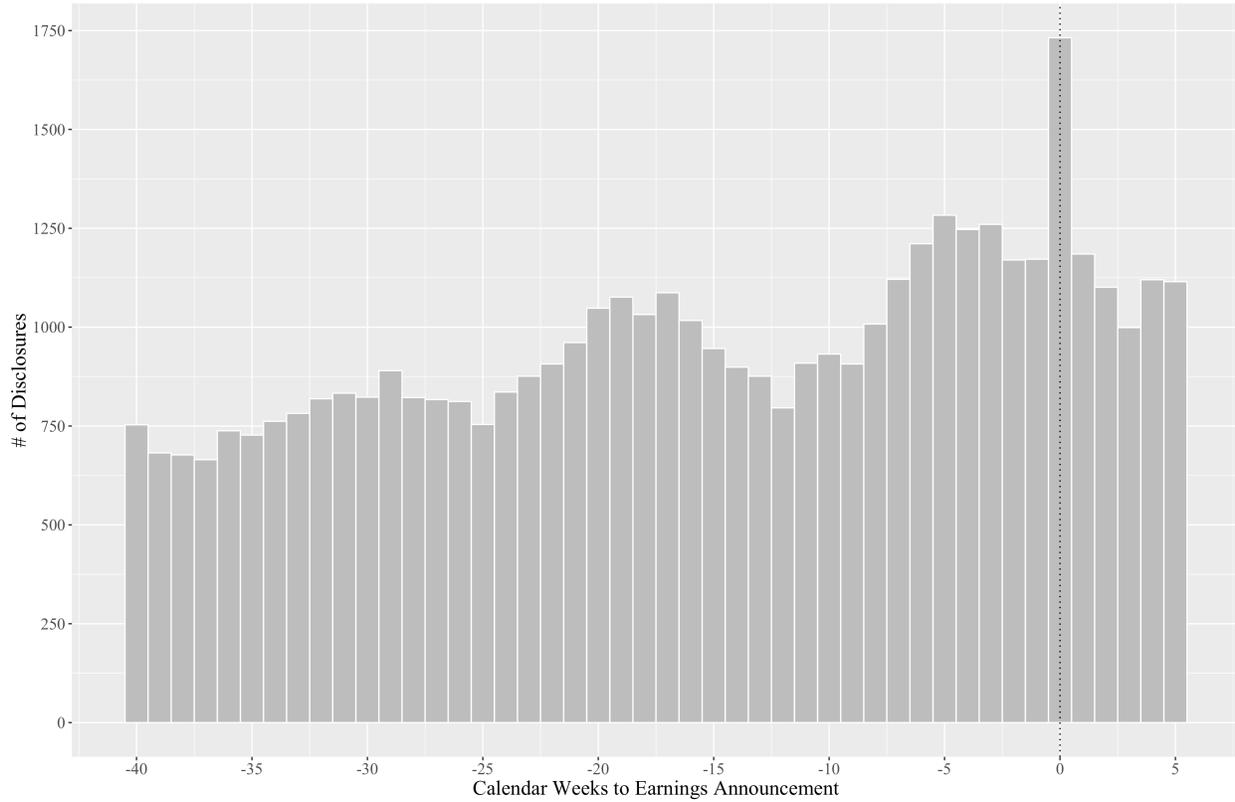
This figure illustrates the frequency of disclosures made under European short disclosure regulations over the year. The bars represent the count of mandatory short disclosures per calendar week relative to the annual earnings announcement date. Hence, calendar week 0 represents the week during which earnings is announced for the year. The sample consists of all earnings announcements from January 2007 through December 2015 that are made under a short disclosure regulation and that survive the sample attrition process.

Table 1: Pooled Summary Statistics

	Mean	SD	1%	25%	50%	75%	99%	Obs.
					Percentiles			
Earnings								
EPS	0.020	0.755	-0.626	0.032	0.060	0.087	0.267	9,088
SUE	-0.009	0.523	-0.286	-0.005	0.000	0.005	0.117	9,088
Info Asymmetry & Uncertainty								
AdjVol(-5,-1)	1.785	1.111	0.329	1.010	1.517	2.258	5.699	8,994
Amihud(-5,-1)	0.362	1.123	0.000	0.002	0.028	0.230	5.360	8,525
RawVol(-5,-1)	1.820	1.202	0.000	0.980	1.557	2.375	5.986	8,994
Spread(-5,-1)	1.353	1.609	0.036	0.277	0.751	1.839	7.689	8,177
Ownership								
Active	0.384	0.273	0.007	0.154	0.318	0.592	0.984	7,262
Index	0.027	0.037	0.000	0.002	0.013	0.045	0.118	6,408
InstOwn	0.548	0.282	0.021	0.328	0.533	0.790	1.000	9,011
Returns								
CAR(-20,-1)	0.015	0.090	-0.219	-0.033	0.011	0.058	0.282	9,088
CAR(0,+1)	0.004	0.061	-0.162	-0.024	0.003	0.033	0.166	9,088
CAR(+2,+61)	0.025	0.165	-0.414	-0.058	0.023	0.109	0.493	9,088
Short Selling								
BorrowCost	2.143	1.413	1.000	1.000	1.545	3.000	6.678	7,283
ShortInterest	0.092	0.157	0.000	0.002	0.023	0.112	0.812	8,207
Supply	0.600	0.389	0.000	0.193	0.669	1.000	1.000	8,207
Utilization	0.112	0.169	0.000	0.005	0.040	0.140	0.805	8,207
Other Variables								
BTM	0.712	0.513	0.057	0.356	0.590	0.936	2.564	8,866
ln(MV)	6.580	1.891	2.974	5.131	6.396	7.843	11.247	9,088
NumEst	8.682	8.035	1.000	2.000	6.000	13.000	32.720	9,029
Turn	0.204	0.237	0.001	0.039	0.121	0.280	1.097	8,609

This table presents descriptive statistics for the sample of all earnings announcements from January 2007 through December 2015 that survive the sample attrition process. All variables are defined in Appendix A.

Table 2: Returns of Earnings Announcements Targeted by Short Disclosures

	Dependent Variable: *CAR(0,+1)*			
Intercept	0.005***	0.005***		
	(4.475)	(4.285)		
Disclosure	-0.007*	-0.011**	-0.012**	-0.011**
	(-1.790)	(-2.042)	(-2.164)	(-2.132)
ShortInterest(-5,-1)		-0.004	0.003	-0.004
		(-.381)	(.354)	(-.354)
BTM				0.004
				(1.111)
ln(MV)				0.002**
				(1.976)
Obs.	4,087	3,444	3,444	3,087
Obs. With Disclosure	346	280	280	274
Adj. R^2	0.001	0.002	0.017	0.016
Country Fixed Effects	No	No	Yes	Yes
Industry Fixed Effects	No	No	Yes	Yes
Year Fixed Effects	No	No	Yes	Yes

This table examines the relationship between negative-signaling short disclosures and the cumulative market-adjusted return immediately following the earnings announcement. *Disclosure* is an indicator taking on a value of 1 if at least one negative-signaling short disclosure targeting the firm is published in the month prior to the firm's earnings announcement date. *ShortInterest(-5,-1)* is the daily short interest averaged over the 5 trading days prior to the announcement date. All other variables are defined in Appendix A. The sample includes only earnings announcements made under a short disclosure regulation. Standard errors are clustered at the firm level and *t*-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 3: Determinants of Short Disclosures Around Earnings Announcements

	x = EPS	x = SUE	x = Q1SUE	
	Disclosure	Disclosure	Disclosure	Open
Intercept	-4.549***	-4.590***	-4.799***	-5.052***
	(-7.951)	(-8.021)	(-8.243)	(-6.165)
AdjVol(-5,-1)	0.198**	0.207**	0.208**	0.044
	(2.208)	(2.308)	(2.330)	(.333)
BTM	0.041	0.045	0.020	-0.253
	(.233)	(.258)	(.111)	(-.958)
DisclosureOld	1.929***	1.960***	1.951***	1.116***
	(12.839)	(13.082)	(13.023)	(5.126)
InstOwn	0.527*	0.492*	0.569*	0.847**
	(1.770)	(1.654)	(1.888)	(1.994)
ln(MV)	0.113**	0.105*	0.120**	0.104
	(2.029)	(1.891)	(2.129)	(1.315)
Spread(-5,-1)	-0.528***	-0.522***	-0.502***	-0.407**
	(-3.660)	(-3.608)	(-3.486)	(-2.068)
Turn	1.848***	1.863***	1.870***	1.600***
	(5.891)	(5.971)	(5.983)	(3.675)
x	-1.691***	-2.324**	0.417**	0.552**
	(-2.742)	(-2.527)	(2.123)	(2.055)
Obs.	3,380	3,380	3,380	3,380
Control Obs.	3,131	3,131	3,131	3,275
Treatment Obs.	249	249	249	105
McFadden Pseudo-R^2	0.213	0.210	0.210	0.104

This table explores the determinants of short disclosures before earnings announcements. Only announcements made under a short disclosure regulation are included in the sample. *Disclosure* is an indicator taking on a value of 1 if at least one negative-signaling short disclosure targeting the firm is published in the month before the firm's earnings announcement date. *Open* indicates the disclosure communicates the opening of a new significant short position. All other variables are defined in Appendix A. Estimates for each variation of the model are reported separately, along with corresponding *z*-statistics in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4: Number of Regulated and Unregulated Earnings Announcements by Country and Event

	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
Event 1												
Unregulated	46	58	86	252	170	8	4	60	16	58	72	185
Regulated	0	0	0	0	0	0	0	0	0	8	0	23
Event 2												
Unregulated	28	60	90	36	224	16	146	84	22	32	78	426
Regulated	0	0	0	0	0	0	0	0	0	54	0	104
Event 3												
Unregulated	34	58	76	145	224	18	148	82	20	0	68	462
Regulated	0	0	0	145	0	0	0	0	0	12	0	114
Event 4												
Unregulated	21	29	41	0	131	11	81	42	13	0	52	294
Regulated	21	29	41	358	131	11	81	42	13	72	52	416

To study the effects of short disclosure regulation, I employ a staggered difference-in-differences design with four regulation change "events", each of which introduced the requirement that short sellers disclose significant positions. This table displays the sample size for these difference-in-differences tests by event, regulation status, and country. The sample consists of earnings announcements that survive the sample attrition process and occur in the sampling window (two years) around each event date. The sample is also balanced in the sense that a firm must announce earnings in both the pre- and post-event periods of at least one event to be included in the sample. Announcements are classified as "regulated" if they occur when the announcing firm is captured by a short disclosure regulation (*Regulated* = 1). Announcements that are classified as "unregulated" are those of firms for which short sellers need not disclose their positions (*Regulated* = 0).

Table 5: Effect of Short Disclosure Regulation on Information Asymmetry and Uncertainty Around Earnings Announcements

	Price Impact		Quoted Spread		Adjusted Volatility		Raw Volatility	
	Amihud(-5,-1)	Amihud(+1,+5)	Spread(-5,-1)	Spread(+1,+5)	AdjVol(-5,-1)	AdjVol(+1,+5)	RawVol(-5,-1)	RawVol(+1,+5)
Regulated	0.129**	0.063	0.018	-0.062	0.147**	0.091	0.236***	0.111
	(2.088)	(1.210)	(.143)	(-.540)	(2.111)	(1.174)	(2.924)	(1.311)
Post	0.073*	0.050*	-0.116***	-0.101**	0.099**	0.098**	0.068	0.064
	(1.880)	(1.661)	(-2.592)	(-2.340)	(2.573)	(2.347)	(1.642)	(1.422)
Regulated × Post	-0.146**	-0.078*	-0.145*	-0.029	-0.220***	-0.213***	-0.320***	-0.277***
	(-2.335)	(-1.779)	(-1.714)	(-.386)	(-3.392)	(-3.066)	(-4.328)	(-3.511)
SUE	-0.096	-0.247	-1.264***	-0.954***	-0.391***	-0.516***	-0.429***	-0.719***
	(-1.126)	(-1.446)	(-3.255)	(-3.494)	(-2.736)	(-4.063)	(-2.901)	(-3.863)
Obs.	5,704	5,823	5,370	5,376	5,987	5,977	5,990	5,977
Adj. R^2	0.052	0.068	0.153	0.147	0.118	0.108	0.127	0.108
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table examines the effect of short disclosure regulation on information asymmetry and uncertainty, which are proxied by the Amihud measure of price impact ($Amihud(t_1,t_2)$), quoted bid-ask spread ($Spread(t_1,t_2)$), and market-adjusted ($AdjVol(t_1,t_2)$) and raw ($RawVol(t_1,t_2)$) return volatilities. The figures in parentheses following variable names indicate the measurement period over which the variable has been averaged. I employ a staggered difference-in-differences design with four regulation change "events", each of which introduced the requirement that short sellers publicly disclose significant positions. The sample consists of earnings announcements that occur in the two-year window around each event date. *Regulated* is an indicator taking on a value of 1 if the announcement is made under regulation, and *Post* is an indicator taking on a value of 1 if the announcement occurs after the event date. Standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 6: Effect of Short Disclosure Regulation on Price Efficiency Around Earnings Announcements

	EPS	SUE
Panel A: Pre-Announcement Information Acquisition		
Regulated	0.011	0.005
	(.741)	(.375)
Post	0.028***	-0.001
	(4.858)	(-.300)
CAR(-20,-1)	0.218*	0.148
	(1.651)	(1.142)
Regulated × Post	-0.041***	-0.004
	(-4.231)	(-.542)
Regulated × CAR(-20,-1)	-0.072	-0.064
	(-.457)	(-.493)
Post × CAR(-20,-1)	-0.374**	-0.269
	(-2.142)	(-1.605)
Regulated × Post × CAR(-20,-1)	0.423*	0.308*
	(1.886)	(1.719)
Obs.	6,034	6,034
Adj. R^2	0.024	0.005
Country Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Event Fixed Effects	Yes	Yes

	ERC	PEAD		
Panel B: Post-Announcement Price Discovery				
	CAR(0,+1)	CAR(+2,+6)	CAR(+2,+21)	CAR(+2,+61)
Regulated	-0.005	0.001	0.002	-0.002
	(-1.287)	(.284)	(.250)	(-.150)
Post	0.004*	0.002	0.000	0.007
	(1.752)	(.778)	(-.018)	(1.220)
SUE	0.000	-0.011	0.012	-0.023
	(.042)	(-.716)	(.895)	(-.814)
Regulated × Post	0.001	-0.004	0.000	0.000
	(.294)	(-1.178)	(-.036)	(.014)
Regulated × SUE	0.111**	0.074	0.144*	0.431**
	(2.518)	(1.082)	(1.676)	(2.275)
Post × SUE	0.046**	-0.002	-0.046**	-0.059
	(2.220)	(-.128)	(-2.150)	(-1.398)
Regulated × Post × SUE	-0.128**	-0.152**	-0.215**	-0.534**
	(-2.224)	(-2.063)	(-2.040)	(-2.447)
Obs.	6,034	6,034	6,034	6,034
Adj. R^2	0.020	0.018	0.013	0.031
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Event Fixed Effects	Yes	Yes	Yes	Yes

This table examines the effect of short disclosure regulation on the efficiency with which the market anticipates and impounds earnings news. I employ a staggered difference-in-differences design with four regulation change "events", each of which introduced the requirement that short sellers publicly disclose significant positions. The sample consists of earnings announcements that occur in the two-year window around each event date. *Regulated* is an indicator taking on a value of 1 if the announcement is made under regulation, and *Post* is an indicator taking on a value of 1 if the announcement occurs after the event date. Panel A examines the effect on information acquisition prior to the announcement. *Regulated × Post × CAR(-20,-1)* captures the effect of short disclosure regulation on the extent to which pre-announcement prices reflect upcoming earnings news, where *CAR(-20,-1)* is the market-adjusted return cumulated over 20 trading days before the announcement date. Panel B examines the effect on price discovery following the release of earnings news. Here, I study the market's immediate reaction, or earnings response coefficient (ERC), as well as longer-term behavior, or post-earnings announcement drift (PEAD). *Regulated × Post × SUE* captures the effect of short disclosure regulation on the extent to which unexpected earnings news is incorporated into post-announcement prices. Standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 7: Effect of Short Disclosure Regulation on Institutional Ownership

	Active	Index
Regulated	-0.027	-0.005*
	(-1.622)	(-1.729)
Post	0.002	0.001*
	(.413)	(1.943)
Q1SUE	-0.070***	-0.003
	(-5.704)	(-.949)
Regulated × Post	0.025**	0.002*
	(2.474)	(1.816)
Regulated × Q1SUE	0.069*	0.003
	(1.876)	(.454)
Post × Q1SUE	0.012	0.001
	(.727)	(.336)
Regulated × Post × Q1SUE	-0.073**	-0.007
	(-1.981)	(-1.251)
Obs.	5,013	4,457
Adj. R^2	0.604	0.292
Country Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Event Fixed Effects	Yes	Yes

This table examines the effect of short disclosure regulation on institutional ownership around earnings announcements. Ownership by actively managed (*Active*) and index (*Index*) funds are components of total institutional ownership. I obtain ownership information for the quarter corresponding to the announcement date from Factset. I employ a staggered difference-in-differences design with four regulation change "events", each of which introduced the requirement that short sellers publicly disclose significant positions. The sample consists of earnings announcements that occur in the two-year window around each event date. *Regulated* is an indicator taking on a value of 1 if the announcement is made under regulation, and *Post* is an indicator taking on a value of 1 if the announcement occurs after the event date. The term *Regulated × Post × Q1SUE* captures the incremental effect of short disclosure regulation on ownership levels on earnings announcements that fall in the bottom quintile of unexpected earnings news for the year. Standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 8: Heterogeneity in Treatment Effect

Panel A: Treatment Effect by Earnings News						
	ERC			PEAD		
	CAR(0,+1)	Obs.	Adj. R^2	*CAR(+2,+61)*	Obs.	Adj. R^2
By Quintiles of *EPS*						
1 (Bad News)	-0.213***	1,093	0.031	-0.972***	1,093	0.055
	(-2.672)			(-5.386)		
5 (Good News)	0.307**	1,199	0.019	0.676	1,199	0.070
	(2.298)			(1.130)		
β_6 *t*-Statistic, *D = Q1EPS*	-2.175**			-1.523		
By Quintiles of *SUE*						
1 (Bad News)	-0.135**	1,099	0.025	-1.068***	1,099	0.069
	(-2.000)			(-6.033)		
5 (Good News)	0.052	1,164	0.043	1.088**	1,164	0.031
	(.271)			(2.100)		
β_6 *t*-Statistic, *D = Q1SUE*	-2.473**			-3.030***		

Panel B: Treatment Effect by Existing Information Environment						
	ERC			PEAD		
	CAR(0,+1)	Obs.	Adj. R^2	*CAR(+2,+61)*	Obs.	Adj. R^2
By Quintiles of *NumEst*						
1 (Poor Environment)	-0.258***	1,202	0.060	-0.852***	1,202	0.061
	(-3.616)			(-4.454)		
5 (Rich Environment)	0.071	1,196	0.002	1.435	1,196	0.044
	(.136)			(1.203)		
β_6 *t*-Statistic, *D = **1**[NumEst ∈ Q1]*	-3.336***			-2.235**		
By Quintiles of *Amihud(-5,-1)*						
5 (Poor Environment)	-0.131*	1,140	0.045	-1.278***	1,140	0.078
	(-1.863)			(-4.772)		
1 (Rich Environment)	0.489	1,146	0.004	1.146*	1,146	0.033
	(1.123)			(1.664)		
β_6 *t*-Statistic, *D = **1**[Amihud(-5,-1) ∈ Q5]*	-3.717***			-3.431***		

Panel C: Treatment Effect by Difficulty of Short Selling

	ERC			PEAD		
	CAR(0,+1)	Obs.	Adj. R^2	*CAR(+2,+61)*	Obs.	Adj. R^2
By Quintiles of *ShortInterest*						
1 (High Difficulty)	-0.260**	1,182	0.070	-1.005***	1,182	0.065
	(-2.385)			*(-3.036)*		
5 (Low Difficulty)	0.253	1,176	0.050	0.105	1,176	0.052
	(1.157)			*(.176)*		
β_6 *t*-Statistic, $D = \mathbf{1}[ShortInterest \in Q1]$	-3.393***			-2.243**		
By Quintiles of *Supply*						
1 (High Difficulty)	-0.347***	1,182	0.039	-0.820***	1,182	0.035
	(-2.678)			*(-2.935)*		
5 (Low Difficulty)	-0.138	1,176	0.019	-0.058	1,176	0.030
	(-.748)			*(-.076)*		
β_6 *t*-Statistic, $D = \mathbf{1}[Supply \in Q1]$	0.930			0.899		
By High/Low *BorrowCost*						
BorrowCost >= 3 (High Difficulty)	-0.122	1,148	0.084	-0.649**	1,148	0.050
	(-1.643)			*(-2.527)*		
BorrowCost = 1 (Low Difficulty)	0.322	1,690	0.013	1.549**	1,690	0.024
	(.896)			*(2.204)*		
β_6 *t*-Statistic, $D = \mathbf{1}[BorrowCost >= 3]$	-0.143			0.427		

This table examines heterogeneity in the treatment effect of short disclosure regulation on price efficiency around earnings announcements. I employ a staggered difference-in-differences design with four regulation change "events", each of which introduced the requirement that short sellers publicly disclose significant positions. The sample consists of earnings announcements that occur in the two-year window around each event date. *Regulated* is an indicator taking on a value of 1 if the announcement is made under regulation, and *Post* is an indicator taking on a value of 1 if the announcement occurs after the event date. I classify the sample by: (i) bad/good earnings news in Panel A, (ii) poor/rich information environment in Panel B, and (iii) high/low difficulty of short selling in Panel C. I examine each subsample created by these classifications separately and report only the coefficient of interest *Regulated* × *Post* × *SUE*, which captures the effect of short disclosure regulation on the earnings response coefficient (ERC) or post-earnings announcement drift (PEAD). I also report the *t*-statistic of β_6 of the following model, which measures the statistical significance of the differences between subsamples:

$$y_{ijksv} = \beta_1 Regulated_{ijksv} + \beta_2 Post_{ijksv} + \beta_3 SUE_{ijksv} + \beta_4 W_{ijksv} + \beta_5 Regulated_{ijksv} \times Post_{ijksv} \times SUE_{ijksv}$$
$$+ \beta_6 Regulated_{ijksv} \times Post_{ijksv} \times SUE_{ijksv} \times D_{ijksv} + \theta_j + \delta_k + \gamma_s + \varepsilon_{ijksv}$$

where D is a partitioning variable as reported within the table. Standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.