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# I only fear when I hear: How media affects insider trading in takeover targets

Mark Aleksanyan<sup>a</sup>, Jo Danbolt<sup>b</sup>, Antonios Siganos<sup>c</sup>, Betty (H.T.) Wu<sup>a,\*</sup><sup>a</sup> University of Glasgow, Adam Smith Business School, Gilbert Scott Building, Glasgow, G12 8QQ, UK<sup>b</sup> University of Edinburgh Business School, 29 Buccleuch Place, Edinburgh, EH8 9JS, UK<sup>c</sup> Edinburgh Napier University Business School, Sighthill Court, Edinburgh, EH11 4BN, UK

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## ABSTRACT

We study how target firm insiders respond to Wall Street Journal articles referring to illegal insider trading in past mergers. Such articles lead to target insider share purchases before bid announcement to drop by 75%. This effect is stronger nearer the bid announcement and increases with article visibility. It remains significant after controlling for public enforcement intensity, but is weakened by the greater potential for profitable trading. Our results suggest insider trading articles temporarily heighten the perception of litigation and reputation risks. Overall, our study indicates that such articles have a meaningful short-term deterrence effect on opportunistic insider trading, and highlights the disciplinary role of the media.

*“One of the most effective brakes on crime is not the harshness of its punishment, but the unerringness of punishment. . . The certainty of even a mild punishment will make a bigger impression than the fear of a more awful one which is united to a hope of not being punished at all.”*

Cesare Beccaria (On Crimes and Punishments, 1764)

## 1. Introduction

Corporate insiders typically have an information advantage over other company shareholders. Their trades are under regulatory scrutiny, and would be deemed illegal if found to be based on material inside information. Fear of unwanted scrutiny may deter insiders from opportunistic trading, and studies such as [Kaplanski and Levy \(2010\)](#) and [Wang and Young \(2020\)](#) show that fear and anxiety reduce investors’ willingness to take risks. Despite the risks, apart from a few exceptions (e.g., [Gėbka et al., 2017](#)), extant research suggests that share transactions of corporate insiders still tend to be opportunistic (e.g., [Cohen et al., 2012](#); [Hong et al., 2019](#)).

This study examines whether insider trading activity is affected by Wall Street Journal news articles covering illegal insider trading in past mergers published during the lead-up to the public announcement of a bid for the firm. As argued by [Tversky and Kahneman \(1973, 1974\)](#), individuals tend to assess risk or estimate probabilities using heuristics (mental shortcuts), rather than all available information. This can bias judgment when evaluating the risks entailed and can be affected by the salience of the event, further exacerbated by media (e.g., [Klibanoff et al., 1998](#); [Kaplanski and Levy, 2010](#)). We posit that media may affect insider trading

\* Corresponding author.

E-mail addresses: [Mark.Aleksanyan@glasgow.ac.uk](mailto:Mark.Aleksanyan@glasgow.ac.uk) (M. Aleksanyan), [Jo.Danbolt@ed.ac.uk](mailto:Jo.Danbolt@ed.ac.uk) (J. Danbolt), [A.Siganos@napier.ac.uk](mailto:A.Siganos@napier.ac.uk) (A. Siganos), [Betty.Wu@glasgow.ac.uk](mailto:Betty.Wu@glasgow.ac.uk) (B. Wu).

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by temporarily heightening the insiders' fear and anxiety of the litigation and reputation risks associated with transacting in their own firm's shares, resulting in a short-term reduction in their purchases.

Insider trading in takeover targets provides an ideal setting for our study. Target company insiders are often aware of takeover negotiations before the announcement, and might be tempted to trade on this information for potentially large financial gains. Several studies (e.g., Jarrell and Poulsen, 1989; Pound and Zeckhauser, 1990; Morgenson, 2006) show that stock returns of target firms usually go up noticeably prior to merger announcements and typically increase significantly (by more than 20%, on average) on the announcement day. Studies such as Agrawal and Nasser (2012) and Cohen et al. (2012) suggest that insiders are aware of not only the forthcoming mergers and likely gains, but also the risks entailed in trading the firms' shares close to the merger announcement. For instance, Ahern (2017) shows that 50% of all illegal insider trading events identified by SEC or DOJ over the years 1996–2003 are associated with informed investors trading in the target's stock. Agrawal and Nasser (2012) provide evidence that corporate insiders reduce their purchases prior to merger announcements.

We build on the Classic Deterrence Theory (CDT) that humans decide whether to undertake an illegal activity based on expected pleasure and pain (Zimring and Hawkins, 1973; Andenaes, 1974). It predicts that the fear of sanctions or punishment would deter rational actors from engaging in potentially illegal activity (Paternoster, 2010). We argue that news covering SEC enforcement can achieve a deterrence effect by altering some insiders' perceived risk, but not necessarily the real risk, of being caught or investigated by the SEC. Even if not convicted, insiders may lose their reputational capital or job. Insiders might have underestimated the risks involved (Wang and Young, 2020), but after reading such news, they quickly update their perceptions about the risks, according to the availability heuristic (Dessaint and Matray, 2017). If so, their subjective probability of litigation and/or reputation risk can be expected to rise temporarily after SEC enforcement news articles, resulting in a reduction in share purchases.

Based on a sample of 1089 merger announcements between 1997 and 2016, our main finding is that news articles about insider trading transgressions in past mergers published in the *Wall Street Journal* have a significant negative short-term effect on insider purchases during the lead up to bid announcements.<sup>1</sup> The publication of such an article leads on average to a 75% drop in insider purchases during the one week afterward. This relation remains robust in various tests, such as using propensity score matching difference-in-differences (PSM-DiD) analysis or alternative samples and insider trading measures. We call this relation the deterrence effect, as the decline found is driven by zero or no purchases, rather than smaller transactions by insiders who still trade. We find that the negative effect is weaker, but still significant, when trading would be highly profitable (when the temptation to trade, despite the risk, would arguably be higher). The deterrence effect of such articles also remains significant after considering the concurrent regulatory environment, in particular the number of formal SEC investigations.<sup>2</sup> These results are consistent with our CDT-based cost-benefit trade-off hypothesis. These articles seem to heighten insiders' perception of risk or fear of getting caught trading based on their inside information, and therefore deter them from trading in the run-up to merger announcements.

The magnitude of this relation increases with the visibility of the articles (length and whether the article is on the front page or not), in line with the salience theory of choice under risk.<sup>3</sup> The deterrence effect is also stronger for articles closer to the bid announcement. At this time, insiders are more likely to be in possession of inside information about the forthcoming bid, but any purchases may also have a higher probability of unwanted regulatory scrutiny. These effects are temporary and seem to last up to three weeks following relevant publications, triggered by temporarily elevated anxiety and perception of risk. In cases that have multiple articles during the run-up period, the effect from the second article onward remains negative, but becomes statistically insignificant. Therefore, even if the articles capture major enforcement events, the effect varies with the length, prominence, and timing of the articles. We do not find a strong reversal effect which is typically seen in behavioral finance studies, suggesting that it may take longer for some insiders to completely 'forget' their anxiety, also consistent with the emerging literature on the effect of visceral emotions on risk aversion (e.g., Guiso et al., 2018; Wang and Young, 2020).

We conduct additional tests and rule out alternative channels that might drive our results. The initial source of information for the article may vary significantly, and include sources such as the SEC, court cases, law enforcement investigation, rumors, or simply editorial interest. This may raise questions as to whether the relation we observe is a result of the publication per se, or whether deterrence articles might forebode greater enforcement in the future. We do not find that these news articles foretell subsequent increases in the number of enforcement actions, even though this is likely what insiders believe when they re-assess the risk-return trade-offs of trading after the publication of the articles but before the public announcement of the forthcoming deal. In addition, we do not find evidence that insider purchases are affected by SEC actions not followed by fear articles. The deterrence effect holds whether articles are associated with SEC enforcement actions or not, and the difference in the effect between the two types of articles is not statistically significant. These results, consistent with Baloria and Heese (2018), suggest that media matters. Lastly, as a placebo test, rather than the  $[-90, -2]$  period used in the main analysis, we use the period  $[-270, -180]$  as the event window. During a period this early, insiders are unlikely to have material inside information about forthcoming mergers, and thus arguably have little to fear from trading. As expected, we do not find any fear effect during this period.

<sup>1</sup> The articles are selected manually and an example of such a news article in the *Wall Street Journal* has the following headline, "Broker Admits Role In Insider Ring – Husband Of Partner In Financial-PR Firm Stole Information On Mergers", which was published on the front page of Section C on 19 December 2008, involving several deals starting from March 2004.

<sup>2</sup> Cohen et al. (2012) find that opportunistic traders reduce trading following waves of SEC insider trading enforcement, and Del Guercio et al. (2017) report that aggressive SEC enforcement deters illegal insider trading activity. Consistent with Beccaria (1764), increasing the likelihood of punishment prevents wrongdoing more effectively.

<sup>3</sup> As discussed in Dessaint and Matray (2017), this theory suggests that decision makers overweight states that draw their attention and neglect others, and low-probabilities are subject to the greatest distortions. Hence unlikely events are overweighted when the associated outcome is salient and underweighted otherwise (Bordalo et al., 2012, 2013; Wang and Young, 2020).

As with most related studies in a non-lab setup, we do not have a direct measure of the perceived risk or fear felt by insiders. To address this, we test the main relation for two different categories of insiders; directors/officers and blockholders. If they face different levels of risk from the trading or have different access to private information, we may observe different deterrence effects and responses, due to different risk/return tradeoffs. We find that the deterrence effect holds for both types of insiders, but is more pronounced in the trading by blockholders.

Overall, our study provides evidence that enhancing risk perception entailed in opportunistic insider trading leads to a significant and immediate, albeit short-term, deterrence effect. In addition, different types of insiders appear to respond differently to the same article in the same regulatory environment, suggesting variation in the change in risk perception among individuals when exposed to salient news. Our results show the significance of media deterrence on potential opportunistic trading by target insiders, consistent with the availability heuristic, and suggest that insiders may engage in opportunistic transactions due to underestimating the risk of unwanted scrutiny.

Our paper makes a major contribution to two strands of literature – the impact of media coverage on insider trading, and the effect of visceral emotions on individual risk perception. First, prior literature on media coverage has examined the role of media on market sentiment (e.g., [Klibanoff et al., 1998](#); [Tetlock, 2007](#); [Fang and Peress, 2009](#)), investor attention (e.g., [Barber and Odean, 2008](#); [Smales, 2016](#); [Kaniel and Parham, 2017](#); [Adra and Barbopoulos, 2018](#)), information dissemination (e.g., [Rogers et al., 2016](#); [Fernandez-Perez et al., 2017](#); [Baloria and Heese, 2018](#); [Calomiris and Mamaysky, 2019](#)), and corporate governance ([Dai et al., 2015](#); [Liu et al., 2017](#)). [Dai et al. \(2015\)](#) explore the significance of the media on corporate insiders' transactions, i.e., the information dissemination channel. They find that when media covers past transactions by corporate insiders, they on average reduce the level of strategic timing of their later transactions. The profitability of insiders' trades after the initial media coverage is also significantly reduced. In our study, the media coverage is not directly linked to insiders themselves, but concerns illegal insider trading by others in past mergers. Media coverage in [Dai et al. \(2015\)](#) reduces the information advantage of corporate insiders' transactions whereas in our study media coverage is not associated with insiders' transactions in question. The channel that drives our results is very different from that in [Dai et al. \(2015\)](#).

Our paper is one of the few to show that such media reporting has a disciplinary effect after controlling for formal regulation. While [Gao et al. \(2020\)](#) find local newspapers hold their governments accountable, resulting in lower municipal borrowing costs which ultimately saves local taxpayers money, our study focuses on the impact of the media in preventing opportunistic behavior by individuals. We find evidence suggesting that corporate insiders significantly reduce opportunistic trading activity after the publication of articles about illegal insider trading. To maintain fairness in financial markets and effectively prevent opportunistic transactions, regulators may use the media as well as strong public enforcement to achieve desired regulatory outcomes.

Our paper also contributes to a growing literature on the effect of visceral emotions on aggregate or individual risk aversion. [Kaplanski and Levy \(2010\)](#) and [Wang and Young \(2020\)](#) show the impact of fear, through salient events such as aviation disasters or terrorist attacks, on financial markets using aggregate proxies such as stock returns or mutual fund flows. Research on individual risk aversion is relatively unexplored and mostly based on experimental data. [Kuhnen and Knutson \(2011\)](#) find that subjects were significantly less likely to choose a risky asset (over a riskless asset) after shown a negative image, while [Guiso et al. \(2018\)](#) show that the quantitative measure of risk aversion of participants was significantly higher after shown a scene from a horror movie. [Dessaint and Matray \(2017\)](#) use hurricane events and show that managers overreact to salient risks associated with the availability heuristic, even though the actual risk remains unchanged.

We study insider trading activity in takeover events and add to this literature by providing evidence consistent with a fear-driven shift in individual risk perception that results in an immediate change in trading behavior in a non-lab setup. Interestingly, in deals with multiple articles, the impact becomes insignificant from the second article onwards, indicating a prolonged shift in individual risk perception for some individuals. We also document variations in this change in individual trading behavior, i.e., different effects for directors or officers versus blockholders, even when exposed to the same news in the same regulatory environment. This finding suggests variations in risk perception and in response to media, likely due to different risk-return trade-off considerations, at the individual level. Similar to [Carvalho et al. \(2011\)](#) and [Tetlock \(2011\)](#), we find that insiders (over)react to past or stale information. Overall, our study offers another main policy implication that periodic dissemination of salient news on illegal financial activities can be a cost-effective way in preventing financial misconduct.

## 2. Related literature and hypothesis development

Our hypothesis builds upon three premises: (1) that registered insiders have to report their stock trades to the SEC and they are aware that these trades may come under SEC's scrutiny; (2) the premise of the Classic Deterrence Theory, that a rational individual would be deterred from engaging in a potentially incriminatory activity when the perceived risk or severity of potential punishment outweighs the reward; and (3) the finding from the field of investor psychology that media attention to negative events may provoke investors' anxiety and fear, and temporarily reduces their willingness to take risks. Below we explicate how these premises constitute necessary conditions for our conjectured effect.

### 2.1. Are corporate insiders' transactions opportunistic?

Section 16a of the Securities Exchange Act of 1934 requires registered corporate insiders to provide public disclosure about their stock trading to the SEC. Their trading would be deemed illegal (and prohibited under SEC Rule 10b-5) if it is based on material non-public information. It is part of the SEC's remit to scrutinize the registered insiders' transactions and to prosecute if there is proof

of illegal activity having taken place. Events such as merger announcements are particularly conducive to SEC's scrutiny of corporate insiders' prior transactions due to their likely information advantage and the magnitude of potential gains from opportunistically acting upon this information.

Several prior studies of managers' transactions offer evidence to suggest that the transactions of some corporate insiders are opportunistic. Cohen et al. (2012) and Hong et al. (2019), for example, report a significant relation between corporate insiders' purchases or sales and next-period stock performance, indicating that some insiders trade to their benefit. Agrawal and Cooper (2015) also explore managers' transactions before accounting scandals and find that managers tend to sell shares in firms that needed to undertake important restatements. Finally, Agrawal and Nasser (2012) report that some corporate insiders reduce their purchases before merger announcements in response to potential scrutiny they may receive from the SEC, indicative of being aware of the forthcoming mergers and the risks involved in their purchases. However, they simultaneously reduce their sales more profoundly, generating net gains from the difference between purchases and sales.

## 2.2. The Classic Deterrence Theory and individuals' decisions

Regulators aim to make markets fair, and they are keen on preventing corporate insiders from abusing their inside information. For this reason, strict rules are present to restrict the scope for opportunistic transactions. Trading based on material inside information is illegal, and it is natural to base our theory on work in the field of criminology. In particular, the Classic Deterrence Theory (CDT) suggests that rational individuals decide whether to undertake a criminal activity based on expected pleasure and pain (e.g., Zimring and Hawkins, 1973; Andenaes, 1974). The CDT conditions the effectiveness of deterrence on individuals' awareness that their actions are wrong, and that there are potential consequences for their actions. Based on this theory, in the context of takeover targets, corporate insiders should weigh the attractiveness of potentially large financial gains from buying shares before merger announcements against the probability as well as the severity of any punishment if found guilty of illegal insider trading.

Punishment by the SEC for insider trading violations can be severe, such as the sentencing to 11 years in prison of Raj Rajaratnam in the Galleon case in 2011.<sup>4</sup> In 2000, the SEC adopted the misappropriation theory of insider trading that expanded the scope of events and individuals that fall within the ambit of Section 10(b) and Rule 10b-5, to include persons outside the firm (e.g., a relative, friend, investment banker, lawyer, etc.). Under the misappropriation theory, outside persons commit fraud when they misappropriate material non-public information for securities trading purposes.<sup>5</sup> Indeed, several such outsiders have also been caught after trading on inside information received from a corporate insider before acquisitions. To the extent that corporate insiders act rationally when contemplating trades, they face a trade-off between abnormal financial gains and anxiety/perceived risk of potential pain. We posit that anxiety and perceived risk can affect both legal and illegal trades by insiders. Concerning legal trades, the effect would transpire through corporate insiders' anxiety of drawing the SEC's unwanted attention, and/or possible reputational damage if such attention 'leaks out'. On the other hand, concerning illegal trades, the effect would be that of the fear of being caught and punished.

## 2.3. The impact of media coverage on individuals' risk perception and trading behavior

The third premise for our hypothesis is that media attention to negative events may provoke investors' anxiety and fear, and temporarily increases awareness of potential risks. Prior literature shows that media is an important determinant of investors' decisions, and studies such as Tetlock (2007), among others, document a positive relation between the tone of the published newspaper articles and the stock market returns. Kaplanski and Levy (2010) and Wang and Young (2020) show that news of negative events can elevate investors' general anxiety and fear, changing their risk perception and affecting their trading behavior.

As discussed in the previous section, according to the CDT, corporate insiders can be expected to weigh the attractiveness of potentially large financial gains from buying shares before merger announcements against the perceived probability of getting caught and the severity of any punishment if found guilty of illegal insider trading. Despite the public enforcement actions, the episodes of regulatory prosecution are still infrequent events when compared to informal or even formal investigations, in part due to limited resources<sup>6</sup> and difficulties in proving trading was based on inside information. Field surveys and lab experiments document that low-probability events are either ignored or over-weighted when the risk materializes and draws attention (e.g., Kunreuther, 1978; Kahneman and Tversky, 1979; Caballero and Krishnamurthy, 2009). One explanation for this tendency is that when conducting risk assessment, people simplify the task through the "availability heuristic". As noted by Tversky and Kahneman (1974, p. 1127), "It is a common experience that the subjective probability of traffic accidents rises temporarily when one sees a car overturned by the side of the road". In our setting, corporate insiders might assess the probability of getting caught for insider trading by recalling examples of such occurrences among their acquaintances. In the absence of recent examples, the risk may be underestimated, but the perceived risk will be revised upwards if being exposed to recent illegal insider trading cases.

This literature on the psychological mechanisms for probability evaluation and risk assessment argues that the drawback of this availability heuristic is that availability may also be affected by factors that are unrelated to the actual frequency of the event. The salience of the event can influence its availability in one's mind (Taylor and Thompson, 1982) and create a discrepancy between perceived and actual risk (Bordalo et al., 2012, 2013). For instance, Chernenko et al. (2016) show that the first-hand experience plays

<sup>4</sup> <https://www.reuters.com/article/us-galleon-rajaratnam/rajaratnam-gets-11-year-prison-sentence-idUSTRE79C0MC20111013> [Last accessed February 2022].

<sup>5</sup> <https://www.sec.gov/rules/final/33-7881.htm> [Last accessed February 2022].

<sup>6</sup> While Seligman (2004) and Del Guercio et al. (2017) indicate that SEC's resources have generally increased over time (with increases in funding mainly after scandals and during market downturns), the agency still arguably has insufficient resources, particularly during market booms when activity is high.

a key role in shaping investors' beliefs, and argue that recent experiences and extreme first-hand experiences are more accessible, or salient, and come to mind more readily, leading people to overestimate the likelihood that extreme or recent experience will recur. Dessaint and Matray (2017) use hurricane events and find that the sudden shock to the perceived liquidity risk leads managers to temporarily increase corporate cash holdings and express more concerns about the hurricane risk in financial reports, even though the actual risk remains unchanged.

In our setup, the publication of articles referring to past insider trading violations can potentially enhance the salience of the episodes of prosecution, causing a substantial but temporary increase in insiders' perceived risk. On the other hand, in times without articles, these infrequent events would draw less or no attention and their probability may be underestimated. In other words, even though the real risk may remain unaltered, the perceived risk goes up when the salience of the risk increases and it goes down when insiders' attention is directed toward other events. In the spirit of Dessaint and Matray (2017), we assume that changes in risk perception can be inferred from managers' actions: in our case, variations in insiders' purchasing activity. Specifically, if media coverage affects the perceived risk of regulatory scrutiny and potential punishment, and therefore the pleasure vs pain trade-off, publication of these articles can be expected to temporarily deter some corporate insiders from purchasing before acquisitions.

### 3. Data and methods

#### 3.1. Datasets used

To test our predictions, we collect data from several sources. We obtain our initial sample of target firms in US public-to-public merger deals announced from SDC Thomson OneBanker. Following the sample selection procedure commonly adopted in prior works (e.g., Agrawal and Nasser, 2012), we require the deal value of each acquisition to be at least \$1 million. In addition, we restrict our sample to acquisitions of at least a 50% stake, not withdrawn, and to transactions where the target company size is at least 1% of the market value of the bidder. We match the target firms with their corporate insiders' purchases data obtained from the Thomson Reuters insiders filing database via the CUSIP code.<sup>7</sup> In line with prior literature (e.g., Cohen et al., 2012; Agrawal and Nasser, 2012; Dai et al., 2015), we focus on open market stock transactions reported to the U.S. Securities and Exchange Commission (SEC) by registered corporate insiders, i.e., directors, officers, and blockholders.

Given our focus on whether corporate insiders change their trading behavior during the run-up to the bid announcement in the presence of fear articles, we exclude from the main analysis deals where we find no record of any purchases at all by corporate insiders, neither during the two years from month -30 to month -7, nor during the 90-day run-up period before the day of the bid announcement. With no purchases during a 24-month period unaffected by a bid, where we might have expected to see a 'normal' level of insider purchases, it may be less clear whether the absence of insider purchases during the run-up period is due to fear or the insiders' general lack of a propensity to trade.<sup>8</sup> Also, we use the Center for Research in Security Prices (CRSP) and Compustat databases to collect stock return data and balance sheet data for firm characteristics such as market-to-book ratio and historical stock return that are used as control variables in our estimations. This leaves us with a sample of 1282 merger announcements between January 1996 and December 2016.<sup>9</sup>

As in other media studies (e.g., Tetlock, 2007; Fang and Peress, 2009; Ahern and Sosyura, 2014), we base our study on articles published in the *Wall Street Journal*, which is considered the top financial news outlet and whose circulation is the highest of US newspapers.<sup>10</sup> We use Factiva to obtain articles published in the *Wall Street Journal* that refer to illegal transactions before past merger announcements. We first identify all articles with the term "inside\*" in their headline, where \* indicates the letter(s), if any, following the asterisk. We then inspect the headline and the content of the lead paragraph of each article to identify articles that refer to illegal transactions before US merger announcements. We select articles manually to eliminate false hits. Specifically, we first identified through Factiva 328 WSJ articles between 01/01/1995 to 31/12/2016 with "inside\* AND trad\* AND (merg\* OR acqui\* OR takeover OR target OR bid\* OR buyout)" in the article headline or lead paragraph. Next, each of the four co-authors read the headline and lead paragraph of the articles and independently scored their perceived deterrence impact as low, moderate, or high. The authors unanimously scored 75 of the articles as having a high deterrence impact, and these are considered as fear articles for analysis.<sup>11</sup>

Among the 1282 deals, 583 of the mergers (46%) had at least one fear article published while 699 deals (54%) had no fear articles published during the 90 days before the merger announcement. Only 193 mergers (15%) had two or more fear articles

<sup>7</sup> The initial matching between the target firms and their corporate insiders' transactions via the CUSIP code results in deals from 1991. We focus on Form 4 filings and select only open market stock transactions by main corporate insiders (transaction code with "P"). We include stock transactions available from "Table 1" in the insiders filing database. We drop transactions with code "S" or "A", while including transactions by "directors", "officers" and "blockholders". Applying the restriction of including purchases with transaction code "P" only results in deals from 1993 onwards. The number of such purchases before 1996 is very small, and therefore we exclude deals prior to 1996.

<sup>8</sup> In unreported robustness testing, we include deals with no purchases, and our results and conclusions hold. Results are available upon request.

<sup>9</sup> One deal in which a proxy fight occurred prior to the announcement was removed.

<sup>10</sup> The circulation is around 2.8 million copies a day, including more than 1.8 million digital subscriptions (as of July 2020 [https://en.wikipedia.org/wiki/The\\_Wall\\_Street\\_Journal](https://en.wikipedia.org/wiki/The_Wall_Street_Journal)).

<sup>11</sup> 66 of these articles are matched with the M&A sample (i.e., they were published during the run-up period of one or more takeover) and used in the analysis. To ensure that results are not driven by deterrence articles published just before the 90 day analysis period, we only include mergers in our estimations without any deterrence article published in the one-month period prior to this period. In addition, we use the same search criteria to obtain any news articles by state, around the publication of the fear articles, and manually identify the local articles associated with the fear articles. Two thirds of the relevant local articles are from one state, NY, and very few are matched to our sample deals. This suggests that insider trading is not a topic particularly appealing to local news outlets.



published, with a maximum of seven fear articles published before six merger announcements. To ensure a clean test of the fear effect, we exclude deals with multiple articles from the main analysis, but include such deals for the sensitivity analysis. The final sample consists of 1089 deals from 1997 to 2016.

### 3.2. Dependent variable

Our main dependent variable is the daily number of purchases by corporate insiders in target firms. For robustness checks, we use the daily sum of the value of the purchases in \$. As shown in Fig. 1, the number of purchases in the 12 months before merger announcements begins to decline around four months before the announcements. This would suggest that insiders in target firms tend to gain awareness of the forthcoming acquisitions on average a few months before public announcements, with most insiders then refraining from trading. For the sample as a whole, the average number of purchases per month is around half the ‘normal’ level calculated as the average of months  $[-12, -5]$  during the last four months  $[-4, -1]$  prior to the bid. Splitting the sample into the 699 deals with no fear article and the 390 deals with a fear article, we see a much larger decrease in insider purchases with the publication of fear articles, and the nearer we get to the bid announcement. The risk of SEC scrutiny is expected to be higher if trading takes place close to the bid announcement, and corporate insiders may not be influenced to the same extent by the publication of a deterrence article if it arrives a long time before the merger announcement. For deals with fear articles, the drop in insider purchases from months  $[-12, -5]$  to  $[-4, -1]$  is substantially higher than for deals without ( $-60\%$  vs.  $-47\%$ ). The fear effect is particularly pronounced in the last month prior to the bid, with only a fifth the normal level of purchases for deals with article.

While there is evidence of a reduction in purchases as much as four months prior to the bid announcement, we follow prior literature (e.g., Brigida and Madura, 2012; Keown and Pinkerton, 1981) and focus on the last three months and use the interval between 90 and 2 calendar days before each merger announcement – the event window  $[-90, -2]$  as the run-up period for our study.<sup>12</sup> We stop at day -2 before each merger announcement, since there is often a significant increase in stock returns of target firms on day -1 which is commonly considered part of the announcement returns. While our data analysis reveals there to be a significant number of days with no purchases by corporate insiders, we do not restrict our sample to mergers with purchases, since this would result in look-ahead bias. Giglio and Shue (2014) show that the passage of time with no news is informative. Zero transactions are also meaningful for this study, since we argue that corporate insiders would be more hesitant about purchasing shares after reading a deterrence article. If we had excluded mergers with zero purchases before merger announcements, we would have in substance disregarded the underlying theoretical proposition of our study and underestimated the influence of deterrence articles. We use Poisson regressions as our dependent variable is based on count data. Robust standard errors are applied across our regressions.

### 3.3. Main independent variable

Our main independent variable contains several “Fear period” variables that estimate the impact of the articles over different time horizons. Specifically, the “Fear period” is a dummy variable that is assigned the value of one on trading days if a deterrence article was published on or before that specific day during the run-up period, and zero otherwise. To explore the length of the fear effect, as illustrated in Fig. 2, we have three additional dummy variables, “Fear period (1w)”, “Fear period (2w)” and “Fear period (3w)”, with each dummy similarly assigned the value of one on trading days where a deterrence article was published within one, two and three weeks, respectively, before that day, and zero otherwise. We also include a deal-based dummy variable named “Fear article” that is assigned the value of one if there is any deterrence article published at any point during the run-up period, and zero otherwise. Including this variable allows us to estimate the *incremental* impact of the articles – that is, the difference in insider trading during different lengths of “fear periods” after an article in comparison to trading during other periods in the run-up period.

By construction of our fear period dummy, a larger proportion of mergers would have had a fear article published during the pre-bid period as we move closer to the merger announcement day. We find no pattern in the timing of fear articles before merger announcements, as shown in Fig. 3. There is no reason to expect that the deterrence articles would appear more frequently during any period before merger announcements than others, since they relate to past mergers and are thus exogenous to the forthcoming mergers. However, to control for possible timing effects on our results, we include fixed effects for every 10 trading-day period before each merger announcement [i.e.,  $(-60, -51)$ ,  $(-50, -41)$ , etc.], as will be discussed in Section 3.4 below. We further test the impact of the timing of fear articles relative to the date of the bid announcement in Section 4.4.1 below.

To test whether the publication of a deterrence article affects the level of insider trading before the merger announcement, we compare corporate insider purchases during a period of one, two or three weeks from the day a deterrence article was published, to the level of trading by insiders in deals without any published fear article during the period before bid announcements. Our main hypothesis will be supported if any of the estimated coefficients on the “fear period” dummies is significantly negative, which would indicate a reduction in the level of corporate insider purchases from the day the deterrence article was published, onwards. To test this specific prediction, as mentioned before, we assume that changes in risk perception can be inferred from variations in insider purchases during the run-up period.

<sup>12</sup> We use trading days for regression analysis and we use calendar days for article-related variables. The cleaned transaction dates from the Thomson Reuters insiders filing database are weekdays, although the as-reported transaction dates can be over the weekend. We use the cleaned transaction dates for analysis.

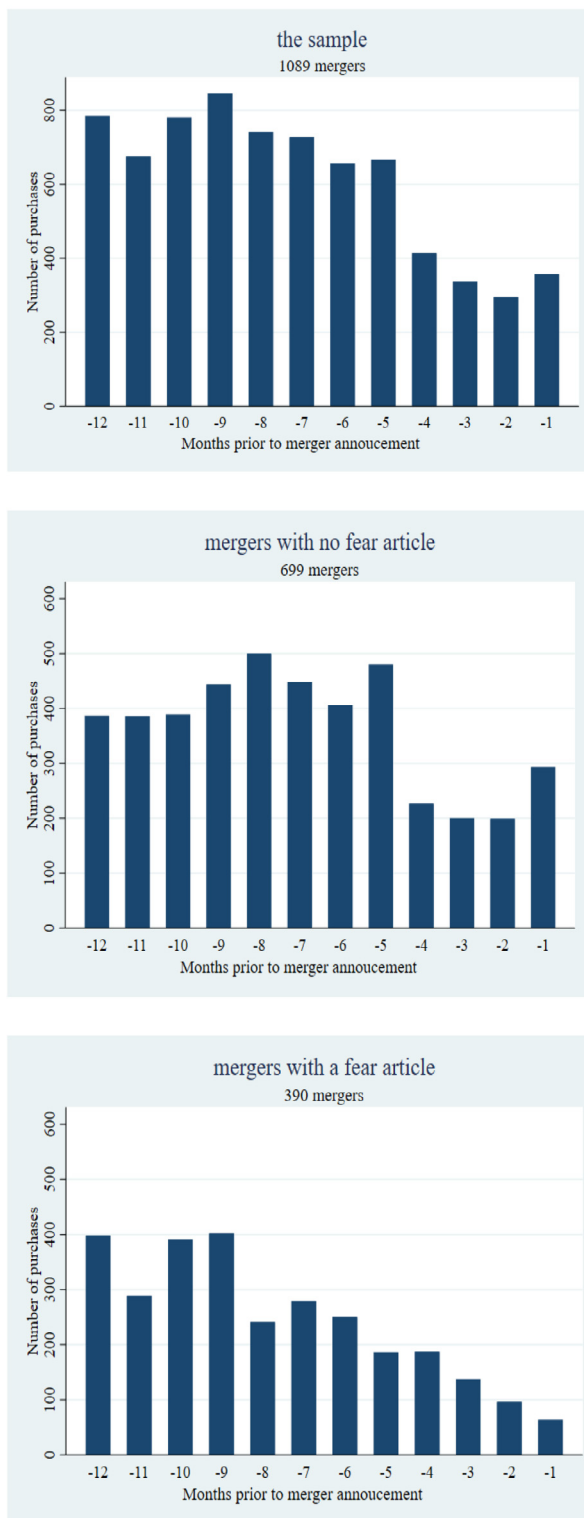


Fig. 1. Number of corporate insider purchases before merger announcements.

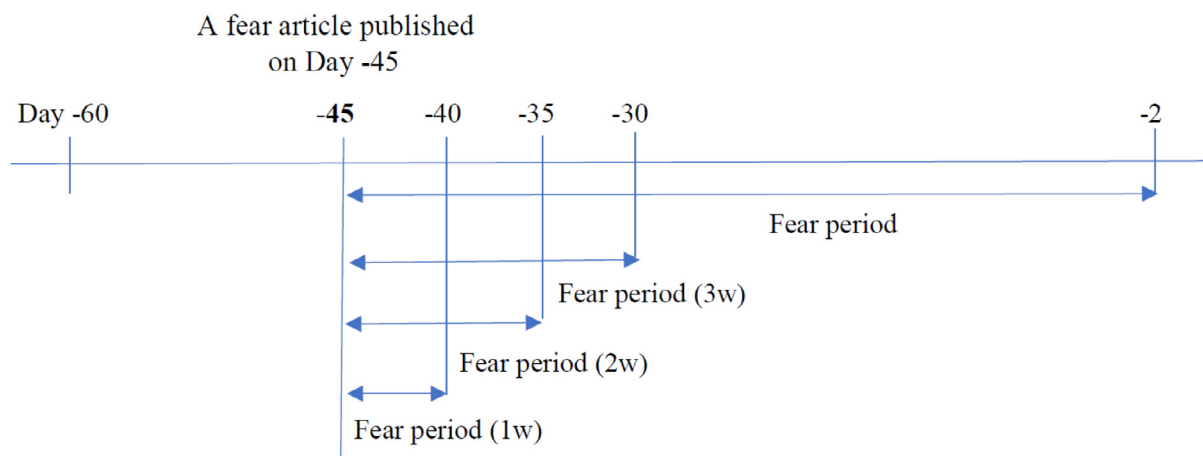


Fig. 2. Timeline for classification of fear period variables (for mergers with one article).

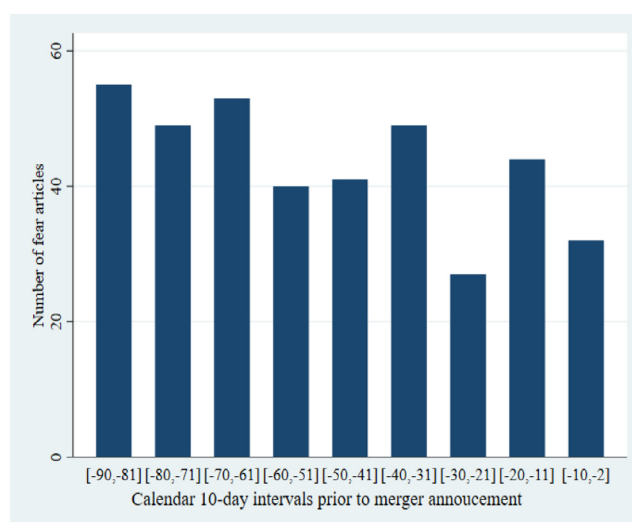


Fig. 3. Number of fear articles before merger announcements.

### 3.4. Control variables

We use several control variables that prior literature documents as potential determinants of corporate insider transactions (e.g., [Agrawal and Nasser, 2012](#)). We first control whether there was a takeover rumor for a particular target firm. To identify rumored merger deals, we download articles from *any* source available from Factiva before each merger announcement that includes the name of the target firm and any of the following terms: *merg\**, *acqui\**, *target*, *takeover*, *rumour\**, *rumor\**, *buyout*, and *bid\** anywhere in the article, where \* indicates any letters (if any) following the asterisk. We inspect each article to ensure that it refers to a potential merger of the particular target. We add a dummy for mergers with rumors to control for corporate insiders who may transact more heavily based on their private information when the wider public may also be aware of a forthcoming deal ([Kyle, 1985](#)).

We add 10-day fixed effects before each merger announcement  $[(-60,-51), (-50,-41), \text{etc.}]$  to control for whether corporate insiders may be more hesitant to purchase shares of their own firms close to the merger announcement, as transacting close to the merger announcement may heighten the probability of SEC scrutiny ([Agrawal and Nasser, 2012](#)). We include the target to bidder relative size ratio as a proxy of the significance of the forthcoming merger deal. Corporate insiders are likely to be aware of the significance of the deal, and relatively large merger deals may be more likely to receive scrutiny by the SEC.

We also control for several firm characteristics, in line with prior literature on insider trading, such as [Agrawal and Nasser \(2012\)](#). In particular, we control for target firms' market capitalization, market-to-book ratio, prior trading, historical stock price return, and standard deviation of stock price returns. We also control for tender offers, since tender offers can be hostile deals that could potentially take place without the managers of the target firms being aware until very close to the merger announcement.



**Table 1**  
Descriptive statistics.

Panel A: Deal-trading-day based variables						
	Mean	Median	Min	Max	StdDev.	N
Number of purchases	0.0146	0	0	20	0.2791	66,618
– Mergers without fear articles	0.0159	0	0	20	0.3088	42,712
– Mergers with fear articles – before article	0.0152	0	0	7	0.1917	11,089
– Mergers with fear articles – since article	0.0100	0	0	14	0.2348	12,817
– Mergers with fear articles – fear period (3w)	0.0071	0	0	7	0.1563	5,067
– Mergers with fear articles – fear period (2w)	0.0068	0	0	5	0.1387	3,526
– Mergers with fear articles – fear period (1w)	0.0033	0	0	2	0.0659	1,840
Fear period	0.1924	0	0	1	0.3942	66,618
Fear period (3w)	0.0761	0	0	1	0.2651	66,618
Fear period (2w)	0.0529	0	0	1	0.2239	66,618
Fear period (1w)	0.0276	0	0	1	0.1639	66,618
Panel B: Deal-based variables						
Number of purchases	0.89	0	0	112	4.84	1,089
Fear article	0.36	0	0	1	0.48	1,089
Rumor	0.15	0	0	1	0.35	1,089
Tender offer	0.16	0	0	1	0.36	1,089
Market value (of target) (ln)	5.56	5.42	–0.24	11	1.80	1,089
StdDev of returns	1.42	1.36	0.44	3.38	0.45	1,089
Target-to-bidder ratio (ln)	2.53	2.67	–2.45	5.93	1.39	1,089
Market-to-book	2.78	1.82	–3.73	26.14	3.81	1,089
Historical stock return	0.07	0.06	–0.23	0.55	0.12	1,089
Prior trading (ln)	2.15	2.08	0	6.38	1.12	1,089

This table offers the descriptive statistics of the variables used in this study. See detailed variable definitions in [Table A.1](#).

Also, we add target firm industry and announcement year dummies. For brevity, we do not tabulate the parameter coefficients on 10-day, industry, and year fixed effects (results available upon request). Detailed variable definitions are shown in [Table A.1](#).

## 4. Empirical results

### 4.1. Summary statistics

We first report in [Table 1](#) the descriptive statistics of the variables used in this study. There are a total of 66,618 trading days during the pre-bid period from calendar day -90 to day -2 for our sample of 1089 deals. Data for trading-day based (dependent) variables are reported in Panel A, and for deal-based (control) variables in Panel B. A fear article is published during the 90-day prior to the bid announcement in 36% of our sample deals, and in 19.2% of trading days after the publication of a fear article (the fear period). Not surprisingly, insider purchases in the run up to mergers are relatively infrequent, averaging 0.89 transactions per firm and 0.015 per trading day. We also show summary statistics of insider purchases in mergers without any fear articles, and on days before vs after any article in mergers with fear articles. Overall, we find that the number of insider trading activity is, on average, lower in deals with than without a fear article and, importantly, lower after the publication of a fear article than before. The reduced level of insider trading activity is more pronounced over the first week after the publication of an article than over longer horizons, providing the first evidence that the impact of fear articles is likely to be short-lived.

### 4.2. Multivariate results – The fear effect

In this section, we present the main test results for the relation between media deterrence and target company insiders' share purchases before merger announcements, based on multivariate estimations that control for several potentially influential variables. Results are reported in [Table 2](#). We first estimate the relation without control variables for the main dependent variable, the daily number of purchases, in columns 1 to 4, while in columns 5 to 8 the control variables are included.

We find the parameter coefficient on each of the fear period variables to be negative in general, and highly significant when restricting the impact to a period of one week after the publication of a fear article. The inclusion of control variables does not substantially affect the regression coefficients for the various fear periods, which remain significantly negative, especially for the one week following the publication of the articles. For instance, we find in column 8 the coefficient of  $-1.405$  with a  $p$ -value of 0.004 on the number of purchases. This result indicates that the (log) number of purchases would be expected to decrease significantly (by 1.405 units) during the week following the publication of fear articles, holding the other variables in the model constant. Alternatively, the incidence-rate ratio for the number of purchases is  $e^{-1.405} = 0.245$ , meaning the number of purchases within the week after articles is expected to be 0.245 times that on days before or after this period. The magnitude of the parameter coefficients, equivalent to a 75% drop in insider purchases, is meaningful, considering the relatively small number of purchases by corporate insiders on any given day during the period leading up to merger announcements, as discussed earlier. The coefficient estimates of the fear period variables decrease gradually, in terms of economic magnitude and statistical significance, with the time horizon,

**Table 2**  
Insider purchasing activity after the publication of fear articles.

	Expected sign	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fear period	–	–0.540** (0.033)				–0.374 (0.123)			
Fear period (3w)	–		–0.628* (0.057)				–0.614* (0.060)		
Fear period (2w)	–			–0.659* (0.069)				–0.661* (0.068)	
Fear period (1w)	–				–1.399*** (0.004)				–1.405*** (0.004)
Fear article	No effect	0.021 (0.883)	–0.148 (0.335)	–0.176 (0.246)	–0.189 (0.203)	–0.158 (0.374)	–0.232 (0.226)	–0.255 (0.179)	–0.268 (0.152)
Rumors	+					–0.537** (0.025)	–0.543** (0.024)	–0.542** (0.025)	–0.542** (0.025)
Tender offer	–					–0.492** (0.011)	–0.501** (0.010)	–0.500** (0.010)	–0.501** (0.010)
Market value	–					0.120*** (0.005)	0.122*** (0.004)	0.122*** (0.004)	0.122*** (0.004)
StdDev of returns	–					–0.124 (0.443)	–0.133 (0.414)	–0.134 (0.411)	–0.135 (0.407)
Target–bidder ratio	–					0.096** (0.047)	0.096** (0.047)	0.095** (0.048)	0.096** (0.046)
Market-to-book	–					–0.052** (0.040)	–0.052** (0.042)	–0.052** (0.042)	–0.052** (0.041)
Historical excess stock return	–					–0.579 (0.392)	–0.561 (0.408)	–0.556 (0.412)	–0.550 (0.417)
Prior trading	+					0.311*** (0.003)	0.311*** (0.003)	0.310*** (0.004)	0.310*** (0.004)
Constant		–3.660*** (0.000)	–3.724*** (0.000)	–3.724*** (0.000)	–3.724*** (0.000)	–6.641*** (0.000)	–6.574*** (0.000)	–6.568*** (0.000)	–6.568*** (0.000)
Pseudo R <sup>2</sup>		0.008	0.008	0.007	0.008	0.098	0.099	0.099	0.099
10-day FEs		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FEs		No	No	No	No	Yes	Yes	Yes	Yes
Year FEs		No	No	No	No	Yes	Yes	Yes	Yes
Observations		66,618	66,618	66,618	66,618	66,618	66,618	66,618	66,618

This table reports the main results of exploring the relation on insider purchasing activity after the publication of fear articles. We compare the frequency of corporate insider purchases after the publication of a deterrence article to purchasing activity before the article (Model 1 and 5), or the difference in insider trading during different lengths of “fear periods” after an article in comparison to trading during other periods in the run-up period. We consider different lengths of the “fear period”, from 1 week after publication, to the maximum period from the publication of the fear article until day -2 (where day 0 refers to the day of the bid announcement). Our dependent variable is the daily number of purchases. The interval to measure corporate insider purchases is based on 90 calendar days that correspond to roughly 60 trading days before each merger announcement. We use Poisson regressions across the study since this approach deals with count data. The main independent variable under consideration is the “fear period” variable, which is a dummy variable that is assigned the value of one on trading days if a deterrence article was published on or before that specific day during the run-up period, and zero otherwise. “Fear period (1w)”, “Fear period (2w)” and “Fear period (3w)” are similarly assigned the value of one on trading days where a deterrence article was published within one, two and three weeks, respectively, before that day, and zero otherwise. “Fear article” is a deal-based dummy variable that takes the value of one if there is any deterrence article published during the whole event window, and zero otherwise. Definition of other independent variables (control variables) is listed in Table A.1: Variable Definitions. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

suggesting the short-term nature of the effect, lasting up to three weeks after the publication of a deterrence article. This finding is similar to the finding in Fernandez-Perez et al. (2017) that investor fear, or the decline in the VIX and VIX futures after the Fed Open Market Committee announcement, is not instantaneous (unlike stock returns and realized volatility) but gradual and persists for about 45 minutes.

Overall, these results support our main hypothesis, indicating that corporate insiders on average undertake fewer purchases, or simply refrain from purchasing shares, after the publication of a fear article in comparison to what they do before a fear article is published during the lead up to the bid announcement. For mergers with fear articles, purchases are reduced during the fear period, especially over short-term time horizons. Corporate insiders become ever more cautious and transact less after the reminder of past illegal activity before the announcement of merger deals.

#### 4.3. The mechanism behind the relation

We next explore the underlying mechanism that drives the relation between deterrence articles and insider trading – that is, the tradeoff between potential gain and potential pain of corporate insiders transacting based on their private information regarding forthcoming merger announcements.

##### 4.3.1. Potential gain

In Section 2 we conjecture that insiders may be tempted to purchase stocks of target firms before merger announcements in expectation of significant positive stock returns in the period leading up to and including the bid announcement, as shown in

**Table 3**  
Insider purchasing activity after the publication of fear articles: Potential pleasure versus potential pain.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Premium (1m)	0.214*** (0.001)	0.183*** (0.005)	0.206*** (0.002)	0.201*** (0.002)	0.205*** (0.001)					
Fear period * Premium (1m)		0.247* (0.092)								
Fear period (3w) * Premium (1m)			0.109 (0.687)							
Fear period (2w) * Premium (1m)				0.460 (0.239)						
Fear period (1w) * Premium (1m)					1.237** (0.017)					
# formal investigations						-1.168*** (0.000)	-1.091*** (0.000)	-1.107*** (0.000)	-1.108*** (0.000)	-1.107*** (0.000)
# of staff						-0.124 (0.835)	-0.204 (0.732)	-0.197 (0.742)	-0.202 (0.736)	-0.207 (0.729)
Fear period		-1.210** (0.041)					-0.464* (0.053)			
Fear period (3w)			-0.991 (0.326)					-0.615* (0.063)		
Fear period (2w)				-2.376 (0.123)					-0.648* (0.075)	
Fear period (1w)					-6.334*** (0.005)					-1.391*** (0.004)
Fear article		-0.157 (0.376)	-0.211 (0.262)	-0.232 (0.213)	-0.246 (0.181)		0.021 (0.893)	-0.107 (0.500)	-0.134 (0.396)	-0.146 (0.343)
Constant	-7.685*** (0.000)	-7.440*** (0.000)	-7.478*** (0.000)	-7.446*** (0.000)	-7.465*** (0.000)	1.566 (0.746)	1.741 (0.715)	1.833 (0.703)	1.892 (0.694)	1.931 (0.689)
Pseudo R <sup>2</sup>	0.102	0.104	0.105	0.105	0.106	0.070	0.072	0.072	0.072	0.072
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes	Yes					
Controls, 10-day, and Industry FEs						Yes	Yes	Yes	Yes	Yes
Observations	64,478	64,478	64,478	64,478	64,478	66,618	66,618	66,618	66,618	66,618

This table shows the strength of the relation in association with insider potential pleasure versus pain. We explore the significance of the premium in columns 1 to 5, and the significance of the number of formal investigations by the SEC in columns 6 to 10. The Premium (1m) variable is defined as the natural logarithm of the ratio of the offer price to the target stock price measured one month before the deal announcement for positive values, and zero otherwise. The corresponding data item from Thomson ONE is ‘Offer Price to Target Stock Price Premium 1 Month Prior’. The # SEC investigation (staff) variable is defined as the natural logarithm of the number of SEC formal investigations (staff) in the year of the announcement. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

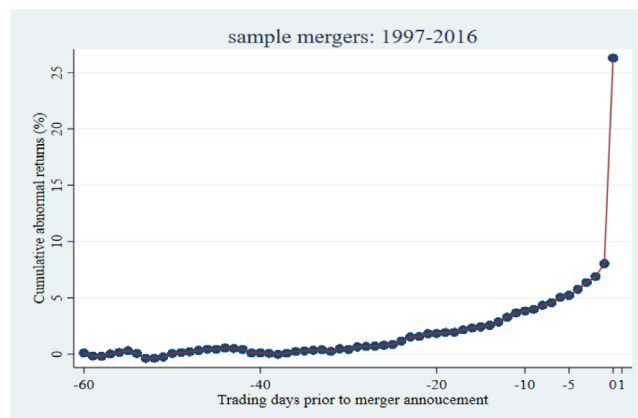


Fig. 4. Abnormal stock returns for target firms in relation to the day of merger announcements.

Fig. 4. If target company insiders have information to help predict the stock market reaction to the forthcoming bid announcement (e.g., from knowing the likely terms of the deal and the offer price), insiders may be expected to use this when deciding whether or not to trade, although there is always uncertainty about the market response. We expect a positive relation between insider trading/purchases and the bid premium (offer price to target stock price one month before the announcement). Our results are consistent with such a conjecture, as shown in Table 3. Results in column 1 indicate that insiders are indeed significantly more likely to purchase shares during the lead up to the bid announcement when the value of the bid premium is higher.

We also expect that the extent of insiders’ reaction to the publication of fear articles would be related to the magnitude of the potential gain. Based on the pleasure versus pain trade-off premise of the Classic Deterrence Theory, there should be less of a response

to the publication of a deterrence article when insiders can expect significant gains from buying shares before the bid announcement. To test this, we interact the bid premium variable with the fear period variables. We find that the parameter coefficients on the fear period dummies remain significantly negative, as shown in columns 2 to 5, but importantly, that the coefficient on the key interaction variable (Fear period (1w) \* Premium (1m)) is significantly positive. These results support our conjecture that when corporate insiders' potential gains are higher, the publication of fear articles exerts a smaller (or less negative) deterrence effect on insiders.

#### 4.3.2. Potential pain

While insiders may be tempted by the potentially large abnormal returns from buying shares in their own firm before bid announcement, such transactions may attract unwelcome attention and potential censure from the SEC if illegal use of inside information is suspected or can be proven. Both the real and the perceived level of risk of insider trading may be expected to vary over time with the level of SEC activity. A high level of concurrently ongoing formal SEC investigations may be associated with a higher probability of getting caught, and can be expected to reduce insiders' incentives to trade. During such periods of 'high salience' of the SEC, insiders will likely already have a heightened awareness of the risk and therefore hesitate to transact based on their private information. Even so, newspaper articles may still have an incremental effect, reminding insiders of the potential risks from trading based on non-public information. We therefore explore whether the deterrence effect of articles found in the main analysis remains after controlling for the regulatory environment.

To test this, we follow [Del Guercio et al. \(2017\)](#) and obtain data on the annual number of formal SEC investigations as well as SEC staff over the sample period, and add these two variables to our baseline regression in [Table 2](#). The results, reported in column 6 of [Table 3](#), show that insiders' purchases are indeed negatively related to the level of formal SEC investigations, although we find no relation in terms of the level of SEC staff. This finding indicates that the SEC's actions, especially outputs rather than inputs of enforcement intensity, influence the likelihood of insiders taking advantage of their private information. However, in line with our expectation, and as shown in columns 7 to 10 of [Table 3](#), the fear articles still have an incremental negative impact on the level of insider trading, significant for the one-week fear period. We conclude that fear articles still have a short-term and meaningful deterrent influence on insiders after considering the general impact of the regulatory environment.

#### 4.4. Sensitivity of the main relation

In this section we conduct two sensitivity tests, to explore how the main relation might vary with the timing and characteristics of fear articles.

##### 4.4.1. Timing of fear articles

Our results provide supporting evidence for the deterrence effect of fear articles on the purchasing behavior of insiders and the underlying tradeoff between potential gain and pain. Our first sensitivity test aims to explore whether these results vary with the timing of the articles relative to the time of the bid announcement. We conjecture the results to be stronger closer to the announcement date, when insiders are more likely to be in possession of information about the forthcoming bid, but also because the risk of SEC scrutiny is expected to be higher if trading takes place close to the bid announcement.

For this test, we look at each of the three months during the run-up period separately and redo the analysis from [Sections 4.2 and 4.3](#). We focus on the one-week fear period because of the short-term nature of the effect and the narrower monthly event window.<sup>13</sup> Specifically, we rerun [Table 2](#) Model (8) and [Table 3](#) Models (5) and (10), for each month separately; month -1 (or trading days [-20,-2]), month -2 (trading days [-40,-21]), and month -3 (event window trading days before day -40). The results are reported in [Table 4](#) Panel A, and Panel B, respectively.

In general, the results are consistent with our expectations. The fear effect is stronger during the month prior to the announcement, as seen in Panel A Model (3), as well as Panel B Model (3) and Model (6), and weaker when further away from the announcement. Note that the coefficient estimate of the fear period (1w) in Panel A Model (2) is not statistically significant, although it is, at the 5% level, in Panel B Model (2) when considering potential gain. Interestingly, the effect of premium also becomes stronger nearer the announcement, which supports the argument that nearer the announcement insiders can have more information or confidence about what potential offer price they will receive. When the fear period is far away from the announcement, higher uncertainty on specific offer price would significantly limit the effect of potential gain. This might help explain why the fear effect contingent on the premium is stronger, in terms of economic magnitude, during the second month before the announcement, when the risk of SEC scrutiny may still be low compared to trades closer to the bid announcement and yet the offer price may be more certain.

##### 4.4.2. Characteristics of fear articles

For the second sensitivity test, on fear article characteristics, we use the merger deals with one fear article only, and an expanded sample that also includes deals with multiple articles, respectively. With the sub-sample of having one article only, we test first the significance of the main relation and secondly the main relation concerning the visibility of the fear articles. With the expanded sample that adds deals with multiple articles to our main sample, we then test the significance of the first article.

<sup>13</sup> Identification for longer fear periods can be difficult to achieve for deals associated with fear articles taking place far away from the announcement.

**Table 4**  
Insider purchasing activity after the publication of fear articles: Timing of articles.

Panel A: Main results	(1)	(2)	(3)			
	Month -3	Month -2	Month -1	(4)	(5)	(6)
Fear period (1w)	-1.441** (0.015)	-1.087 (0.164)	-15.663*** (0.000)			
Fear article	-0.000 (1.000)	0.558* (0.086)	-0.901** (0.017)			
Constant	-5.934*** (0.000)	-7.706*** (0.000)	-9.415*** (0.000)			
Pseudo R <sup>2</sup>	0.122	0.189	0.313			
Controls, and Year & Industry FEs	Yes	Yes	Yes			
Observations	24,147	21,780	20,691			
Panel B: Pleasure vs. Pain	(1)	(2)	(3)	(4)	(5)	(6)
	Month -3	Month -2	Month -1	Month -3	Month -2	Month -1
Premium (1m)	-0.009 (0.921)	0.253** (0.030)	0.546*** (0.000)			
Fear period (1w) * Premium (1m)	1.591 (0.174)	1.413** (0.027)	0.618** (0.025)			
# formal investigations				-0.408 (0.262)	-1.606*** (0.003)	-1.488** (0.019)
# of staff				-1.012 (0.207)	3.192*** (0.001)	-3.311** (0.011)
Fear period (1w)	-7.916 (0.138)	-6.562** (0.012)	-17.033*** (0.000)	-1.414** (0.017)	-1.071 (0.168)	-14.725*** (0.000)
Fear article	0.065 (0.740)	0.503 (0.105)	-0.871** (0.029)	0.114 (0.539)	0.062 (0.831)	-0.822** (0.049)
Constant	-5.835*** (0.000)	-9.062*** (0.000)	-11.938*** (0.000)	5.686 (0.348)	-24.997*** (0.008)	27.655*** (0.004)
Pseudo R <sup>2</sup>	0.119	0.200	0.329	0.086	0.121	0.215
Controls, and Year & Industry FEs	Yes	Yes	Yes			
Controls, and Industry FEs				Yes	Yes	Yes
Observations	23,372	21,080	20,026	24,147	21,780	20,691

This table shows the strength of the relation with respect to the timing of articles – the main relation (Panels A) and the main relation in association with insider potential pleasure versus pain (Panel B), focusing on the one-week fear effect. Specifically, we rerun Table 2 Model (8), and Table 3 Models (5) and (10), for each month separately: Month -1 (trading days [-20,-2]), Month -2 (trading days [-40,-21]), and Month -3 (trading days before day -40) before the announcement, and report results in Panel A and Panel B, respectively. “Fear period (1w)” is a dummy variable assigned the value of one on trading days where a deterrence article was published within one week before that day, and zero otherwise. “Fear article” is a deal-based dummy variable that takes the value of one if there is any deterrence article published during the whole event window, and zero otherwise. The Premium (1m) variable is defined as the natural logarithm of the ratio of the offer price to the target stock price measured one month before the deal announcement for positive values, and zero otherwise. The corresponding data item from Thomson ONE is ‘Offer Price to Target Stock Price Premium 1 Month Prior’. The # SEC investigation (staff) variable is defined as the natural logarithm of the number of SEC formal investigations (staff) in the year of the announcement. Definition of other independent variables (control variables) is listed in Table A.1: Variable Definitions. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

The results regarding the significance of the main relation are reported in Table 5, Panel A. Columns 1 to 4 show the baseline regression results (comparable to the main results for the overall sample, reported in columns 5 to 8 of Table 2). The coefficients are greater in terms of magnitude (both economically and statistically) as compared to those using the whole sample. We then test the purchasing activity by the insiders concerning how many days have lapsed since the fear article was published. Note that days before articles are not included in this test. We expect the magnitude of the relation to become weaker with the passing of time. This is indeed what we find. As shown in column 5, the parameter coefficient for the “Days since the article” variable is significantly positive, indicating relatively more purchases (i.e., less of a fear effect) as time lapses after the publication of the article.

We next test whether the characteristics of the fear articles affect the strength of the deterrence effect. Klubanoff et al. (1998) study the effect of salient news (news appearing on the front page of the *New York Times*) on closed-end fund prices to the asset value. In a similar vein, we explore the impact of salient news, on insider trading activity and examine the hypothesis that insiders assign more importance to more prominent news, even if the two pieces of news contain similar and relevant information, resulting in different deterrence effects. Longer fear articles and those published on a front page are likely to have more visibility and may therefore make more of an impression.

For this test, we first explore whether articles on the front page of one of the main sections of the *Wall Street Journal* (i.e., sections A, B or C) have more of an impact than articles on other pages.<sup>14</sup> The results are reported in Table 5, Panels B and C. We run separate regressions for deals with a front page article (columns 1 to 4 in Panel B) versus for deals with a non-front page article (columns 1 to 4 in Panel C), and we find that the negative impact of fear periods is stronger for front page articles.

<sup>14</sup> In our sample, only three deterrence articles (out of 66 in total) appear on the front/cover page of the newspaper. We therefore consider articles on the front pages of the various sections of the WSJ instead – 12 articles in total.

**Table 5**  
Insider purchasing activity after the publication of fear articles: Characteristics of articles.

Panel A: Deals with one article						
	(1)	(2)	(3)	(4)	(5)	
Fear period	−0.399 (0.129)					
Fear period (3w)		−0.625** (0.047)				
Fear period (2w)			−0.700** (0.044)			
Fear period (1w)				−1.462*** (0.003)		
Days since the article					0.640* (0.065)	
Constant	−4.659*** (0.000)	−4.560*** (0.000)	−4.545*** (0.000)	−4.544*** (0.000)	−10.898*** (0.000)	
Pseudo R <sup>2</sup>	0.207	0.209	0.209	0.211	0.282	
Controls, 10-days, and Year & Industry FEs	Yes	Yes	Yes	Yes	Yes	
Observations	23,906	23,906	23,906	23,906	12,817	
Panel B: Deals with one article and visibility - Front page articles						
	Front page (1)	Front page (2)	Front page (3)	Front page (4)		
Fear period	−1.828** (0.010)					
Fear period (3w)		−1.996 (0.100)				
Fear period (2w)			−3.384** (0.034)			
Fear period (1w)					−14.328*** (0.000)	
Constant	−4.805 (0.341)	−5.187 (0.308)	−5.645 (0.306)	−4.465 (0.399)		
Pseudo R <sup>2</sup>	0.544	0.545	0.555	0.537		
Controls, 10-days, and Year & Industry FEs	Yes	Yes	Yes	Yes		
Observations	5773	5773	5773	5773		
Panel C: Deals with one article and article visibility - Non-front page articles						
	Non-front page (1)	Non-front page (2)	Non-front page (3)	Non-front page (4)	Long non-front page (5)	Short non-front page (6)
Fear period	−0.186 (0.532)					
Fear period (3w)		−0.529 (0.124)				
Fear period (2w)			−0.555 (0.138)			
Fear period (1w)				−1.283*** (0.009)	−1.679*** (0.005)	−0.452 (0.582)
Constant	−4.577*** (0.002)	−4.545*** (0.002)	−4.544*** (0.002)	−4.528*** (0.002)	−4.853** (0.012)	−1.928 (0.400)
Pseudo R <sup>2</sup>	0.193	0.196	0.195	0.198	0.200	0.257
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,133	18,133	18,133	18,133	9463	8670
Panel D: Including deals with multiple articles						
	(1)	(2)	(3)	(4)	(5)	
Fear period (first article)	−0.536*** (0.005)					
Fear period (3w, first article)		−0.640*** (0.009)				
Fear period (2w, first article)			−0.649** (0.020)			
Fear period (1w, first article)				−0.782** (0.043)	−0.786** (0.041)	
Fear period (1w, second article+)					−0.095 (0.774)	

(continued on next page)



Table 5 (continued).

Fear article	−0.108 (0.470)	−0.223 (0.157)	−0.249 (0.111)	−0.276* (0.074)	−0.274* (0.078)
Constant	−4.054*** (0.000)	−3.909*** (0.000)	−3.899*** (0.000)	−3.896*** (0.000)	−3.885*** (0.000)
Pseudo R <sup>2</sup>	0.081	0.080	0.080	0.080	0.080
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes	Yes
Observations	78,504	78,504	78,504	78,504	78,504

This table shows the strength of the relation – the relation in association with the article visibility using merger deals with one fear article only (Panels A to C) and the relation in association with the article using a sample including deals with multiple articles (Panel D). In Panel A, we explore the significance of the main relation in columns 1 to 4. Column 5 tests the significance of the relation in association on which day the purchasing activity takes place concerning the publication of the fear articles. With regard to article visibility, in Panel B we explore the significance of the publication of the articles on the first page of each section in the *Wall Street Journal* in columns 1 to 4. In Panel C, we further consider the length of the article (the number of words used) for non-front-page articles in columns 1 to 6. In Panel D, the top four fear-period variables are defined based on the first article only, when applicable. The “Fear period (1w, second article+)” is defined in the same way as the “Fear period (1w, first article)” except that it applies to the 2nd article onward for deals with multiple articles, capturing the one-week effect of non-first articles. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

For non-front page articles, we further explore whether the length of these articles, measured by the number of words, affects the main relation. We use the median value (433 words) of the length of articles to form two groups – deals with a long non-front page article versus deals with a short non-front page article. As shown in Panel C columns 5 and 6, we find that the parameter coefficient of the one-week fear period variable is significantly negative for long non-front page articles. In line with our expectation, longer articles have more of an impact on the insiders’ behavior, and are associated with a larger reduction in share purchases after publication.

Lastly, the main relations still hold even when including deals with multiple articles, as reported in Panel D. We find that the deterrence effect for the first article remains significant. The effect from the second article onward on average is negative, but not statistically significant. This suggests that insiders are less affected if they have recently been reminded of the risks and some might have a prolonged shift in individual risk perception.

Overall, our results indicate the existence of a deterrence effect, i.e., a statistically significant reduction in the frequency of purchases after the publication of fear articles. This deterrence effect seems to be temporary – being apparent for up to three weeks but becoming weaker as time goes by. The impact increases when closer to the announcement, and with article visibility, which manifests via either location or length of articles, but disappears when insiders have been reminded of the risks recently. In Sections 4.5 to 4.7 below, we explore three potential alternative hypotheses to examine whether the deterrence effect found is spurious.

#### 4.5. Alternative hypothesis 1: The informational channel – Does the response capture the change in the real risk of getting caught?

Our results indicate that the publication of fear articles has a significant impact on insiders’ behavior. However, with articles referring to insider trading violations in *past* mergers, such articles are arguably not expected to change the *real* risk of insider trading in the lead up to merger announcements. This, together with the temporary nature of the effect, as discussed in the previous sections, would suggest that the change in behavior we observe is consistent with the availability heuristic and a result of a change in the perceived risk of trading.

Admittedly, the fear articles may precede regulatory changes, and as such contain (or proxy for) relevant information about current or forthcoming changes in the actual risk of engaging in insider trading. In this section, we aim to disentangle the “perceived risk” channel against the alternative “information” channel. To that end, similar to the way we identify the fear articles, we manually identify sixteen articles that clearly indicate greater SEC enforcement in the future, and construct “Real-risk fear period” and “Regulatory tightening article” dummy variables in a similar manner to the “Fear period” and “Fear article” dummies above.<sup>15</sup> Table 6 shows that, after including the variables related to the SEC tightening articles, the impact of fear articles remains statistically significant. The coefficient estimates of the fear period dummy variables are similar to those in Table 2 (columns 5 to 8) and Table 4 (columns 1 to 4 in Panel A), in terms of both economic and statistical significance, suggesting that our results hold when taking into account other news that may signal a contemporaneous or forthcoming change in SEC enforcement and the real risk of censure if engaging in insider trading activity.

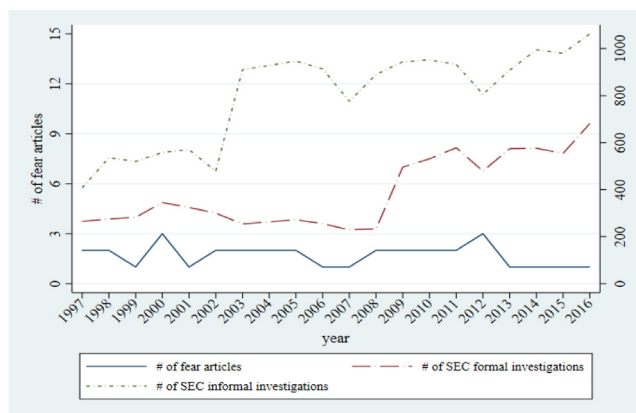
We also explore time trends in the publication of fear articles and SEC enforcement actions. As shown in Fig. 5, the frequency of fear articles seems stable over time. However, a positive trend is observed in the frequency of both formal and informal SEC investigations, which have both increased dramatically over the period from 1997 to 2016. Note that our articles do not necessarily refer to SEC investigations only, and the articles are subject to WSJ editorial choices/preferences. The different time-trends for the number of articles and the number of SEC investigations are intriguing, and do not support the notion that the fear articles capture either the contemporaneous or help predict future levels of SEC activity. Overall, our results seem to indicate that the fear articles do not correlate with or signal any change in the real or actual risk of getting caught. The response by insiders to the publication of fear articles would therefore appear to be behavioral, possibly as a result of the risk becoming more salient.

<sup>15</sup> One example of such an article has the following headline, “Insider Targets Expanding – FBI Is Building Cases on 120 People for Alleged Illegal Trading, Enlists Douglas”, dated on 28 February 2012.

**Table 6**  
Insider purchasing activity after the publication of fear articles: Risk perception versus information channels.

	(1)	(2)	(3)	(4)
Fear period	-0.453* (0.070)			
Fear period (3w)		-0.581* (0.075)		
Fear period (2w)			-0.644* (0.076)	
Fear period (1w)				-1.402*** (0.004)
Real-risk fear period	-0.504 (0.225)			
Real-risk fear period (3w)		-0.277 (0.548)		
Real-risk fear period (2w)			-0.569 (0.320)	
Real-risk fear period (1w)				-1.527 (0.133)
Fear article	0.077 (0.679)	-0.056 (0.769)	-0.076 (0.688)	-0.087 (0.639)
Regulatory tightening article	-1.096*** (0.001)	-1.222*** (0.000)	-1.209*** (0.000)	-1.216*** (0.000)
Constant	-6.873*** (0.000)	-6.745*** (0.000)	-6.744*** (0.000)	-6.744*** (0.000)
Pseudo $R^2$	0.107	0.106	0.106	0.107
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes
Observations	66,618	66,618	66,618	66,618

This table shows the strength of the relation after considering real litigation/reputation risks. The “Regulatory tightening article” is a deal-based dummy variable that takes the value of one if there is an article indicating a change in SEC enforcement during the whole event window, and zero otherwise. The real-risk fear period variables are constructed in the same way as the fear period variables. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.



**Fig. 5.** Time trends of articles and enforcement actions.

#### 4.6. Alternative hypothesis 2: Endogeneity of articles – Does media really matter?

In this section, we address the endogeneity issue about articles by testing whether the deterrence effect remains when we consider the release of information regarding SEC actions, the main source of fear articles, in our analysis. Firstly, for each article, we manually check whether there is a contemporaneous SEC litigation release providing a source for the article.<sup>16</sup> Fifty-five percent of the articles are found to be associated with SEC litigation releases (which are normally on the same day, or one day before the publication of the articles).<sup>17</sup> Next, we check SEC litigation releases on insider trading cases over our sample period and manually identify cases

<sup>16</sup> The SEC litigation releases (from 1995 onwards) are available via the SEC website <https://www.sec.gov/litigation/litreleases.shtml> [Last accessed February 2022].

<sup>17</sup> This is not surprising, as in our setup the news is typically expected to have a source and to be reported in a timely manner. Other articles can be associated with court decisions (from different jurisdictions), or a general discussion of recent regulatory development. We focus on SEC litigation releases as these are typically the “origin” of a series of law enforcement actions, including court decisions, and they account for the majority of the source of our fear articles. Therefore, in this analysis the source refers to SEC actions, unless otherwise stated.

**Table 7**  
Insider purchasing activity after the publication of fear articles: Fear articles versus SEC M&A insider-trading releases.

Panel A: Fear period and SEC action period						
	(1)	(2)	(3)	(4)		
Fear period	−0.374 (0.123)					
Fear period (3w)		−0.593* (0.070)				
Fear period (2w)			−0.628* (0.084)			
Fear period (1w)				−1.399*** (0.004)		
SEC action period	−0.231 (0.232)					
SEC action period (3w)		−0.278 (0.148)				
SEC action period (2w)			−0.214 (0.178)			
SEC action period (1w)				−0.026 (0.862)		
Fear article	−0.150 (0.399)	−0.217 (0.252)	−0.246 (0.195)	−0.267 (0.154)		
Constant	−6.580*** (0.000)	−6.528*** (0.000)	−6.528*** (0.000)	−6.564*** (0.000)		
Pseudo $R^2$	0.099	0.100	0.100	0.099		
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes		
Observations	66,618	66,618	66,618	66,618		
Panel B: Fear articles of enforcement actions and SEC actions (one-week period)						
	(1)	(2)	(3)	(4)	(5)	(6)
Fear period (1w)	−1.538*** (0.001)		−1.151* (0.051)		−1.530*** (0.002)	−1.147* (0.052)
Fear period (1w, article with source)		−1.811** (0.017)	−0.665 (0.488)			−0.660 (0.491)
SEC action period (1w)				−0.055 (0.716)	−0.033 (0.828)	−0.032 (0.832)
Constant	−6.713*** (0.000)	−6.771*** (0.000)	−6.721*** (0.000)	−6.753*** (0.000)	−6.707*** (0.000)	−6.715*** (0.000)
Pseudo $R^2$	0.098	0.098	0.098	0.096	0.098	0.098
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	66,618	66,618	66,618	66,618	66,618	66,618

This table shows the strength of the relation after considering SEC insider trading releases concerning M&A cases. Panel A considers SEC actions/releases and Panel B considers articles associated with an enforcement action. The SEC action period variables are constructed in the same way as the fear period variables. The Fear period (1w, article with source) variable is a dummy variable equal to one if the article published on or within a week has a source (i.e., SEC insider-trading releases) before the publication, and zero otherwise. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

relating to M&A deals. SEC litigation releases are relatively frequent events (averaging around 50 insider trading cases each year, with 60% of these relating to trading around M&As), and our sample is matched with 269 unique releases.

For our analysis, we construct four SEC action period variables, similar to the way we construct fear period dummy variables and include them in the main regressions, following the format of Table 6. Note that there is only one deal that has no SEC litigation release during the whole run-up period, so we are unable to include a dummy variable similar to the Fear article dummy variable. The results are reported in Table 7 Panel A. We find that, in general, the coefficient estimates of the SEC action period variables are negative but not statistically significant, suggesting that insiders do not seem to respond to SEC actions that are not followed by fear articles. On the other hand, the impact of the fear articles remains significantly negative, particularly within the one-week period.

We explore further whether this finding is driven by articles that are associated with related SEC actions. To that end, we focus on the one-week fear period, or column (4) in Table 7 Panel A, and construct a dummy variable that is equal to one if the article published on or within a week has a source (i.e., SEC insider-trading releases) before the publication, and zero otherwise. The results, reported in Panel B, show that the fear effect exists for articles, with or without such a source, and the difference between these two types of news does not seem to be statistically significant. This holds when considering the one-week SEC action period in general (that is not associated with the articles).

Our results show that media matters. Fear articles have a significant deterrence effect, even when the article does not directly relate to SEC action. Furthermore, SEC's enforcement actions that are not publicized in the media have no significant impact on insiders' trades. Our findings support the argument that articles help with the effective dissemination of information and have a meaningful role in deterring insider purchases.

**Table 8**  
Insider purchasing activity after the publication of fear articles: PSM-DiD test.

	(1)	(2)	(3)	(4)
Treated * Fear period	-1.798*** (0.007)			
Treated * Fear period (3w)		-1.707** (0.019)		
Treated * Fear period (2w)			-1.613** (0.045)	
Treated * Fear period (1w)				-1.981* (0.093)
Treated	0.162 (0.746)	-1.046** (0.013)	-1.142*** (0.005)	-1.301*** (0.001)
Fear period	2.755*** (0.000)			
Fear period (3w)		0.654* (0.081)		
Fear period (2w)			0.683* (0.089)	
Fear period (1w)				0.360 (0.518)
Constant	-8.753*** (0.000)	-7.784*** (0.000)	-7.796*** (0.000)	-7.730*** (0.000)
Pseudo R <sup>2</sup>	0.201	0.178	0.177	0.172
Controls and 10-day FEs	Yes	Yes	Yes	Yes
Observations	25,942	25,942	25,942	25,942

This table tests the strength of the relation shown in Table 2 Models (5)–(8) using the propensity score matched difference-in-differences (PSM-DiD) regression. We conduct propensity score matching (PSM), a logistic model for estimation of the propensity score based on all the control variables (specifically, Fear article (whether there is any), Rumors, Tender offer, Market value, Standard Deviation of returns, Target–bidder ratio, Market-to-book, Historical stock return and Prior trading), to form a control group (deals with no fear articles) for the treatment group (deals with one fear article). Treated is a dummy variable that is equal to one for deals that have one fear article (the treated firms), and zero otherwise (the control firms). For each control firm, the value is based on the counterfactual article dates from its matched treated firm (that have fear articles). Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

#### 4.7. Alternative hypothesis 3: Self-selection of target firms – Is it possible that merger announcements with articles and those without any are inherently different?

Some might argue that in our sample, mergers are not randomly associated with the articles. That is, target firms might not be similar, or insiders would have traded differently in mergers with or without articles. To address this concern, we follow Koirala et al. (2020) and conduct the propensity score matched difference-in-differences (PSM-DiD) regression analysis to avoid spurious relations in our analysis.

Our first step is to conduct propensity score matching on the target firm level by using all the control variables used across our regressions (no fixed effects). Specifically, the variables contain a Fear article (whether there is any), Rumors, Tender offer, Market value, Standard Deviation of returns, Target–bidder ratio, Market-to-book, Historical stock return and Prior trading. We then apply the propensity score matching approach and run the treatment-effect regression of a stock price run-up variable<sup>18</sup> on these nine variables to get, for each target firm in the treated group (i.e., mergers with an article), the three closest matches in the control group (i.e., mergers without articles). We further exclude matches that are more than three years apart in terms of the year of merger announcement and those whose difference in propensity scores is higher than 0.001. For the remaining matches, for each treated firm, we include the closest match and its control or untreated firm. For each match, we apply the pattern of fear articles during the run-up period observed in the treated firm to the control firm. For the control group, the article dates are counterfactual and are based on the trading-day pattern of their paired treated firms. We then check whether there is any insider purchase before the article for each match (i.e., the treated firm and its control firm) and include matches that have similar levels of pre-article insider trading activity.<sup>19</sup> In the end, we have 213 one-to-one pairs of mergers for this analysis. This represents a matching rate of 54.6% (out of in total 390 treated firms, or mergers with an article).

These results are reported in Table 8. The main variable of interest contains four interaction terms of Treated and Fear period (DiD) which capture, over time horizons from 1 week onwards, the difference in insider purchases on average since the publication of articles between the treated and untreated firms. The coefficients are negative across all specifications and seemingly remain significant over a longer time horizon. This finding provides additional supporting evidence of the deterrence effect of fear articles when considering similar target firms when no fear articles were published.

Regarding the stand-alone treated and fear period variables, note that the treated variable captures the difference in purchases before articles between the two groups and the fear period variables capture the difference in purchases before versus after the

<sup>18</sup> That is, we use the abnormal return over the three-month period including the bid announcement.

<sup>19</sup> According to this criterion, there are four outcomes for each match – (yes,yes), (yes,no), (no,no), (no,yes). Matches having (yes,no) or (no,yes) are excluded. To be conservative, one match having (yes,yes) is also excluded as the difference in sum of the number of purchases exceeds 10.

counterfactual publication date for the untreated group. In general, we find no significant difference in insider purchases before articles between these two groups, although there is evidence that trading in the treated group remains somewhat reduced after fear periods. The positive coefficient of the fear period variable indicates that trading in the untreated group, or mergers with no article, does not decline as much as that in the treated group.

Despite the PSM-DiD analysis, other firm-specific variables such as corporate governance could arguably still account for our results. For instance, in response to a major SEC litigation release, a target firm could implement tighter internal controls to mitigate litigation risk. If this release is covered in the WSJ, then the effect is actually driven by tighter internal controls, rather than the salience of the articles. However, we believe that such internal governance is unlikely to drive our findings of a short-term effect: If the article *had* led to the change in the company policy on trading by insiders, we would not have observed the effect to decay within weeks.

#### 4.8. Additional analysis

To ensure that the documented deterrence effect is not spurious and to explore the relation further, we conduct additional robustness checks. Following the format of Tables 6 to 8, we report the results of the additional analysis in Tables 9 to 12.

##### 4.8.1. Robustness tests – Alternate sample and insider trading measure

We perform two sets of robustness tests of the main relations between fear articles and insider trading. The first set considers alternative samples: the sample with deals associated with at least one purchase during the run-up period and the sample considering non-routine purchases only. Among the 1089 deals in our sample, 179 (16.44%) contain at least one purchase during the event window. We use these deals and re-run the analysis. As shown in Table 9 Panel A, the parameter coefficients associated with the fear periods are all negative and statistically significant in the short term. Next, we explore whether routine traders may be behind the pattern rather than insiders engaging in opportunistic trading. In the spirit of Cohen et al. (2012), we identify routine traders as those who have bought shares in their own firms in the same quarter for three consecutive years. These may be routine traders who make similar transactions each year and whose transactions may not reflect opportunism. To ensure that our results are not driven by routine corporate insider purchases, we exclude such trades and re-run the tests. As shown in Table 9 Panel B, the relations persist after relevant exclusions.

Next, we conduct a further robustness check by using another measure for insider trading activity – the *value* of purchases. We report the summary statistics of this measure in Table 10 Panel A. On days when purchases do occur, the mean (median) value is \$328,728 (\$22,881), with a maximum of \$7,894,700. The mean value is \$389,771 for mergers without fear articles and it is \$9,388 during the one-week fear period. We use OLS to estimate the impact of fear periods on the value of purchases and, as shown in Panel B, the main relations hold for a longer period. For instance, within the one-week fear period, the value of purchases is 4.2% lower and the reduction is 2.7% for the entire period afterward. Interestingly, when removing days of zero transaction, the coefficients associated with the fear periods all become statistically insignificant, as shown in Panel C. This finding provides further supporting evidence for the deterrence effect. That is, the effect is largely driven by insiders refraining from transacting after the publication of a fear article, rather than by them making smaller transactions. Altogether, these findings show that the deterrence effect found in the main analysis is robust to alternative sample construction methods and insider trading measures.

##### 4.8.2. Placebo test – Alternate setup

In this section, we conduct a placebo test using an alternative event window. In the main analysis, we use the interval from –90 to –2 calendar days before the bid announcement. For this test, we look at a similar three-month period, but six months before the announcement. Target company insiders are unlikely to be in possession of inside information about the forthcoming acquisitions this early, as discussed in Section 3.2 (regarding Fig. 1). Even if they were, it would arguably be more difficult for the SEC to prove illegal insider trading activity. Specifically, we estimate the relation using the relatively early interval period between –270 and –180 calendar days before the merger announcement, rather than the period from –90 to –2 used in the main analysis. We would expect fear articles to have no impact on insiders' transactions during this early period, as insiders would likely have little to fear if trading more than six months before a bid announcement. In line with our expectation, results in Table 11 show that fear articles are not negatively associated with insider trading activity during this earlier period.

In this study, we focus on insiders' purchases rather than sales. Managers often sell shares regularly, and Agrawal and Nasser (2012) find that insiders may also take advantage of their private information by reducing their normal levels of share sales before merger announcements. Unlike purchases, it is, however, much less clear what impact fear articles may have, if any, on sales activity before the merger announcement. For instance, if insiders have an incentive to refrain from selling due to expected gains from forthcoming bids, fear articles may have limited incremental impact on insiders' propensity to sell. In unreported tests, we find a negative relation between fear articles and sales (number and value of transactions) and net purchases (difference in shares of purchases and sales), although the relation is generally not statistically significant, in line with our expectation.

##### 4.8.3. Categories of insiders

We do not have a direct measure of the perceived risk or fear felt by insiders from insider trading or the publication of fear articles. However, if different categories of insiders are likely to experience different levels of risk from trading before bid announcements or have different levels of access to private information, we may observe different impacts from the publication of fear articles. It is possible that the risk/return tradeoff, and the experience of fear after the publication of deterrence articles, may differ between

**Table 9**

Insider purchasing activity after the publication of fear articles: Robustness test using alternate sample.

Panel A: Deals with purchases only				
	(1)	(2)	(3)	(4)
Fear period	-0.201 (0.413)			
Fear period (3w)		-0.469 (0.151)		
Fear period (2w)			-0.508 (0.158)	
Fear period (1w)				-1.295*** (0.008)
Fear article	-0.288* (0.084)	-0.310* (0.081)	-0.328* (0.063)	-0.328* (0.058)
Constant	-4.915*** (0.000)	-4.844*** (0.000)	-4.844*** (0.000)	-4.841*** (0.000)
Pseudo $R^2$	0.115	0.116	0.116	0.117
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes
Observations	10,949	10,949	10,949	10,949
Panel B: Non-routine purchases				
	(1)	(2)	(3)	(4)
Fear period	-0.557** (0.038)			
Fear period (3w)		-0.598* (0.084)		
Fear period (2w)			-0.779* (0.051)	
Fear period (1w)				-1.169** (0.017)
Fear article	-0.224 (0.228)	-0.368* (0.070)	-0.378* (0.059)	-0.406** (0.042)
Constant	-6.180*** (0.000)	-6.097*** (0.000)	-6.091*** (0.000)	-6.092*** (0.000)
Pseudo $R^2$	0.113	0.112	0.113	0.113
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes
Observations	66,618	66,618	66,618	66,618

This table shows the first set of robustness tests of the relation. We test the strength of the relation using alternate samples. Panel A shows results using deals with purchases only (excluding deals with no purchase) and Panel B using non-routine purchases (via estimation). Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

different categories of insiders.<sup>20</sup> To test this conjecture, we conduct separate analyzes for directors/officers and blockholders (which tend to be institutional investors, specifically asset management companies) separately.

There are several reasons for the deterrence effect to possibly be different for corporate insiders and blockholders. First, we observe that the purchases made by blockholders tend to be much larger than those made by directors/officers. For instance, in our sample, the mean number of purchases is 2.89 for blockholders, and 2.02 for others. Regarding value of purchases, the mean (median) is \$839,939 (\$110,950) for blockholders, and \$130,840 (\$11,744) for others. Larger purchases are associated with potentially larger returns, but might also have a greater probability of attracting scrutiny.<sup>21</sup> Blockholders may therefore have more at stake and be more likely to experience fear from the articles than other insiders.

On the other hand, while institutional investors and asset managers may have incentives to trade on inside information to boost the performance of their fund and through that their compensation and reputation, their personal gains from such trades is maybe less direct than for corporate insiders trading on their own account. It is therefore *a priori* not clear whether directors/officers or blockholders will have the greater incentive to engage in illegal insider trading.

It is reasonable to assume that blockholders are more likely to follow financial news closely daily, for investing purposes, than company directors/officers, and so to be affected by salient news. We might therefore expect a stronger deterrence effect associated with purchases made by blockholders.

Finally, some might claim that blockholders are less likely to possess private information (and thus have less reason to trade) than company directors or senior officers. However, consistent with Dai et al. (2017), who provide evidence of hedge funds exploiting insider information leakage before merger announcements, we do not find evidence for this claim; as shown in Fig. 6, the decline in purchases closer to the announcement is apparent for blockholders too.

<sup>20</sup> Kallunki et al. (2018) similarly explore the impact of insiders' characteristics on their likelihood of transacting based on private information, and find that less wealthy insiders are more likely to sell prior to significant decreases in stock returns of their firms.

<sup>21</sup> This is supported by another observation (from our work checking the sources of the fear articles for Section 4.6) – the majority of the articles associated with SEC actions are about institutional investors, such as hedge fund managers, and professionals involved in the deal-making process such as investment bankers, lawyers, accountants or analysts. Less than 20% of the cases involve company directors or officers.



**Table 10**

Insider purchasing activity after the publication of fear articles: Robustness test using alternate insider trading measure.

Panel A: Deal-trading-day based variables						
	Mean	Median	Min	Max	Dev.	N
Value of purchases (\$)	2,122	0	0	7,894,700	80,836	66,618
– Mergers without fear articles	2,583	0	0	7,894,700	95,003	42,712
– Mergers with fear articles – before article	2,129	0	0	3,816,000	57,175	11,089
– Mergers with fear articles – since article	580	0	0	2,880,000	32,492	12,817
– Mergers with fear articles – fear period (3w)	1,208	0	0	2,880,000	51,140	5,067
– Mergers with fear articles – fear period (2w)	1,554	0	0	2,880,000	60,894	3,526
– Mergers with fear articles – fear period (1w)	26	0	0	14,375	543	1,840
Value of purchases (\$), days of purchases only	328,728	22,881	14	7,894,700	952,411	430
– Mergers without fear articles	389,771	21,300	30	7,894,700	1,102,516	283
– Mergers with fear articles – before article	248,510	29,270	14	3,816,000	568,963	95
– Mergers with fear articles – since article	143,062	12,936	237	2,880,000	494,477	52
– Mergers with fear articles – fear period (3w)	322,118	14,375	1615	2,880,000	791,809	19
– Mergers with fear articles – fear period (2w)	391,355	12,936	1615	2,880,000	917,159	14
– Mergers with fear articles – fear period (1w)	9,388	8,770	1615	14,375	5,076	5
Panel B: Value of purchases						
	(1)	(2)	(3)	(4)		
Fear period	–0.027** (0.016)					
Fear period (3w)		–0.026** (0.017)				
Fear period (2w)			–0.025** (0.040)			
Fear period (1w)					–0.042*** (0.001)	
Fear article	0.008 (0.467)	–0.001 (0.881)	–0.003 (0.715)		–0.003 (0.659)	
Constant	0.075* (0.053)	0.082** (0.037)	0.083** (0.036)		0.083** (0.035)	
R <sup>2</sup>	0.006	0.006	0.006		0.006	
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes		Yes	
Observations	66,618	66,618	66,618		66,618	
Panel C: Value of purchases (days of purchases only)						
	(1)	(2)	(3)	(4)		
Fear period	0.037 (0.936)					
Fear period (3w)		0.534 (0.272)				
Fear period (2w)			0.747 (0.190)			
Fear period (1w)					–0.061 (0.917)	
Fear article	–0.105 (0.755)	–0.164 (0.563)	–0.162 (0.556)		–0.089 (0.744)	
Constant	8.310*** (0.000)	8.450*** (0.000)	8.418*** (0.000)		8.292*** (0.000)	
R <sup>2</sup>	0.397	0.399	0.399		0.397	
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes		Yes	
Observations	430	430	430		430	

This table shows the second set of robustness tests of the relation. We test the strength of the relation using another measure for insider trading – value of purchases. Panel A shows summary statistics of this measure. Panel B shows regression results using the OLS estimation method. Finally, Panel C reports results when removing days of zero transactions. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

The extent to which the deterrence effect would differ between directors/officers and blockholders is therefore an open empirical question. Table 12 presents the results – directors or officers in Panel A and blockholders in Panel B. We find that the negative effect is present for both categories of insiders, but with varying degrees of economic and statistical significance. For instance, the one-week deterrence effect seems more pronounced among blockholders than directors or officers. This finding suggests different risk-return tradeoff considerations as well as responses to news between these insiders.<sup>22</sup>

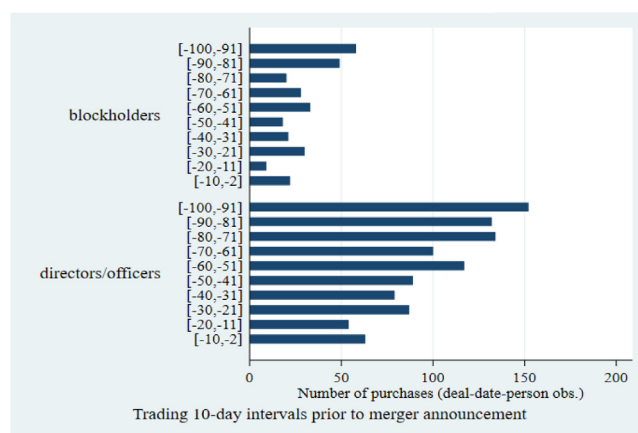
<sup>22</sup> In unreported tests, we find fear articles to have only a very limited and generally not statistically significant negative impact on target company abnormal stock returns, suggesting the articles do not deter other shareholders, who are not likely to be in possession of inside information, from trading. Similarly, we find no significant change in overall trading volumes following the publication of fear articles.

**Table 11**

Insider purchasing activity after the publication of fear articles: Placebo test using alternate setup.

	(1)	(2)	(3)	(4)
Fear period	0.062 (0.742)			
Fear period (3w)		0.241 (0.193)		
Fear period (2w)			-0.240 (0.316)	
Fear period (1w)				-0.357 (0.284)
Fear article	-0.237 (0.121)	-0.263** (0.045)	-0.174 (0.170)	-0.182 (0.149)
Constant	-7.295*** (0.000)	-7.316*** (0.000)	-7.323*** (0.000)	-7.321*** (0.000)
Pseudo R <sup>2</sup>	0.200	0.200	0.200	0.200
Controls, 10-day, and Year & Industry FEs	Yes	Yes	Yes	Yes
Observations	50,135	50,135	50,135	50,135

This table shows the relation from the placebo testing by using the interval period between day -270 and day -180 before the announcement. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

**Fig. 6.** Corporate insider purchases (by category) before merger announcements.

## 5. Conclusion

Opportunistic transactions by corporate insiders can jeopardize the public's trust in the financial system. This study explores the relation between opportunistic insider trading and media. We test whether news articles referring to illegal insider trading in past acquisitions affect target company insiders' trading behavior before public announcements of takeover bids for their companies. Such news stories may temporarily heighten the awareness and perceived risk of purchasing shares in the lead up to merger announcements, leading to insiders transacting differently. We are focusing on corporate insiders' purchases of shares in their own company before the firm receives a takeover bid, since target firms tend to experience significant increases in their stock returns before their merger announcements.

Based on a sample of US acquisitions between 1997 and 2016 and articles in the *Wall Street Journal* relating to past illegal insider trading, we find a significant and temporary reduction in purchases by target insiders after the publication of an article referring to illegal insider trading in past merger deals. We find that this reduction is stronger nearer the bid announcement and the deterrence effect most pronounced when the article is more attention-grabbing or visible, by being either published on a front page or lengthy if not on a front page. We also find that, consistent with the CDT-based cost-benefit trade-off hypothesis, the deterrence article effect is weaker when trading is expected to be highly profitable. The deterrence effect persists during periods when there are more formal investigations by the SEC – periods when insiders may anyway be fearful of engaging in trading for fear of attracting unwanted SEC attention. The effect holds when controlling for other news stories which may indicate a tightening of SEC enforcement. We observe similar effects between articles associated with SEC actions or not, but no effect when SEC actions are not associated with articles. We do not find any effect during a similar-length earlier period when insiders are less likely to be aware of the forthcoming bid. Overall, we conclude that, consistent with the availability heuristic, the change in insider purchases documented in our study is likely due to a substantial increase in risk perception of corporate insiders from the publication of 'fear articles', with insiders mainly affected by media coverage rather than a regulatory change that heralds an increase in real risks.

A possible limitation of our study is that we do not know who of the corporate insiders may have read the particular articles published in the *Wall Street Journal*. However, to the extent that some insiders have not read the *Wall Street Journal* 'fear articles',

**Table 12**  
Insider purchasing activity after the publication of fear articles: Types of corporate insider.

Panel A: Directors or officers				
	(1)	(2)	(3)	(4)
Fear period	0.138 (0.602)			
Fear period (3w)		−0.630* (0.092)		
Fear period (2w)			−0.830** (0.046)	
Fear period (1w)				−1.139** (0.021)
Fear article	−0.244 (0.205)	−0.067 (0.711)	−0.083 (0.643)	−0.116 (0.507)
Constant	−7.801*** (0.000)	−7.844*** (0.000)	−7.833*** (0.000)	−7.826*** (0.000)
Pseudo R <sup>2</sup>	0.122	0.123	0.124	0.123
Controls, 10-day, and Industry FEs	Yes	Yes	Yes	Yes
Observations	66,498	66,498	66,498	66,498
Panel B: Blockholders				
	(1)	(2)	(3)	(4)
Fear period	−2.389*** (0.000)			
Fear period (3w)		−0.878 (0.203)		
Fear period (2w)			−0.542 (0.439)	
Fear period (1w)				−14.437*** (0.000)
Fear article	−0.073 (0.788)	−0.738*** (0.007)	−0.806*** (0.004)	−0.780*** (0.006)
Constant	−6.429*** (0.000)	−6.061*** (0.000)	−6.035*** (0.000)	−6.022*** (0.000)
Pseudo R <sup>2</sup>	0.226	0.214	0.213	0.215
Controls, 10-day, and Industry FEs	Yes	Yes	Yes	Yes
Observations	66,308	66,308	66,308	66,308

This table shows the last set of robustness tests of the relation. We test the strength of the relation considering types of corporate insiders. Panel A shows results using purchases made by directors or officers. Panel B shows results using purchases made by blockholders. Robust standard errors are applied. P-values are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the ten, five and one percent levels, respectively.

this would bias the results against our hypothesis. We may therefore, if anything, be underestimating the magnitude of the relation reported in this study. Our results indicate the importance of the media in influencing individual behavior and highlight its disciplinary role in preventing potential wrongdoing by corporate insiders using their information advantage for private gain. Our study offers significant policy implications regarding effective approaches, e.g., using the media to raise awareness of illegal insider trading through disseminating salient news on SEC actions periodically, to maintain fairness in financial markets.

### CRediT authorship contribution statement

**Mark Aleksanyan:** Conceptualization, Writing, Validation. **Jo Danbolt:** Conceptualization, Methodology, Formal analysis, Writing, Validation, Supervision. **Antonios Siganos:** Conceptualization, Methodology, Formal analysis, Writing, Validation. **Betty (H.T.) Wu:** Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing, Visualization, Validation.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table A.1

Variable definitions.

Variable	Definition
Fear article	An indicator variable taking the value of one if there is a fear article during the whole event window, and zero otherwise.
Fear period	An indicator variable taking the value of one if there is a fear article on or before the day, and zero otherwise.
Fear period (1w)	An indicator variable taking the value of one if there is a fear article within 7 calendar days before the day, and zero otherwise.
Fear period (2w)	An indicator variable taking the value of one if there is a fear article within 14 calendar days before the day, and zero otherwise.
Fear Period (3w)	An indicator variable taking the value of one if there is a fear article within 21 calendar days before the day, and zero otherwise.
Historical stock return	Average daily excess returns of the target over the last four years compared to S&P 500 (winsorized at the 1% level).
Market-to-book	Market to book ratio of common equity of the target (Compustat data items: prcc_c * csho/ ceq, winsorized at the 1% level).
Market value	The natural logarithm of target's market capitalization (Thomson ONE data item: Target Market Value 4 Weeks Before Announcement (\$mil)).
Number of purchases	The number of purchases
Prior trading	The natural logarithm of one plus the number of purchases made during the period of two years before 6 months before the announcement ( $[-30\text{ m}, -7\text{ m}]$ )
Rumor	An indicator variable taking the value of one if there is a takeover rumor pertaining to the deal before the announcement date, and zero otherwise.
StdDev of returns	The natural logarithm of one plus the standard deviation of daily stock returns computed over trading days ( $-250, -126$ ) relative to the announcement date.
Target-bidder ratio	The natural logarithm of one plus the ratio of target's market capitalization to bidder's market capitalization $\Leftrightarrow \ln(1 + (\text{Target Market Value 4 Weeks Prior to Announcement}/(\text{csho\_Acq} * \text{prcc\_f\_Acq})) * 100)$
Tender offer	An indicator variable taking the value of one if the deal is a tender offer, and zero otherwise. The corresponding data item from Thomson ONE is "Tender Offer (Y/N)".
Value of purchases	The natural logarithm of one plus the dollar value of purchases $\Leftrightarrow \ln(1 + \text{shares} * \text{tprice}$ (both from Thomson Reuters insiders filing))

This table presents the variables used for the main empirical analysis (in alphabetical order) and describes their construction. Unless specified otherwise, all days represent trading days. We obtain stock price data from CRSP, balance sheet data from Compustat, insider purchases data from Thomson Reuters insiders filing database, and deal-specific information from Thomson ONE. All balance sheet items are measured at the fiscal year-end before the deal announcement date, obtained from Thomson ONE, unless noted otherwise.

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## Appendix

See Table A.1.

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