Overnight Returns: Investor Sentiment or Investor Attention?

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Abstract

What are the behavioural characteristics of overnight returns? This paper explores whether overnight trading activity exhibits behavioural elements of investor sentiment or investor attention. Overnight returns are employed as a proxy of investor sentiment and absolute overnight returns are used a proxy of investor attention. Using M&As as a testing framework, we find pre-acquisition announcement absolute overnight returns are positively associated with bidder short-run performance. In line with the predictions of the investor attention hypothesis, this relationship is reversed and becomes negative for negative signalling deals such as stock-financed acquisitions of public targets. The market overreaction is stronger for harder-to-value deals and those with lower institutional ownership while it is revered in the long-run. There is no relationship between pre-acquisition announcement overnight returns and bidder short-run performance. We unveil that overnight trading activity exhibits behavioural elements of an investor attention rather an investor sentiment measure.

JEL Classification: G14, G34, G40

Keywords: Overnight Returns, Sentiment, Attention, Mergers and Acquisitions

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"If you had bought the SPY at the last second of trading on each business day since 1993 and sold at the market open the next day — capturing all of the net after-hour gains — your cumulative price gain would be 571 percent.

On the other hand, if you had done the reverse, buying the E.T.F. at the first second of regular trading every morning at 9:30 a.m. and selling at the 4 p.m. close, you would be down 4.4 percent since 1993." (Source: Bespoke Investment Group and The New York Times, 02/02/2018).

1. Introduction

Overnight returns are price returns from the 4 p.m. close to the market opening at 9:30 a.m. the following day. Trading behaviour and price discovery during non-trading hours has attracted attention of markets and academia. Trading activity after-hours is a lot thinner with higher trading costs (Barclay & Hendershott 2004). Stock prices during after-hours are less efficient and less informative. In terms of magnitude, Kelly and Clark (2011) show that overnight risk-adjusted stock returns are higher than intraday ones. Barclay *et al.* (2003) suggest that the low trading volume and inefficient price discovery contains more information per individual trades after-hours. Lou *et al.* (2019) argue that the two periods – during and after-hours trading – exhibit difference in terms of information flow, price impact, and borrowing costs. They show that different types of investors are more likely to trade during the two periods. Retail investors who may be less concerned with liquidity and price impact are more likely to dominate the after-hours market. They also find that find that institutional ownership increases more with intraday than with overnight returns. Jiang et al. (2012) show that trading after-hours reveal a great degree of information efficiency while Akbas *et al.* (2021) show that the high intensity in reversals between overnight and intraday returns lead to higher future returns. We contribute to the ongoing discussion by examining behavioural-based explanations of the nature of after-hours stock returns.

Aboody *et al.* (2018) find that overnight returns exhibit a short-term overnight persistence, which is more prominent for harder-to-value firms, followed by a long-term

reversal. They argue that these are characteristics expected of a sentiment measure. For these reasons, they introduce overnight returns as a proxy of firm-specific sentiment. Similarly, Weißofner and Wessels (2020) show that overnight returns could serve as an international proxy of firm-specific sentiment. Xiong *et al.* (2020), by following similar methodological approaches, examine the appropriateness of overnight returns as a firm-specific sentiment measure across eleven major economies, excluding the U.S. Unlike previous studies, Xiong *et al.* (2020) fail to confirm the three characteristics (i.e. short-ren persistence, more pronounced for hard-to-value firms and long-term reversal) expected by a sentiment measure. Berkman *et al.* (2012) attributes the overnight-intraday pattern of stock returns to investor attention. They find that stock that exhibit high overnight returns, start with high opening prices, leading to price reversals during the normal trading hours. This behaviour is mostly pronounced for stocks that have recently attracted the attention of retail investors. The academic literature is inconclusive on the behavioural elements of overnight returns. This paper aims to examine and distinguish whether overnight trading activity exhibits characteristics of investor sentiment or investor attention.

Investor sentiment and investor attention are two different behavioural concepts. Investor sentiment is investors' belief about future cash flows and investment risks that is not justified by firm fundamentals (Baker & Wurgler 2006). Noise-trader sentiment models predict a short-run deviation of prices from fundamentals while there is a long-run reversal as mispricing is eventually corrected (Daniel *et al.* 1998). The phenomenon is more pronounced for stocks hard-to-arbitrage and those with low institutional ownership (De Long *et al.* 1990). Investor attention is defined as a scarce cognitive resource and refers to investors inability to follow all market developments closely (Kahneman & Tversky 1973)). Individual investors are net buyers of attention-grabbing stocks (Barber & Odean 2008). Kraemer *et al.* (2000) document that an individual's ability to give attention may vary based on time-of-day, and the

peak in attention often coincides when the stock market is closed in the overnight period. The main properties for high attention stocks suggest that there is a short-term price overreaction followed by a longer-term reversal (Barber & Odean 2008; Da *et al.* 2011). The market overreaction is more pronounced for hard-to-value and difficult to arbitrage stocks (Berkman *et al.* 2012). The predictions of investor sentiment and investor attention are alike.

To differentiate and disentangle whether overnight return exhibit properties of an investor sentiment versus an investor attention measure, we adopt a mergers and acquisitions testing framework. Unlike other corporate announcements such as earnings announcements and dividend announcements, merger announcements are unscheduled and unanticipated corporate events, which have significant valuation implications for the bidding firms' shareholders. More importantly, acquisition announcements with specific characteristics, such as the target public status and the method of payment, convey positive or negative signals to the market regarding the intrinsic value of the acquiring firm. Based on the information asymmetry hypothesis of Myers and Majluf (1984), Travlos (1987) shows that investors perceive acquisitions of public target firms paid with stock as bad news. The market infer that the stock offer signals that the bidding firm is likely to be overvalued leading to a lower re-evaluation upon the announcement of the deal. On the other hand, Chang (1998) shows that acquisitions of private target firms paid with stock signal positive news to the market and investors re-evaluate the bidders' share price upwards. The corporate monitoring hypothesis and the information asymmetry hypothesis explain the positive market reaction to acquisition announcements of private target firms paid with stock. The corporate monitoring hypothesis suggests that the owners of the private target firms become blockholders in the new combined firm which leads better monitoring and reduced agency cost for the new firm. The information asymmetry hypothesis implies that the small concentrated ownership of private firms has more incentives to examine bidders' stock and is unlikely to accept overvalued equity, conveying

positive signal to the market. The differential signalling effects and market reaction to acquisitions of private versus public target firms paid with equity enables us to test the two alternative behavioural effects: investor sentiment versus investor attention.

If overnight returns exhibit elements of a firm-specific sentiment measure and positive (negative) overnight returns are associated with positive (negative) investor sentiment, we would expect a positive relationship between overnight returns and acquisition announcements irrespective of the type of the deal. Danbolt *et al.* (2015) find that when investor sentiment is high (low) in the pre-announcement period, investors are subconsciously more likely to overestimate (underestimate) potential synergies and underestimate (overestimate) the risks associated with the merger. Hence, the positive market reaction for private stock deals would be expected to be more positive for firms subject to positive sentiment as compared to firms subject to negative investor sentiment. Similarly, the negative market reaction for public stock deals would be expected to be less negative for firms subject to positive sentiment and more negative for firms subject to negative investor sentiment.

On the other hand, if overnight returns exhibit elements of a firm-specific attention measure, the predictions of the market reaction for the various types of acquisition announcement would be different. For high attention stocks, we would expect to observe a positive overreaction for positive signalling deals - private stock ones - and a negative overreaction for negative signalling deals - public stock ones. In other words, for private stock acquisitions, the market would react more positive for high attention stocks and less positive for low attention ones (Louis & Sun 2010). Hence, we should expect a positive relationship between attention and acquisition announcements of private targets paid with stock. Similarly, for public stock acquisitions, the market would react more negative for high attention stocks and less negative for low attention ones (Louis & Sun 2010). Therefore, we should expect a

negative relationship between attention and acquisition announcements of public targets paid with stock.

To uncover the relation between overnight returns and the market reaction to various types of acquisition deals, we use a sample of US M&As deals announced between 1993 and 2018. We employ overnight returns into two alternative ways. Following Aboody *et al.* (2018) and Weißofner and Wessels (2020) who propose overnight returns as a measure of firm-specific sentiment, we estimate average overnight returns for each bidder in a pre-announcement period. Bidders with positive (negative) pre-announcement overnight trading activity are assumed to be subject to positive (negative) firm-specific sentiment. Alternatively, motivated by Barber and Odean (2008) who suggest high absolute returns as a proxy of attention, we estimate average absolute overnight returns for each bidder in a pre-announcement period. Bidders with high (low) pre-announcement absolute overnight returns are assumed to be subject to high (low) investor attention.

To investigate our empirical predictions, we begin by diving our M&As sample into ten deciles according to bidders' pre-announcement average overnight returns (OR) and absolute overnight returns (AOR). Based on average overnight returns, there is hardly any difference in the average M&As performance between the portfolio with the most negative pre-announcement average overnight returns and the portfolios with most positive ones. This finding goes against the investor sentiment-related predictions. On the other hand, there is a difference of 3.8% between the low and high portfolios based on pre-announcement average absolute overnight returns, providing support to the investor attention-related predictions. We further estimate the impact of overnight and absolute overnight returns on bidders' announcement abnormal returns in a multivariate framework. We are mindful that bidders' announcement performance may be affected from a number of different factors and hence, we control for a number of firm-related and deal specific characteristics as well as market wide conditions. The results show no significant relationship between overnight returns and bidders' announcement abnormal performance while

there is a positive and statistically significant relationship between pre-announcement absolute overnight returns and bidders' performance. Controlling for a number of different indicators, our results support the prediction of investor attention rather than investor sentiment.

To further validate that overnight trading activity exhibits elements of an investor attention measure, we test the predictions related to stock-financed acquisitions for private and public target firms respectively. As discussed above, both sentiment and attention predict a positive relationship with the performance of private stock deals while attention, unlike sentiment, predicts a negative relationship for public stock deals. First, we explore the impact of overnight returns on the bidder performance of the two subsamples of stock-financed acquisitions of private versus public targets and we do not find any statistically significant relationship. Then, we examine the impact of absolute overnight returns on the bidder performance of stock-financed deals of private versus public targets. The results show a statistically significant positive relationship for private stock deals and a statistically significant negative relationship for public stock ones. The evidence of these tests is in line with the behavioural predictions in favour of investor attention.

As an additional test to further validate that absolute overnight returns exhibit elements of an investor attention proxy, we predict that attention-driven overreaction should be stronger for the acquiring firms with greater information asymmetry and harder to value or arbitrage (Daniel *et al.* 1998; Baker & Wurgler 2006; Zhang 2006; Berkman *et al.* 2012). According to Da *et al.* (2011) and Berkman *et al.* (2012), attention-driven purchasing behaviour is more pronounced in firms with less institutional investors, since small retail investors as a group are more likely to be affected by attention. Retail investors tend to overestimate their ability to generate accurate information, particularly in cases where they personally collected the data (Odean 1999). To test these predictions, we take small bidders, young bidders, and acquisitions of private targets as our three proxies for hard of value acquires and deals. Following Buchanan

et al. (2018), we construct two measures of institutional ownership such as the Top 5 institutional ownership and the blockholder ownership. Keeping in line with our assumption, we find that the positive association between absolute overnight returns (AOR) and acquirer abnormal returns is strongest for the sub-section of small bidders, young bidders, and private targets and those with lower institutional investor holdings.

If absolute overnight returns capture investor attention, the above mechanism should hold for private stock and public stock deals but with opposite directions. We posit that the attention driven positive overreaction for the private stocks and the negative overreaction for public stocks should be more pronounced under the moderating effect of deal complexity and institutional ownership. Confirming our prediction, we find that the coefficients on the interaction variable of absolute overnight returns and private stocks are more positive for the sub-sample of small bidders, young bidders, low institutional and low blockholder ownership. On the contrary, for the same sub-sample of firms, we find the coefficients on the interaction variables of AOR and public stocks to be more negative.

To further confirm the behavioural nature of the attention driven short-term overreaction, we examine the long-term acquisition performance. One could argue that the positive coefficient on AOR is simply reflecting the favourable bidder and deal-specific fundamentals captured through the high AOR before the official announcement. Da *et al.* (2011) propose a way of disentangling the overlapping findings between investor attention and the information-based hypothesis by testing reversal patterns in returns. If the positive market reaction is due to the nature of the acquirer and deal-specific fundamentals, then the positive reaction will continue as the news of the successful acquisition gradually gets incorporated into the acquirer stock price. However, if the temporal price pressure is due to the attention-driven acquirer stock purchase behaviour, then we should expect the positive market reactions to be followed by price reversals in the post-announcement periods. Supporting the latter prediction,

our results show that overnight attention-driven overreaction is followed by price reversals in the post-announcement period.

For robustness, we perform several additional tests. We recognize that while investors' attention might be grabbed for a multitude of reasons, the nature of firms and deals that grab their attention more easily may not be randomly distributed. For example, it is more likely that investors pay more attention to renowned bidders or public targets. Thus, the bidders that get more attention are likely to differ in terms of several characteristics relative to the bidders that get less attention. Although we control for several bidder and deal characteristics, to reinforce the validity of our prior findings, we perform a propensity score matching (PSM) analysis to control for the firm and deal-level characteristics that could potentially lead to the selection bias in our empirical tests. In particular, we follow the method suggested in Drucker and Puri (2005) and construct a sample of bidders that experienced high investor attention (treatment group) with similar characteristics to the low-investor attention bidders (control group). To match firms, we use size, book leverage, market–to–book, return on assets (ROA), past returns, firm age, firm volatility, target public status, and the method of payment. The impact of absolute overnight returns on bidder announcement performance as well as abnormal trading volume for the matched sample remains positive and statistically significant at 1% level of significance, alleviating the concern that potential selection bias by investors may drive our overall results.

To address the potential issue that omitted variables may drive our results, we perform a two-stage instrument variable (IV) analysis. For this procedure, we take the percentage of home-broadband users in the US provided by the PEW research center as the instrumental variable. Barber and Odean (2002) find that the availability of the internet in the US homes changed the way retail investors trade in the market. Due to the availability of online trading facilities, retail investors are trading more actively, more speculatively, and earning less profit in the long run (Barber & Odean 2002). In the context of our study, the percentage of home-broadband users should affect our independent variable AOR, however, unlikely to influence the bidder abnormal returns.

Supporting our conjecture, we find that access to the home-internet has a statistically significant association with retail investor attention. More importantly, the post estimation results from the first-stage regression show that the Kleibergen–Paap rk Wald F statistic for the weak identification test is higher than the critical value prescribed in (Stock & Yogo 2002). Besides, the results from the second stage of the IV regression confirm that the instrumented AOR remains positive and statistically significant.

Finally, we confirm that our results are not driven by any particular window of bidder abnormal returns as the association between AOR and bidder CARs holds for three different windows of bidder abnormal returns. Second, to address the concerns regarding the capacity of the AOR to capture investor attention, we take two alternate measures of AOR. The coefficients on the alternate proxies of AOR remain statistically and economically significant in explaining both bidder CARs. Third, we further confirm that all the variants of AOR remain positive and significant in explaining abnormal trading volumes as well.

Our study makes several novel contributions to different strands in the literature. First, it contributes to the renewed academic interest in understanding the price discovery of trading activity after-hours from a behavioural perspective. Our study relates to those of Aboody et al. (2018), Weißofner and Wessels (2020), Xiong et al. (2020) and Berkman et al. (2012) which attribute overnight returns mostly to investor sentiment. By employing a research framework that offers heterogeneous predictions, we differentiate between the investor sentiment and investor attention elements of overnight returns. We find that overnight trading behaviour could be a good measure of investor attention rather than a measure of investor sentiment. Our work also relates to the studies of Barclay and Hendershott (2003) and Lou *et al.* (2019) which investigate the price discovery mechanisms behind after-hours trading activity.

Second, our study adds to the literature on the effect of inattention and corporate decisions (DellaVigna & Pollet 2009; Hirshleifer *et al.* 2009). Our study is closely related to Louis and Sun (2010) and Michaely *et al.* (2016) who show that the negative market reaction

for acquisitions of public target firms financed with equity is moderated and the market underreacts when investor attention is low. Also, our study related to Adra and Barbopoulos (2018) and Liu and Krystyniak (2021) who show that overvalued bidder do not experience great losses when stock-financed deal for public targets are announced on low attention periods. Our findings further confirm the above studies by employing a new measure of firm-specific attention, which is absolute overnight returns.

The remainder of the paper is organized as follows: Section 2 presents related studies and builds empirical predictions and section 3 describes the sample, data, and variables. Section 4 presents the empirical results and finally, section 5 concludes the paper.

2. Related Literature and Predictions

2.1. Investor Sentiment

Investor sentiment is investors' belief about future cash flows and investment risks that is not justified by firm fundamentals (Baker & Wurgler 2007). Shleifer and Vishny (2003) explain that it is costly to bet against investor sentiment in financial markets. The extant literature on investor sentiment shows that market-wide sentiment affects both the cross-sectional and time-series characteristics of stock returns (Baker & Wurgler 2006; Lemmon & Portniaguina 2006; Stambaugh *et al.* 2012). Noise-trader sentiment models suggest a short-term overreaction followed by long-ren market corrections (De Long *et al.* 1990). In addition, investor sentiment affects firm-specific corporate outcomes as well. For instance, Arif and Lee (2014) report that corporate investments peak in periods of high investor sentiment. Bergman and Roychowdhury (2008) find that in the periods of low sentiment, managers increase forecasts to enhance current estimates of future earnings over long horizons and vice-versa. Mian and Sankaraguruswamy (2012) examine the role of investor sentiment to firm-specific earnings news and report that stock price sensitivity to good earnings news is amplified under

the presence of high investor sentiment and the stock price sensitivity to bad news is more pronounced in the low sentiment period.

Among the studies that examine the moderating role of investor sentiment in M&As, Bouwman *et al.* (2009) find acquisitions announced during overvalued periods generate high short-run gain but underperformance in the long run. Similarly, Rosen (2006) finds high short-run acquirer abnormal returns and long-term reversals during hot merger markets. Danbolt *et al.* (2015) use the Gross National Happiness Index (GNH) from Facebook as a direct proxy for investor sentiment and find that bidder abnormal returns are significantly higher for the announcements made during high GNH periods followed by underperformance in the long run. Conclusively, in the presence of high investor sentiment, the investors tend to overestimate the potential synergy from the announced deal while underestimating the risks associated with the merger, resulting in a positive market overreaction during the announcement irrespective of the type of deal. Keeping these studies as our backdrop, we form the following empirical predictions of investor sentiment in relation to M&As outcomes:

Prediction 1a: Sentiment is positively related with bidder announcement abnormal returns

Prediction 1b: Sentiment is positively related with bidder announcement abnormal returns for stock-financed deals of private target firms.

Prediction 1c: Sentiment is positively related with bidder announcement abnormal returns for stock-financed deals of public target firms.

2.2. Investor Attention

Investor attention is defined as a scarce cognitive resource and refers to investors inability to follow all market developments closely (Kahnemann & Tversky, 1973). In our everyday life, there is more attention than mere selection. The capacity theory of attention considers that individuals have limited ability to carry out multiple activities at the same time

and hypothesizes that the total amount of attention that an individual can assert at any time is limited (Kahneman 1973). This limited capacity can be allocated with considerable freedom among concurrent activities (Moray 1967). When the supply of attention does not meet the demand then the performance of a task falters or even fails.

In financial markets, it is well-documented that on days of information release or large price movements, stock trading volume increases (Karpoff 1987; Bamber *et al.* 1997). The neoclassical asset pricing models assume that new information in the market is readily incorporated into stock prices, assuming that investors pay enough attention to the news. However, the attention paid by equity investors is a scarce resource (Barber & Odean, 2008) and when bombarded with too many options, attention-grabbing stocks are more likely to be selected. On the other hand, stocks that don't attract the attention of investors are more likely to be ignored.

Studies on investor attention provide us with a theoretical framework to understand how investor attention affects share price movements in financial markets. Barber and Odean (2008) posit that important news or announcements about a firm often results in significant positive or negative returns. When there are extreme movements in the stock prices, it is likely that events that move share prices also grabbed the investors' attention. This notion is further supported by Lee *et al.* (1991) who find that small retail traders are the net buyers of stocks having both positive and negative earnings surprises. More recently, Da *et al*., (2011) suggest google search volume index as a potential proxy for retail investor attention. While the proxy can potentially capture the retail investor's attention, the lack of data for the less renowned firms remains a hurdle.

Barber and Odean (2008) propose that individual investors are the net purchasers of attention-grabbing stocks. Individual investors face great difficulty in shortlisting stocks to purchase as they are bombarded with hundreds of choices. However, while selling, they can

only sell from the few stocks that they have in their portfolio. Although retail investors do not end up buying all the stocks that grab their attention, however, they are the net buyers of the attention-grabbing stocks. In the context of M&As, if the news of the impending mergers grabs the attention of investors, it increases the demand for the bidders' stocks. Reyes (2018) investigates the relationship between google attention and merger performance reporting that investors' attention to a merging firm increases as the announcement date approaches, peaks on the announcement day, and remains high in the post-announcement days. The increased attention captured by google coupled with high news coverage leads to high abnormal returns.

On the other hand, there is also extant research explaining the impact of inattention on different corporate announcements including M&As. Hirshleifer *et al.* (2009) find evidence that the stock market's reaction to earnings surprises is weak on days during which multiple firms make similar announcements. DellaVigna and Pollet (2009) find that abnormal returns are muted for announcements made on Fridays when the investor attention is low. Louis and Sun (2010) and Michaely *et al.* (2016) document similar findings showing that the market underreacts to public stock deals, and they experience less negative effects. Adra and Barbopoulos (2018) and Liu and Krystyniak (2020) find that limited investor attention allows overvalued bidders to engage in stock-financed acquisitions without experiencing great wealth losses. On the contrary, bidders with high attention, experience more negative abnormal returns for acquisition announcements of public targets financed with stock. Keeping these studies as our backdrop, we form the following empirical predictions of investor attention in relation to M&As outcomes:

Prediction 2a: Attention is positively related with bidder announcement abnormal returns

Prediction 2b: Attention is positively related with bidder announcement abnormal returns for stock-financed deals of private target firms.

Prediction 2c: *Attention is negatively related with bidder announcement abnormal returns for stock-financed deals of public target firms.*

3. Sample, Data and Variable Definition

3.1. M&As Sample

Our M&A sample which is collected from the SDC Platinum Database includes deals announced between January 1993 to December 2018. The dates before 1993 are not considered because information for overnight returns is not available in the CRSP database before 1993. The bidders are US public firms and targets are either public, private or subsidiary firms from all over the world. Next, we exclude deals with a value of less than $1 million and relative deal value to acquirer market capital capitalization one month before the announcement less than 1% (Fuller *et al.* 2002). The highly regulated financial (SIC 6000-6999) and utility (SIC 4900–4999) companies are excluded from the sample. We also exclude bidders that have stock prices less than $1 in our sample period (Fuller *et al.* 2002). After this procedure, our M&A sample consists of 16,177 deals with 4,193 unique acquiring firms worth, on average, a total of $2.79 billion per year.

3.2. Calculating Overnight Returns

The total returns of a company can be divided between returns earned in the overnight and intraday period. Overnight returns are the returns earned by firms between the closing of the market and the opening of the market the next day. Overnight returns are calculated in the following way:

$$OR_{i,t} = \frac{OP_{i,t} - CP_{i,t-1}}{CP_{i,t-1}}$$

where $OR_{i,t}$ is the overnight return of bidder i on day t. $OP_{i,t}$ is the opening price of stock i on day t, $CP_{i,t-1}$ is the closing price of stock i on day t-1. Opening and the closing prices of stocks are adjusted for stock splits, stock dividends, and cash dividends.

In order to differentiate of whether of overnight trading activity embeds characteristics of investor sentiment or investor attention, we treat overnight returns in two different ways. We either use the actual series of overnight returns as proxy for investor sentiment or the absolute overnight returns as a proxy for investor attention.

3.2.1. Investor Sentiment

We follow Aboody *et al.* (2018) and Weißofner and Wessels (2020) who propose overnight returns as a proxy of firm-specific investor sentiment. High levels of positive overnight returns would imply positive investor sentiment while high levels of negative overnight returns would imply negative investor sentiment. For each bidder, we estimate the average overnight returns for a window of -20 to -3 days prior to the acquisition announcement as shown in the formula below:

$$Bidder\ OR_{(-20,-3)} = \frac{\sum_{-3}^{-20} OR_i}{18}$$

Bidders with high positive pre-announcement overnight performance are considered to be exposed to positive investor sentiment while bidders with high negative pre-announcement overnight performance are considered to be exposed to negative investor sentiment.

3.2.2. Investor Attention

For investor attention, we are motivated by Barber and Odean (2008) who argue that retail investors herd into attention-grabbing stocks. They argue that individual investors are net buyers on the next trading day following days with high absolute returns, which is one of their proxies for attention. Extreme movements in the market, irrespective of direction, are

associated with investor attention. Kraemer *et al.* (2000) document that an individual's ability to give attention may vary based on time-of-day, and the peak in attention often coincides when the stock market is closed in the overnight period. Hence, we argue that high levels of overnight returns, irrespective of being positive or negative (i.e. high levels of positive of negative overnight returns), would imply high investor attention. On the other hand, low levels of overnight returns (i.e. close to zero) would imply low investor attention. For these reasons, we estimate the absolute overnight returns as a proxy for investor attention. For each bidder, we estimate the average absolute overnight returns for a window of -20 to -3 days prior to the acquisition announcement as shown in the formula below:

$$Bidder\ AOR_{(-20,-3)} = \frac{\sum_{-3}^{-20}|OR_i|}{18}$$

Bidders with high pre-announcement absolute overnight performance are considered to be exposed to high investor attention while bidders with low pre-announcement overnight performance are considered to be exposed to low investor attention.

3.3. Sample descriptive statistics

Panel A of Table 1 reports all the descriptive statistics of the bidder pre-announcement overnight and absolute overnight measures and other control variables used in the empirical setting. A detailed definition of all the variables is included in Appendix A. To take out the effect of the extreme values, we winsorize all the continuous variables at the 1st and 99th percentile. The sample descriptive statistics are in line with the findings of the previous studies(Bonaime *et al.* 2018; Hao *et al.* 2020). Panel B of Table 1 presents the major deal-and firm-specific characteristics according to high and low OR and AOR before the acquisition announcement. There are not major differences between high and low OR and AOR subgroups.

[Insert Table 1 About Here]

Table 2 presents the average bidder performance for the overall sample and for various portfolios as divided by the target public status and the method of payment. Bidder performance is estimated as bidders' cumulative abnormal returns for a window of three days surrounding the acquisition announcement (-1, +1), calculated by using the market model where the CRSP value-weighted index return is the market return. For the full sample, the mean cumulative abnormal return for the three-day window is 0.9 %. Acquisitions of public targets generate low and insignificant abnormal returns while those of private and subsidiary targets earn positive and significant gains of around 1% - 1.5% (Fuller *et al.* 2002). Acquisitions financed with cash also generate positive abnormal returns (1.5%) while those financed with stock experience low and insignificant gains (-0.3%). This is mainly driven by the negative performance of stock acquisitions for public target firms (-2.5%) (Travlos, 1987) and the positive performance of stock acquisitions for private target firms (2.1%) (Chang, 1998). The performance of the various portfolios of the M&As sample are in line with prior evidence in the literature which indicate that our M&As data compose a consistent and comprehensive sample for further analysis.

[Insert Table 2 About Here]

4. Empirical analysis

4.1. Investor Sentiment or Investor Attention?

In order to differentiate of whether of overnight trading activity embeds characteristics of investor sentiment or investor attention, we start our analysis by splitting our overall M&As sample into ten deciles, either based on the actual overnight returns or the absolute value of overnight returns.

First, we estimate the mean overnight returns (OR) of the stock of each bidding firm for the period of -20 to -3 days before the takeover announcement. Based on the pre-

announcement period average overnight returns, we split the sample into 10 deciles. Portfolio 1 consist of M&As deals for which the average pre-announcement overnight returns are the most negative and portfolio 10 consist of M&As deals for which the average pre-announcement overnight returns are the most positive. If overnight trading activity proxies for investor sentiment, portfolio 1 would consist of stocks with very negative sentiment while portfolios 10 would consist of stocks with very positive sentiment. We then estimate the average announcement market reaction for bidding firms for each one of the ten "sentiment portfolios". The acquisition market reaction is estimated as bidders' cumulative abnormal returns for a window of three days surrounding the acquisition announcement (-1, +1). Table 3, column (1) presents the results. The average announcement market reaction for the "negative sentiment portfolio" (portfolio 1) is 3.1% while for the "positive sentiment portfolio" (portfolio 10) is 2.9%. The performance of the ten portfolios forms a U-shape as it declines gradually from portfolio1 to portfolio 4 while it increases from portfolio 5 to portfolio 10. This finding is consistent with the findings of Aboody et al. (2018) who also find a non-monotonic relationship between weekly overnight returns and total returns for the following 1 to 4 weeks. According to our sentiment-related predictions and the study of Danbolt *et al*. (2015), M&As deals subject to high investor sentiment are associated with the highest announcement abnormal returns since investors affected by positive sentiment tend to overestimate synergies and underestimate associated risks. On the contrary, M&As deals subject to low investor sentiment are associated with the lowest announcement abnormal returns. However, the initial results from the univariate analysis as described above suggest that there is hardly any difference between positive and negative sentiment portfolios and hence, they do not seem to confirm these predictions.

Second, we estimate the mean *absolute* overnight returns (AOR) of the stock of each bidding firm for the period of -20 to -3 days before the takeover announcement. Based on the

pre-announcement period average absolute overnight returns, we again split the sample into 10 deciles. Portfolio 1 consist of M&As deals for which the average pre-announcement absolute overnight returns are the lowest and portfolio 10 consist of M&As deals for which the average pre-announcement absolute overnight returns are the highest. If absolute overnight returns proxy for investor attention, portfolio 1 would consist of stocks with the lowest attention while portfolios 10 would consist of stocks with the highest attention. We then estimate the average announcement market reaction for bidding firms for each one of the ten "attention portfolios". Table 3, column (2) presents the results. The average announcement market reaction for the "low attention portfolio" (portfolio 1) is 0.9% while for the "high attention portfolio" (portfolio 10) is 4.7%. the difference is statistically significant at the 1% level. The relationship between portfolios 1 to 10 and bidders' abnormal returns appears to be linear. Higher-order attention portfolios appear to generate higher bidder announcement abnormal returns. These findings appear to be consistent with our attention-related predictions, the price pressure hypothesis suggested by Barber and Odean (2008) as well as the empirical predictions by Da *et al*. (2011).

[Please Insert Table 3 About Here]

To further assess and empirically establish the impact of overnight returns and absolute overnight returns on bidders' announcement abnormal returns, we perform a multivariate analysis as well. We run OLS regression where the dependant variable is bidders' three-day cumulative abnormal returns [CARs (1, +1)] and the main variables of interests are either pre-announcement overnight returns (Model 1) and absolute overnight returns (Model 2), by controlling for a series of firm-, deal-, and macro-level determinants that previous literature has shown to affect the acquirers' acquisition performance. We use the following models:

$$CARs(-1,+1)_{i,t} = \alpha + \beta \times OR_{i,t} + \theta \times C_{i,t-1} + \gamma IndustryFE + \delta YearFE + \varepsilon_{i,t} \quad (1)$$

$$CARs(-1,+1)_{i,t} = \alpha + \beta \times AOR_{i,t} + \theta \times C_{i,t-1} + \gamma IndustryFE + \delta YearFE + \varepsilon_{i,t} \quad (2)$$

where the dependent variable is bidders' cumulative abnormal returns for a window of three days surrounding the acquisition announcement (-1, +1). Our main variables of interest are overnight returns (OR) and absolute overnight returns (AOR) in models (1) and (2) respectively. Overnight returns (OR) is the average overnight returns for the bidding firm calculated for the period -20 to -3 days before the merger announcement. Likewise, absolute overnight returns (AOR) is the average absolute overnight returns for the bidding firm calculated for the period -20 to -3 days before the merger announcement. C is a vector of all the control variables included in the multivariate model. All firm-level control variables are measured in the fiscal year ending in the previous calendar year, and the macroeconomic variables are measured in the prior calendar year of the acquisition announcement.

The bidder-specific firm-level control variables include size, book leverage, market–to–book, return on assets (ROA), sales growth, cash to assets, past returns, non–cash working capital, firm age, and firm volatility. For the deal-specific control variables, we include the listing status of the target firm (public vs private) and payment method (cash vs stock payment), high tech dummy, hostile takeover dummy, diversification dummy, and challenge dummy (Myers & Majluf 1984; Travlos 1987; Chang 1998; Draper & Paudyal 2006).

We follow Bonaime *et al*. (2018) to include the following macro-variables that may affect the bidders' announcement returns. Among the macro-level control variables, we include investment opportunities, industry economic shock, rate spread, Shiller's CAPE ratio, industry median Q, industry median past returns, industry standard deviation of past returns, and macroeconomic uncertainty. The detailed descriptions of the variables are presented in Appendix A.

Table 4 reports the results for multivariate OLS regressions. Specifications (1) and (3) do not include the macro-level controls whereas specifications (2) and (4) are the complete models including the macro-level controls. In all the specifications, we further include year and

industry fixed effects. Finally, we use robust standard errors double–clustered by firm and year. For Specifications (1) and (2), the main variable of interest is pre-announcement overnight returns (OR). In both specifications, the coefficients of overnight returns (OR) are negative and statistically insignificant. These findings complement the univariate analysis results and fail to confirm the sentiment-related predictions of a positive relationship between overnight returns and bidders announcement abnormal returns. In specifications (3) and (4), the coefficient for absolute overnight returns (AOR) is positive and highly statistically significant at the 1% significance level. Specification (4), which is our main multivariate model, reports that the parameter coefficient on AOR is 0.428 with a t-value equal to 3.017, depicting that with one percentage point increase in bidder AOR is associated with a .428 percentage point increase in the three-day bidder cumulative abnormal returns. The economic magnitude of such an increase in the coefficient on AOR translates into a $1.19 billion value increase for our sample average bidder with a market value of $ 2.79 billion. Moreover, as bidder CARs are calculated in-excess of the CRSP value-weighted market returns, the reported positive association in the study is on top of the attention-driven stock returns already reported in previous studies. The findings corroborate to the univariate analysis and confirm the attention-related predictions.

[Please Insert Table 4 About Here]

4.2. Stock-Financed Deals

An important test to differentiate between an investor sentiment versus and an investor attention measure is to examine their impact on positive versus negative signalling announcements. In our research framework, we employ stock-financed deals. Acquisitions of public targets paid with stock signal negative news to the market and the market reacts negatively (Travlos, 1987) while acquisitions of private targets paid with stock are perceived as positive news and the market reacts positively (Chang, 1998). While the predictions of both

a sentiment and an attention measure suggest a positive relationship with bidders' announcement abnormal returns for the overall sample or for positive signalling deals such as private stock deals, the predictions are of opposite direction for negative signalling announcements such as stock-financed acquisitions of public targets. If overnight returns embed elements of an investor sentiment measure, we should expect a positive relationship between overnight returns and both private stock and public stock deals. Higher levels of investor sentiment should be associated with more positive announcement returns for private stock deals or less negative for public stock ones (Danbolt *et al*., 2015). If overnight returns embed elements of an investor attention measure, we should expect a positive relationship between absolute overnight returns and private stock deals and a negative relationship with public stock deals. Under the attention hypothesis, we would expect the market to underreact and observe a less positive reaction for low attention private stock deals and a less negative reaction for low attention public stock ones. Similarly, for high attention stocks, we would expect the market to overreact and be more positive for private stock deals and more negative for public stock ones (Louis & Sun 2010; Liu & Krystyniak 2021).

Table 5 reports the results of the impact of overnight and absolute overnight returns in relation to private stock and public stock deals. In specifications (1) and (2), the variables of interest are the interaction between overnight returns (OR) and a private stock dummy variable and public stock dummy variable respectively. Both coefficients are statistically insignificant indicating that there is no special relationship between pre-announcement overnight returns and these two particular types of deals. . In specifications (3) and (4), the variables of interest are the interaction between absolute overnight returns (AOR) and the respective private stock and public stock dummy variables. The interaction between absolute overnight returns (AOR) and the private stock dummy variable is positive and highly statistically significant indicating that higher levels of attention are associated with a more positive marker reaction for private

stock deals. On the other hand, the interaction between absolute overnight returns (AOR) and the public stock dummy variable is negative and highly statistically significant suggesting that higher levels of attention are associated with a more negative marker reaction for public stock deals. These findings are consistent with Louis and Sun (2010) and Liu and Krystyniak (2021). This test and results further confirm that overnight returns appear to exhibit characteristics of an investor attention measure rather than an investor sentiment proxy. These results do not only provide evidence to differentiate between the two behavioural concepts, in support of investor attention, but also further validate the predictions of an investor attention measure.

[Please Insert Table 5 About Here]

4.3. Economic mechanism

The results so far provide clear support to the price pressure hypothesis that overnight trading activity exhibits elements of investor attention rather than investor sentiment. To further validate the finding that temporal price pressure is indeed the economic mechanism that drives our results, we only focus on absolute overnight returns (i.e. proxy for investor attention) and do additional tests related to the acquiring firms' institutional ownership, harder to value deals, and stock-financed deals.

4.3.1. Harder to value deals and institutional ownership

In our attention framework, investors' subjective valuation about a bidder varies with the level of information uncertainty in the stock market. For example, smaller and younger firms make it difficult for the investors to justify their subjective valuations (Baker and Wrugler, 2007). Investors overweight their ability to generate and process private information and underweight the forecasting error associated with the prediction (Odean, 1999). Zhang

(2006) suggests that investors overreact more when the market provides less information on certain stocks (i.e. harder to value stocks). Also, the market overreaction is more pronounced for retail investors (Barber and Odean, 2008). Institutional investors are less likely to be affected by attention since they have access to far better information gathering sources like Reuters or Bloomberg (Da *et al*., 2011). Keeping these findings as a backdrop, we predict that the attention-driven overreaction should be stronger for acquiring firms and deals that that harder to value or arbitrage and firms subject to lower level of institutional investors(Daniel *et al.* 1998; Zhang 2006; Baker & Wurgler 2007; Berkman *et al.* 2012).

We take small bidders, young bidders, and acquisitions of private targets as our three proxies for hard to value acquirers and deals. A series of extant literature shows that arbitrage is particularly expensive for the smaller and younger firms with a high degree of idiosyncratic variations in their returns and cashflows (D'avolio 2002; Wurgler & Zhuravskaya 2002). Moreover, the attention-driven overreaction should be pronounced for the small firms that are usually associated with a larger price change (Da *et al*., 2011). To test the predictions, we construct the following variables: a small firm dummy variable which is equal to 1 if the bidder's size is lower than the 25th percentile and 0 otherwise, a young firm dummy variable which is equal to 1 if the age of the bidder is less than the 25th percentile and 0 otherwise and a private dummy variable which is equal to 1 if the target is private, 0 otherwise.

We further predict that as retail investors are more likely to rely on private information that grabbed their attention, the attention driven overreaction should be stronger for retail rather than institutional investors. Following Buchanan *et al.* (2018), we construct two dummy variables as proxies for firms with high retail traders: one is a low institutional ownership dummy variable which is equal to 1 if the percentage of top 5 institutional owners is lower than the 25th percentile and 0 otherwise. A second proxy is a low blockholder ownership dummy

variable which is equal to 1 if the blockholder ownership variable is less than the 25th percentile value of our sample and 0 otherwise.

Panel A of Table 6 presents the results. In all specifications, we interact absolute overnight returns with the five dummy variables as described above. The interaction coefficients in all specifications are positive and statistically significant. Consistent with our predictions, the results confirm that the market overreaction is higher for harder to value deals and for stocks followed by a lower number of institutional investors. Smaller and less sophisticated retail investors who are susceptible to behavioural biases are more likely to overreact. This evidence further confirms that overnight trading activity is consistent with the attention hypothesis.

4.3.2. Institutional ownership, deal complexity, and stock swap

If absolute overnight returns affect bidders' announcement abnormal returns through the mechanism of investor attention, the observed attention-based overreaction for hard to value deals and low institutional holder stocks should be evident with opposite signs for positive and negative signalling deals. In other words, the attention-based overreaction should generate an even more positive market reaction for private stock deals and an even more negative market reaction for public stocks deals for harder to value and for lower institutional ownership stocks.

To test our predictions, we re-run the models of Table 5 for the two subsamples of each of the variables such as firm size, firm age, top 5 institutional ownership percentage, and blockholder ownership percentage. Panel B of Table 6 presents the results. The interaction coefficients of absolute overnight returns (AOR) and the private stock dummy is more positive for the small bidders, young bidders, the low percentage of top 5 institutional ownership, and low percentage blockholder ownership subgroup. For the same subgroups, the interaction

coefficients of absolute overnight returns (AOR) and the public stock dummy is the most negative. The differences among the different subgroups are statistically significant. Conclusively, the attention driven positive overreaction for private stock deals and negative overreaction for public stock deals is amplified for the sub-section of small bidders, young bidders, the low percentage of top 5 institutional ownership, and low percentage blockholder ownership. These findings offer further support that overnight trading exhibits elements of investor attention.

[Please Insert Table 6 About Here]

4.4. Long-Run Reversal

The positive and statistically significant absolute overnight return (AOR) coefficients in Table 4 are consistent with the price pressure hypothesis suggested by Barber and Odean (2008). On the contrary, neo-classical theorists might argue that the price increase simply reflects the market's positive reaction to the potential merger synergy. Consequently, if the absolute overnight return (AOR) coefficient captures the positive deal-specific fundamentals, then the initial positive reaction should remain in the post-merger stock performance of the acquirer as the potential merger synergies slowly get integrated into the acquirer's stock price. However, if the positive short-term performance is an overreaction due to overnight attention paid by retail investors, then we should expect the market to adjust their initial overreaction in the post-merger period and observe a reversal.

Hence, we examine the effect of absolute overnight return (AOR) on post-merger bidder cumulative abnormal returns for a window of +4 to +8 days after the announcement. Supporting our conjecture of returns reversal, specification (1) of Table 8 reports that the coefficient on AOR in explaining CARs (+4, +8) is negative and statistically significant. More specifically, one percentage point increase in acquirer AOR results in a .166% decrease in the

four-days post-announcement CARs (+4, +8). After comparing the coefficients on AOR between the announcement and the post-announcement period, we can see that a significant portion of the retail investor attention-based overreaction in the market is quickly adjusted in the post-announcement period. The result is in line with the previous findings that suggest that the initial overreaction in the short-term is corrected in the long-run and drive stock prices back to fundamental values (Daniel *et al*., 1998). Additionally, merger arbitrageurs actively trade around the announcement days to take advantage of the short-term mispricing and cause the post-merger prices to reverse (Danbolt *et al*., 2015).

Additionally, we complement the short-run analysis by investigating the long-run effect of AOR on acquirer 1-, 2-, and 3-year Buy and Hold Abnormal Returns (BHARs) using the matched firm adjusted method suggested by Barber and Lyon (1997) and Lyon *et al.* (1999). The long-run analysis helps to further distinguish between the price pressure and favourable information incorporation hypothesis. If the acquirer AOR indeed captures good news instead of retail investor attention, then the positive association should persist in the long run. Specifications (2) to (4) of Table 8 report that the association between AOR with long-run BHARs is statistically insignificant. These results further confirm our previous finding that AOR affects the bidder abnormal returns through the price pressure channel.

[Please Insert Table 7 About Here]

4.5. Robustness Tests

4.5.1. Propensity Score Matching (PSM)

Attention paid by investors in different merger announcements may not be distributed randomly. As Da *et al*., (2011) and Reyes (2018) point out that retail investors are more likely to pay attention to the deals that make the headlines. Moreover, the Google search volume index shows that investors actively pay more attention to the deals involving large bidders and

targets (Reyes, 2018). Consequently, AOR may also differ along with these different bidders and deal-specific characteristics. Even though our results do hold even after controlling for a series of firm-, deal- and macro-level characteristics, to further control for the potential selection bias that the retail investors might have, we conduct a propensity score matching (PSM) analysis. In particular, we follow the method suggested in Drucker and Puri (2005) and construct a sample of bidders that experienced high investor attention (the treatment group) with similar characteristics to the low-investor attention bidders (the control group). Next, we use the sample to retest our multivariate OLS regressions in Table 4. This method eradicates potential biases while estimating the average treatment effects (Rosenbaum & Rubin 1985; Imbens & Wooldridge 2009). To match the firms, we use the following covariates based on the different deal- and bidder-specific variables: size, book leverage, market–to–book, return on assets (ROA), firm age, firm volatility, target public status, and method of payment. Panel A of Table reports the univariate comparison between the firm-characteristics between the treatment group and the control group. In the majority of the cases, the differences between the two groups remain insignificant, meaning that most of the characteristics between the two groups are largely similar. Panel B of Table 8 shows that the impact of the absolute overnight returns (AOR) on bidder cumulative abnormal returns (CARs) and the abnormal trading volume for the matched sample remains positive and statistically significant at 1% level of significance. These results alleviate the concern that potential selection bias by the investors may drive our overall results.

[Please Insert Table 8 About Here]

4.5.2. Instrumental variable (IV)

To address the issue that omitted variables may drive our results, in this section of our analysis we perform a two-stage instrumental variable (IV) procedure. This method requires

an instrumental variable that affects our independent variable, absolute overnight returns (AOR), but is unlikely to influence the bidder abnormal returns. To instrument for absolute overnight returns, we select the percentage of home-broadband users in the US provided by the PEW research agency. The suitability of using the percentage of home-broadband users stems from the findings in Barber and Odean (2002) that the availability of internet in the US homes changed the way retail investors trade in the market. After the easy accessibility to online trading, particularly from 1999 onwards, these retail investors have started trading more actively, more speculatively, and earning less profit in the long run (Barber & Odean, 2002). On the contrary, institutional investors rely primarily on the more sophisticated news sources like Reuters or Bloomberg terminals (Da *et al*., 2011). In the context of our study, the accessibility to home internet may affect the retail investor attention driven decisions in two ways. Firstly, the internet has become one of the most important sources of verifying attention-grabbing events. Secondly, it gives the retail investors the option to trade instantly on the news that grabbed their attention. At the same instant, it is unlikely that the percentage of home-broadband users would have any direct association with bidder abnormal returns. One of the potential pitfalls of using this IV is that it restricts our sample as the percentage of home broadband users is only made available from the year 2000.

Table 9 reports the findings from the IV analysis. To perform the IV analysis, in the first stage (specification (1) and specification (3)), we quantify the impact of the percentage of home-broadband subscribers on absolute overnight returns (AOR). Supporting our conjecture, we find that access to the home-internet has a statistically significant association with retail investor attention. More importantly, the post estimation results from the first-stage regression show that the Kleibergen–Paap rk Wald F statistic for the weak identification test is higher than the critical value prescribed in Stock and Yogo (2002) (i.e., LIML Size of Nominal 10% Wald, that is 16.38 in our case) and rejects the null hypothesis of the weak instrument. In specification

(2) and (4) of table 9, the results confirm that the instrumented AOR remains positive and statistically significant in explaining bidder abnormal returns and abnormal trading volume.

[Please Insert Table 9 About Here]

4.5.3. Alternate CARs, Alternate AOR, and Abnormal Trading Volume

In this section, we further justify our main results by extending our analysis for different windows of CARs, alternate definitions of AOR, and abnormal trading volume. First, we test the impact of absolute overnight returns (AOR) on bidder cumulative abnormal returns (CARs) for two additional windows: CARs (-2, +2) and CARs (0, +3). Specifications (1) and (2) of Table 10 confirm that our results are not driven by any particular window of bidder abnormal returns. For the next robustness tests, we construct two alternate proxies of investor attention based on two different construction periods. For the first alternate proxy of AOR, we take the mean absolute overnight returns measured -40 to -3 days prior to the takeover announcement. We construct the second alternate proxy of attention by taking the mean absolute overnight returns measured -60 to -3 days prior to the takeover announcement. Specifications (3) and (4) of Table 10 confirm that the coefficients on the alternate proxies of AOR remain statistically and economically significant in explaining bidder CARs. Finally, we test the association between AOR and abnormal trading volume. If the price pressure hypothesis truly holds then high acquirer AOR leading to the merger announcement should result in a high announcement period abnormal trading volume as well. To construct the abnormal trading volume, we take the percentage change of the acquirers' trading volumes from the pre-bid (-40, -24) to the announcement (0, +3) period. To measure the abnormal trading volumes, first, we take the natural logarithm of the daily trading volumes. Next, we estimate the percentage difference between mean LOG_VOLUME at the merger announcement period (0, 3 days) and mean LOG_VOLUME calculated over the pre-bid period (-40, -24 days). The control variables

remain unchanged. The specification (5) confirms that AOR positively affects the bidder abnormal volume around the merger announcements.

[Please Insert Table 10 About Here]

5. Conclusions

This study contributes to the literature that investigates the price discovery of after-hours trading activity (Barclay *et al.* 2003; Barclay & Hendershott 2004; Lou *et al.* 2019) by examining behavioural-based explanations of the nature of after-hours stock returns. Some studies like Aboody *et al*. (2018) and Weißofner and Wessels (2020) show that overnight stock returns exhibit characteristics of a sentiment measure while others like Xiong *et al*. (2020) fail to do so for markets outside the US. Berkman *et al*. (2012) finds that the following day overnight reversals are more pronounced for stock that attract more investor attention. Since the academic literature is inconclusive on the behavioural elements of overnight returns, the purpose of this paper is to examine and differentiate whether overnight trading activity exhibits characteristics of an investor sentiment or investor attention measure.

Investor sentiment and investor attention are two distinct behavioural concepts. Investor sentiment is investors' belief about future cash flows and investment risks that is not justified by firm fundamentals (Baker & Wurgler, 2007) while investor attention is a scarce cognitive resource and refers to investors inability to follow all market developments closely (Kahnemann & Tversky, 1973). To differentiate and disentangle whether overnight return exhibit properties of an investor sentiment versus an investor attention measure, we adopt a mergers and acquisitions testing framework. Mergers and acquisitions are major corporate events that have significant valuation effects. The positive signalling effect of private stock deals (Chang, 1998) and the negative signalling effect of public stock deals (Travlos, 1987) is an ideal framework to differentiate between the two behavioural concepts of investor sentiment

and investor attention. Sentiment is expected to be positively related with M&As outcomes irrespective of the type of deal (Danbolt *et al*, 2015) while attention is also positively related with most takeover deals but it is negatively related with stock-financed acquisitions of public target firms (Louis &Sun, 2010).

The actual series of pre-announcement bidder overnight returns (OR) is employed as a proxy of investor attention while the absolute overnight returns (AOR) prior to the acquisition announcements is used as a proxy of investor attention. Our findings show a positive and statistically significant relationship between AOR and bidder announcement returns while there is no significant relationship between OR and bidder announcement returns. A 1 % percent increase in AOR before the announcement leads to a 0.428% percent increase in bidder cumulative abnormal returns. The magnitude of the association is quite high considering that bidder cumulative abnormal returns are calculated excess market returns Absolute overnight returns exhibit a more pronounced and negative relationship with stock-financed deals for private targets while there is a negative and statistically significant relationship between AOR and bidder cumulative abnormal returns for stock-financed deals for public targets. We find no statistical relationship between OR and bidder announcement abnormal returns. These findings confirm the prediction of price pressure hypothesis of investor attention and provide evidence that overnight trading activity exhibits elements of an investor attention measure.

To further validate that absolute overnight returns exhibit elements of an investor attention proxy, we predict and find that attention-driven overreaction should be stronger for the acquiring firms with greater information asymmetry and harder to value or arbitrage (Daniel *et al.* 1998; Zhang 2006; Baker & Wurgler 2007; Berkman *et al.* 2012). In addition, if the temporal price pressure is due to the attention-driven acquirer stock purchase behavior, then we should expect the positive market reactions to be followed by price reversals in the post-announcement periods. Supporting both predictions, our results show that overnight attention-

driven overreaction is more pronounced for harder-to-value stock and those with lower institutional ownership and is followed by price reversals in the post-announcement period.

Our results are robust to various test. Investors' attention might be grabbed for a multitude of reasons, the nature of firms and deals that grab their attention more easily may not be randomly distributed. For this reason, we perform a propensity score matching (PSM) analysis to control for the firm and deal-level characteristics that could potentially lead to the selection bias in our empirical tests and out findings remain robust. Furthermore, to address potential issues that omitted variables may drive our results, we perform a two-stage instrument variable (IV) analysis, by employing the percentage of home-broadband users in the US provided by the PEW research center as the instrumental variable (Barber & Odean, 2002). Our findings still remain unchanged. Finally, we check for alternative windows of bidder cumulative abnormal returns, alternative windows for absolute overnight returns and trading volume as a response to higher attention. All robustness tests provide further evidence in favour of the investor attention hypothesis.

To the best of our knowledge, this is the first paper that adopts a methodological framework with clear predictions that aims to disentangle the behavioural nature of overnight trading activity. In a period characterized by great uncertainty across the world, our findings have important implications for corporate managers as well. Corporate managers, who are responsible for assessing the risks and strategically time the announcement of their corporate events, should pay special consideration to the attention paid by overnight traders and the impact on the shareholder value. The market (over)-reaction is shaped by the nature of the news announced.

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Appendix A

Variables	Definitions	Source
	Panel A: AOR and OR	
AOR	Mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement with 0 being the announcement day.	CRSP
OR	Mean Overnight Returns (OR), measured -20 to -3 days prior to the takeover announcement with 0 being the announcement day.	CRSP
Alternate AOR	Mean Absolute Overnight Returns (AOR), measured -40 to -3 days prior to the takeover announcement with 0 being the announcement day.	CRSP
Alternate AOR_2	Mean Absolute Overnight Returns (AOR), measured -60 to -3 days prior to the takeover announcement with 0 being the announcement day.	CRSP
	Panel B: Dependent variables	
CARs (-1, +1)	Acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return.	CRSP
CARs (0, +3)	Acquirer 4-day (0, +3) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return.	CRSP
CARs (-2, +2)	Acquirer 5-day (-2, +2) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return.	CRSP
CARs (+4, 7)	Acquirer 4-day (+4, +7) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return.	CRSP

Buy-hold abnormal returns (BHARs)	Buy–and–hold abnormal returns (BHARs) are estimated using the matched firm adjusted method suggested by Barber and Lyon (1997) and Lyon, Barber, and Tsai (1999) for 1-, 2- and the 3 years after the acquisition.	CRSP
Abnormal trading volume	Abnormal trading volume calculated as the percentage change between mean LOG_VOLUME at the merger announcement period (0, 3 days) and mean LOG_VOLUME calculated over the pre-bid period (-40, -24 days).	CRSP
Panel C: Firm-specific Controls		
Size	The natural logarithm of the book value of assets.	Compustat
Book leverage	Long-term debt (item DLTT) plus debt in current liabilities (item DLC), divided by total assets (item AT).	Compustat
Market to book	The ratio of the market value of assets to the book value of assets.	Compustat
ROA	Return on assets, measured as income before extraordinary items (annual item IB) plus interest expense (item XINT) plus income taxes (item XINT), divided by total assets (item AT).	Compustat
Sales growth	The company year–on–year difference of year-end sales.	Compustat
Cash to assets	Cash and short-term investments (item CHE) divided by total assets (item AT).	Compustat
Stock returns	Cumulative returns during the 12 months ending at the end of the firm's fiscal year. This is measured using monthly returns from the CRSP monthly database.	CRSP
Non-cash working capital	The ratio of (working capital – cash) to the book value of assets.	Compustat
Firm age	Number of years that a firm appears in Compustat.	Compustat
Firm volatility	The standard deviation of the firm's daily returns from month *t*-13 to *t*-2.	CRSP
Panel D: Macro Controls		
Investment opportunities (First principal component)		
1. Consumer confidence	The monthly, survey-based index of consumer confidence developed by the University of Michigan.	Available at http://www.sca.isr.umich.edu/

2. CFNAI	The Chicago Fed National Activity Index, which is designed to measure current economic activity and inflationary pressure based on 85 monthly economic indicators.	Available at https://www.chicagofed.org/research/ data/cfnai/historical- data
3. Expected GDP growth	The average one-year-ahead GDP forecast from the biannual Livingstone Survey of Professional Forecasters	The Philadelphia FED
Industry economic shock	It is constructed based on the following seven firm-level indicators: net income to sales (IB/SALE), sales to assets (SALE/AT), R&D to assets (XRD/AT), capital expenditures to assets (CAPX/AT), employment growth (percentage change in item EMP), return on assets (IB/AT), and sales growth (percentage change in item SALE). For each of the 48 industries in the Fama and French (1997) classification, each year, we take the industry median of the absolute (annual) change in each of the above variables.	Compustat
Rate spread	The spread between Baa-rated bonds and the Federal Funds rate. To match the annual frequency of the firm-level data, we use calendar-year averages of this (monthly) spread variable.	The St. Louis FED
Shiller's CAPE ratio	The cyclically adjusted price-earnings (CAPE) ratio developed by Robert Shiller.	Available at http://www.econ.yale.edu/~shiller/data.htm
Industry median Q	The annual, median value of Tobin's Q for each of the Fama and French (1997) 48 industries. Tobin's Q is measured as the book value of assets minus the book value of equity plus the market value of equity, divided by the book value of assets.	Compustat
Industry median past returns	The annual median of firm-level 36–month cumulative returns for each of the Fama and French (1997) 48 industries. Each calendar year *t*, we calculate each firm's cumulative returns using the 36 months leading up to the last month of the fiscal year ending in *t*.	CPSP
Industry σ past returns	The annual median of firm-level 36–month return volatility for each of the Fama and French (1997) 48 industries. Each calendar year *t*, we calculate the standard deviation of each firm's returns, using the 36 monthly return observations leading up to the last month of the fiscal year ending in *t*.	CRSP
Macroeconomic uncertainty (First principal component)		
1. JLN uncertainty index:	Monthly index of macro-economic uncertainty developed by Jurado et al. (2015) as the unforecastable component in a system of 279 macroeconomic variables.	Available at https://www.sydneyludvigson.com/data-and-appendixes

2. VXO index	Daily index of implied volatility released by the Chicago Board Options Exchange, calculated based on the trading of S&P 100 options.	Available at http://www.cboe.com/products/vix-index-volatility/volatility-on-stock-indexes
3. CS σ past returns	The cross-sectional standard deviation of cumulative returns from the past three months, calculated each month.	CPSP
4. CS σ past sales growth	The cross-sectional standard deviation of year-on-year sales growth (percentage change in the Compustat quarterly item SALEQ), calculated each calendar quarter.	Compustat
Panel D: Deal-level Controls		
Stock deal dummy	A dummy variable that takes the value of 1 if the payment is 100% in stock, and 0 otherwise.	SDC
Cash deal dummy	A dummy variable that takes the value of 1 if the M&A deal is 100% funded by cash, and 0 otherwise.	SDC
High tech dummy	A dummy variable that takes the value of 1 if an acquirer's 4–digit SIC code is equal to 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3671, 3672, 3674, 3675, 3677, 3678, 3679, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7371–7375, 7378, or 7379, and 0 otherwise.	SDC
Diversification deal dummy	A dummy variable that takes the value of 1 if the acquirer and target belong to different 2–digit SIC code industries, and 0 otherwise.	SDC
Hostile deal dummy	A dummy variable that takes the value of 1 if the M&A deal is a hostile takeover, and 0 otherwise.	SDC
Public target	A dummy variable that takes the value of 1 if the target is a publicly listed firm, and 0 otherwise.	SDC

Table 1 Summary statistics

Panel A of Table 1 reports summary statistics of all variables used in our baseline regression models. The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The number of observations, mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum are reported from left to right, in sequence for each variable. Detailed definitions of all variables are described in Appendix A. Panel B reports the major deal- and firm-specific characteristics by high versus low OR and AOR respectively.

Panel A	N	Mean	p25	Median	p75	Std. Dev.
OR	12,879	0.001	-0.002	.0.000	0.002	0.007
AOR	12,879	0.011	0.005	0.008	0.013	0.012
Size	12,879	5.768	4.332	5.706	7.095	1.984
Book Leverage	12,879	0.225	0.027	0.187	0.349	0.226
A M2B	12,879	2.417	1.312	1.739	2.577	3.150
A ROA	12,879	0.010	0.004	0.044	0.080	0.210
Sales growth	12,879	0.17	-0.06	0.05	0.21	50.731
Cash to assets	12,879	0.186	0.027	0.097	0.280	0.212
Stock return	12,879	0.138	-.0108	0.147	0.404	0.522
Non-cash working capital	12,879	.075	-.021	0.059	0.167	0.169
Firm age	12,879	2.113	1.266	2.178	2.98	1.056
Firm volatility	12,879	0.038	.025	.035	.052	0.016
Stock	12,879	0.130	0.000	0.000	0.000	0.336
Cash	12,879	0.310	0.000	0.000	1	0.463
High tech	12,879	0.314	0.000	0.000	1	0.464
Diversification	12,879	0.377	0.000	0.000	1	0.485
Hostile	12,879	0.013	0.000	0.000	0	0.111
Public	12,879	0.189	0.000	0.000	0	0.391
Challenge	12,879	0.018	0.000	0.000	0	0.135
Investment opportunity	12,879	60.891	56.259	62.301	66.085	7.988
Shock index	12,879	0.230	0.146	0.202	0.274	0.129
Rate spread	12,879	3.796	2.402	4.060	4.994	1.533
Shiller's Cape ratio	12,879	26.846	21.755	25.943	30.955	6.427
Industry median Q	12,879	1.65	1.27	1.48	1.84	0.551
Industry median past returns	12,879	1.225	0.985	1.209	1.451	0.372
Industry σ past returns	12,879	0.141	0.110	0.136	0.161	0.041
Macro uncertainty	12,879	11.284	8.220	11.103	15.752	8.073

	High OR	Low OR	High AOR	Low AOR
Panel B	Mean	Mean	Mean	Mean
Completion time	56.106	54.719	52.58	58.161
Completed deals	0.905	0.904	0.895	0.913
Public deal	0.190	0.187	0.164	0.213
Stock deal	0.144	0.116	0.186	0.074
Cash deal	0.298	0.323	0.249	0.371
High tech deal	0.317	0.311	0.384	0.244
Diversify	0.372	0.381	0.368	0.385
Hostile deal	0.012	0.013	0.009	0.016
Multiple bidder	0.020	0.017	0.011	0.026
Size	5.777	5.759	4.820	6.714

Book Leverage	0.231	0.219	0.204	0.245
Market to book value	2.538	2.297	2.74	2.096
ROA	0.002	0.019	-0.026	0.047
Cash to asset	0.191	0.181	0.232	0.14
Stock Return	0.162	0.114	0.117	0.157

Table 2 Sample CARs distribution

Table 2 presents the results of univariate acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) by target listing status in Panel A, payment method in Panel B, and the combinations between them in Panel C. The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A		**Target Listing Status**		
	Full Sample	**Public**	**Private**	**Subsidiary**
	(1)	(2)	(3)	(4)
CARs (-1,1)	0.009***	-0.001	0.010***	0.015***
	(16.856)	(- 0.218)	(11.560)	(16.396)
N	16,177	3,050	7,719	5,408

Panel B	**Payment Method**		
	Cash	**Stock**	**Mix**
	(1)	(2)	(3)
CARs (-1,1)	0.015***	-0.005***	0.009***
	(17.309)	(-2.611)	(12.125)
N	5,020	2,101	8,438

Panel C	**Target Listing Status & Payment Method**			
	Public Cash	**Public Stock**	**Private Cash**	**Private Stock**
	(6)	(7)	(8)	(9)
CARs (-1,1)	0.022***	-0.025***	0.011***	0.021***
	(12.311)	(-7.120)	(7.38)	(5.334)
N	1,270	760	1,831	1,110

Table 3 Univariate analysis: OR, AOR and acquirer market reactions

Table 3 provides acquirer short-run returns by decile ranking of the (1) mean Overnight Returns (OR), measured -20 to -3 days prior to the takeover announcement and, (2) mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement. The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The dependent variable in specifications (1) and (2) is the acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Portfolios	OR	AOR
Portfolio 1	0.031***	0.009***
	(6.840)	(6.987)
N	1,617	1,618
Portfolio 2	0.011***	0.013***
	(5.453)	(8.970)
N	1,618	1,618
Portfolio 3	0.012***	0.009***
	(6.651)	(5.647)
N	1,618	1,618
Portfolio 4	0.009***	0.008***
	(5.066)	(4.764)
N	1,618	1,618
Portfolio 5	0.012***	0.011***
	(6.575)	(6.243)
N	1,617	1,617
Portfolio 6	0.012***	0.011***
	(6.575)	(6.243)
N	1,617	1,616
Portfolio 7	0.014***	0.009***
	(7.328)	(4.217)
N	1,618	1,618
Portfolio 8	0.009***	0.021***
	(4.739)	(6.139)
N	1,618	1,618
Portfolio 9	0.015***	0.016***
	(6.188)	(6.389)
N	1,618	1,618
Portfolio 10	0.029***	0.047***
	(6.161)	(8.190)
N	1,618	1,618

Table 4 Multivariate analysis of OR, AOR and acquirer market reaction

Table 4 presents the results of the OLS regression analysis for the effect of mean Overnight Returns (OR) measured -20 to -3 days prior to the takeover announcement in specifications (1) and (2), and mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement in specifications (3) and (4) on acquirer short-run returns (specifications (1) - (4)). The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The dependent variable in specifications (1)-(4) is the acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. All firm-level variables are measured at the end of the prior fiscal year t; macroeconomic variables are measured as averages over the prior calendar year t. The definitions of all variables are provided in Appendix A. In all models, we control for Fama–French 48 industry fixed effects and year fixed effect. Heteroscedasticity– robust standard errors clustered by both firm and year are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Acquirer Short-Run CARs			
	(1)	**(2)**	**(3)**	**(4)**
OR	-0.417	-0.412		
	(-1.153)	(-1.137)		
AOR			0.411***	0.428***
			(3.017)	(3.125)
Size	-0.008***	-0.008***	-0.005***	-0.005***
	(-10.469)	(-11.347)	(-11.845)	(-11.828)
Book leverage	0.010	0.011	0.004	0.004
	(0.874)	(0.909)	(0.992)	(1.056)
Market to Book	-0.001*	-0.001**	-0.001***	-0.001***
	(-1.950)	(-2.089)	(-3.358)	(-3.262)
ROA	-0.012	-0.013	0.001	-0.000
	(-0.967)	(-1.048)	(0.128)	(-0.002)
Sales Growth	-0.000	-0.000	-0.000	-0.000
	(-0.900)	(-0.897)	(-0.433)	(-0.406)
Cash to Assets	-0.021**	-0.021*	-0.018***	-0.016***
	(-2.079)	(-1.998)	(-3.569)	(-3.349)
Stock Returns	-0.010***	-0.010***	-0.005***	-0.005***
	(-4.553)	(-4.468)	(-3.277)	(-3.105)
Non-Cash Working Capital	-0.014	-0.014	-0.006	-0.006
	(-1.360)	(-1.354)	(-1.095)	(-1.027)
Firm Age	0.001	0.001	0.001	0.001
	(1.199)	(1.250)	(1.515)	(1.347)
Firm Volatility	-0.356***	-0.322**	-0.158	-0.143
	(-2.871)	(-2.216)	(-1.590)	(-1.440)
Stock deal	-0.007*	-0.007*	-0.007***	-0.007***
	(-1.905)	(-1.846)	(-3.355)	(-3.225)
Cash deal	0.011***	0.011***	0.011***	0.011***
	(5.086)	(5.119)	(5.683)	(5.742)
High tech deal	-0.003	-0.003	-0.003	-0.002
	(-0.852)	(-0.745)	(-0.927)	(-0.765)

Diversifying	-0.004	-0.004	-0.005***	-0.005***
	(-1.598)	(-1.617)	(-3.035)	(-3.085)
Hostile	-0.013**	-0.014**	-0.012**	-0.012**
	(-2.212)	(-2.321)	(-2.064)	(-2.180)
Public	-0.006*	-0.005	-0.006**	-0.006**
	(-1.747)	(-1.682)	(-2.227)	(-2.181)
Competing Bidder	0.007	0.008	0.006	0.007
	(0.476)	(0.539)	(0.441)	(0.502)
Investment opportunities (First principal component)		-0.000		0.000
		(-0.392)		(0.850)
Industry economic shock		-0.022*		-0.019
		(-1.798)		(-1.679)
Rate spread		0.001		0.001
		(0.656)		(0.366)
Shiller's CAPE ratio		0.001*		0.001
		(1.989)		(1.426)
Industry median Q		-0.000		-0.000
		(-1.007)		(-1.014)
Industry median past returns		0.004		-0.001
		(1.197)		(-0.414)
Industry σ past returns		0.021		-0.011
		(0.427)		(-0.239)
Macroeconomic uncertainty (First principal component)		-0.000		0.000
		(-0.854)		(0.197)
Industry Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
N	12,885	12,879	12,885	12,879
Adjusted R square	0.027	0.027	0.039	0.039

Table 5 Stock swap deals

Table 5 presents the results of Multivariate analysis for the effect of mean Overnight Returns (OR), measured -20 to -3 days prior to the takeover announcement in specifications (1) and (2), and mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement in specifications (3) and (4), on acquirer short-run returns by the stock swap deals (Private Stock and Public Stock). The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The dependent variable in specifications (1)-(4) is the acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. All firm-level variables are measured at the end of the prior fiscal year t; macroeconomic variables are measured as averages over the prior calendar year t. The definitions of all variables are provided in Appendix A. In all models, we control for Fama–French 48 industry fixed effects and year fixed effects. Heteroscedasticity– robust standard errors clustered by both firm and year are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Acquirer Short-Run CARs			
	(-1, +1)	**(-1, +1)**	**(-1, +1)**	**(-1, +1)**
	(1)	**(2)**	**(3)**	**(4)**
OR	-0.096	-0.150		
	(-0.927)	(-1.538)		
AOR			0.284***	0.502***
			(3.690)	(6.736)
Private stock	0.006***		-0.003	
	(2.576)		(-0.885)	
Public stock		-0.037***		-0.027***
		(-14.095)		(-7.244)
OR*Private stock	-0.201			
	(-0.788)			
OR*Public stock		0.571		
		(1.620)		
AOR*Private stock			0.534***	
			(2.989)	
AOR*Public stock				-0.860***
				(-3.815)
Firm-level controls	Yes	Yes	Yes	Yes
Deal-level controls	Yes	Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
N	12,879	12,879	12,879	12,879
Adjusted R square	0.031	0.045	0.028	0.049

Table 6 Economic mechanism

Table 6 presents the results of OLS regression analysis for the effect of mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement, on acquirer short-run returns by deal complexity, institutional ownership percentage, and stock swap deals. The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The dependent variable in the specifications in Panel A and B is the acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. In Panel A: 1) Small firm, a dummy variable equals 1 if the bidder's size is lower than the 25th percentile and 0 otherwise; 2) Young firm, a dummy variable equals if the bidder's age is less than the 50^{th} percentile value of our sample and 0 otherwise; 3) Private, a dummy variable equals 1 if the target is private, 0 otherwise; (4) Low institutional ownership (IO), a dummy variable equals 1 if the top 5 institutional ownership is lower than the 25th percentile and 0 otherwise; and (5) Low Block holder ownership, a dummy variable equals if the blockholder ownership variable is less than the 25th percentile value of our sample and 0 otherwise. For the sub-sample analysis in Panel B the additional variables are 1) Big firm, a dummy variable equals to 1 if the bidder's size is higher than the 75thth percentile and 0 otherwise; 2) Old firm, a dummy variable equals if bidder's age is greater than the 50th percentile value of our sample and 0 otherwise (3) High institutional ownership (IO), a dummy variable equals 1 if the top 5 institutional ownership is higher than the 75thth percentile and 0 otherwise; and (4) High Block holder ownership, a dummy variable equals if the blockholder ownership variable is higher than the 75th percentile value of our sample and 0 otherwise. All firm-level variables are measured at the end of the prior fiscal year t; macroeconomic variables are measured as averages over the prior calendar year t. The definitions of all variables are provided in Appendix A. In all models, we control for Fama–French 48 industry fixed effects and year fixed effects. Heteroscedasticity– robust standard errors clustered by both firm and year are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Acquirer Short-Run CARs				
	(-1, +1)	**(-1, +1)**	**(-1, +1)**	**(-1, +1)**	**(-1, +1)**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
AOR	0.248	0.269	0.214**	0.148*	0.297***
	(1.443)	(1.642)	(2.307)	(1.781)	(3.736)
Small firm	0.006**				
	(2.424)				
Young firm		-0.012**			
		(-2.758)			
Private			-0.005**		
			(-2.510)		
Low investor ownership				-0.005*	
				(-1.946)	
Low blockholder					-0.005**
					(-2.187)
AOR*Small firm	0.555***				
	(2.894)				
AOR*Young firm		0.690**			
		(2.105)			
AOR*Private			0.332***		
			(2.666)		
AOR*Low investor ownership				0.778***	
				(5.736)	
AOR*Low blockholder					0.464***
					(3.162)
Firm-level controls	Yes	Yes	Yes	Yes	Yes
Deal-level controls	Yes	Yes	Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes
N	12,879	12,879	12,879	12,879	12,879
Adjusted R square	0.032	0.037	0.029	0.039	0.036

Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Small Firms	Big Firms	Young Firms	Old Firms	Low IO	High IO	Low Blockholder	High Blockholder	Small Firms	Big Firms	Young Firms	Old Firms	Low IO	High IO	Low Blockholder	High Blockholder
AOR*Private_Stock	5.401***	0.488	0.913***	-0.775	2.763***	-0.143	0.907***	-0.435								
	(11.112)	(0.451)	(3.650)	(-0.866)	(6.362)	(-0.191)	(2.591)	(-0.553)								
AOR*Public_Stock									-2.842***	-1.089	-1.862***	-0.679**	-1.769***	-1.330	-1.286***	-1.389
									(-3.708)	(-1.130)	(-3.014)	(-2.592)	(-2.926)	(-1.515)	(-2.661)	(-1.436)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,714	3,478	5,452	7,420	2,501	3,236	2,406	2,764	2,714	3,478	5,452	7,420	2,501	3,236	2,406	2,764
Adjusted R-squared	0.088	0.044	0.033	0.041	0.097	0.057	0.059	0.056	0.054	0.053	0.051	0.040	0.087	0.062	0.066	0.063

Table 7 Returns reversal

Table 7 presents the results of OLS regression analysis for the effect of mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement, on acquirer short-run returns (specification (1)) and acquirer long run BHARs (specifications (2) to (4)). The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The dependent variable in specifications (1) is the acquirer 4-day (4, 8) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. The dependent variables in specifications (2) to (4) are the acquirer 1-, 2-, and 3-year buy-and-hold abnormal returns (BHARs), respectively, after the completion date. The abnormal returns for long-run analysis are calculated using the matched firm adjusted method suggested by Barber and Lyon (1997) and Lyon, Barber, and Tsai (1999). All firm-level variables are measured at the end of the prior fiscal year t; macroeconomic variables are measured as averages over the prior calendar year t. The definitions of all variables are provided in the Appendix. In all models, we control for Fama–French 48 industry fixed effects and year fixed effects. Heteroscedasticity– robust standard errors clustered by both firm and year are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Acquirer Short-Run CARs	**Acquirer Long-Run BHARs**		
	(4, 8)	**(1 Year)**	**(2 Years)**	**(3 Years)**
	(1)	**(2)**	**(3)**	**(4)**
AOR	-0.166**	2.636	2.198	2.505
	(-2.122)	(1.407)	(1.055)	(1.293)
Firm-level controls	Yes	Yes	Yes	Yes
Deal-level controls	Yes	Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
N	12,879	12,004	12,004	12,004
Adjusted R square	0.004	0.036	0.051	0.064

Table 8 Propensity score matching (PSM) analysis

Table 8 presents the results of propensity score matching (PSM) analysis of the effect of Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement, on acquirer short-run returns and abnormal trading volume. The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The treatment group consists of bidders that generated high attention, while the control group consists of firms that did not receive high attention. We match firms using one-to-one nearest neighbour propensity score matching without replacement. Panel A reports univariate comparisons between the treatment and control firms' characteristics and their corresponding t-statistics. Panel B reports the OLS regressions on the matched sample. The dependent variable in Panel B specifications (1) is the acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. The dependent variables in Panel B specification (1) is the abnormal trading volume calculated as the percentage change between mean LOG_VOLUME at the merger announcement period (0, 3 days) and mean LOG_VOLUME calculated over the pre-bid period (-40, -24 days). All firm-level variables are measured at the end of the prior fiscal year t; macroeconomic variables are measured as averages over the prior calendar year t. The definitions of all variables are provided in the Appendix. In all models, we control for Fama–French 48 industry fixed effects and year fixed effects. Heteroscedasticity– robust standard errors clustered by both firm and year are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A	**Mean**		**T-test**		
	Treated	**Control**	**% Bias**	**T value**	**P-Value**
Size	4.309	4.331	-1.300	-0.510	0.612
Book Leverage	0.201	0.184	7.500	2.750	0.006
Market to book value	2.534	2.92	-14.500	-4.420	0.000
Return on asset	-0.053	-0.063	4.400	1.230	0.217
Firm age	1.971	1.987	-2.000	-0.790	0.429
Firm Volatility	0.039	0.04	-0.700	-0.280	0.777
Stock deal	0.062	0.074	-2.000	-0.690	0.491
Cash deal	0.233	0.245	-2.700	-1.100	0.271
Public	0.158	0.169	-3.000	-1.200	0.231

Panel B: Regression on the matched sample	**Acquirer Short-Run CARs (-1,+1)**	**Acquirer Abnormal Volume**
	(1)	**(2)**
AOR	0.292***	0.387***
	(3.980)	(3.617)
Firm-level controls	Yes	Yes
Deal-level controls	Yes	Yes
Macro-level controls	Yes	Yes
Industry Fixed Effect	Yes	Yes
Time Fixed Effect	Yes	Yes
N	5,781	5,754
Adjusted R square	0.069	0.057

Table 9 Instrumental variable (IV) analysis

Table 9 presents the results of a two-stage instrumental variable (IV) regression analysis using as an instrumental in the first stage regression, the percentage of home broadband owners provided by PEW research agency to instrument the mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement. The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 2000 and 2018 that pass the filters described in section 3.1. The dependent variable in the specification (2) is the acquirer 3-day (-1, +1) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. CRSP value-weighted index return is the market return. The dependent variable in the specification (4) is the abnormal trading volume calculated as the percentage change between mean LOG_VOLUME at the merger announcement period (0, 3 days) and mean LOG_VOLUME calculated over the pre-bid period (-40, -24 days). All firm-level variables are measured at the end of the prior fiscal year t; macroeconomic variables are measured as averages over the prior calendar year t. The definitions of all variables are provided in the Appendix. In all models, we control for Fama–French 48 industry fixed effects and year fixed effects. Heteroscedasticity– robust standard errors clustered by both firm and year are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Two-stage IV analysis	**First stage**	**Second stage**	**First stage**	**Second stage**
	(1)	**(2)**	**(3)**	**(4)**
Percentage of home broadband users	0.004***		0.004***	
	(6.15)		(6.15)	
Instrumented AOR		3.859**		4.356***
		(2.27)		(2.68)
Firm-level controls	Yes	Yes	Yes	Yes
Deal-level controls	Yes	Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes
Kleibergen-Paap rk	37.76		37.76	
LIML size of nominal 10% Wald	16.38		16.38	
Industry fixed effects	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
N	7,509	7,509	7,509	7,509

Table 10 Alternate CARs, Alternate AOR, and Abnormal Trading Volume

Table 10 presents the results of OLS regression analysis for effect mean Absolute Overnight Returns (AOR), measured -20 to -3 days prior to the takeover announcement (specifications (1), (2) and (5)), and two alternate variants of AOR (specifications (3), and (4)) for different windows of acquirer CARs (specifications (1)-(4)) and abnormal trading volume (specification (5)). The sample consists of all merger and acquisition announcements reported in the Securities Data Corporation (SDC) database between 1993 and 2018 that pass the filters described in section 3.1. The independent variable Alternate_AOR in the specification (3) is calculated by taking mean Absolute Overnight Returns (AOR), measured -40 to -3 days prior to the takeover announcement. The independent variable Alternate_AOR2 in the specifications (4) is calculated by taking mean Absolute Overnight Returns (AOR), measured -60 to -3 days prior to the takeover announcement. The dependent variable in the specification (1) is the acquirer 5-day (-2, +2) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The dependent variable in the specification (2) is the acquirer 4-day (0, +3) cumulative abnormal returns (CARs) with day 0 being the M&A announcement day. The abnormal returns are calculated using the market model with the market model parameters estimated over the period starting 255 days and ending 46 days prior to the announcement. The dependent variables in specification (5) is the abnormal trading volume calculated as the percentage change between mean LOG_VOLUME at the merger announcement period (0, 3 days) and mean LOG_VOLUME calculated over the pre-bid period (-40, -24 days). All firm-level variables are measured at the end of the prior fiscal year t; macroeconomic variables are measured as averages over the prior calendar year t. The definitions of all variables are provided in Appendix A. In all models, we control for Fama–French 48 industry fixed effects and year fixed effects. Heteroscedasticity– robust standard errors clustered by both firm and year are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Alternate CARs		**Alternate AOR**		**Acquirer Abnormal Volume**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
AOR	0.352***	0.290*			0.398***
	(3.400)	(1.830)			(3.574)
Alternate_AOR			0.402***		
			(2.972)		
Alternate_AOR2				0.488***	
				(3.283)	
Firm-level controls	Yes	Yes	Yes	Yes	Yes
Deal-level controls	Yes	Yes	Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes
N	12,879	12,879	12,879	12,879	12,854
Adjusted R square	0.032	0.028	0.038	0.039	0.039