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Limited Attention and Post-Earnings-Announcement Drift

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Abstract

Recent evidence in psychology indicates that we are surprisingly unaware of the details of our environment from one view to the next. We often do not detect major changes to objects (*change blindness*). Furthermore, without attention, we may not even perceive objects (*inattentional blindness*). This paper tests the *limited attention hypothesis*, which holds that investors under react to extraneous news causing trading and market prices to react sluggishly to news about a firm. Our test focuses on the competition for professional investors' attention between firms with eye-catching streaming news and those with less coverage. We find that a stock's post-earnings-announcement drift is stronger when professional investors are in a state of *inattentional blindness*.

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Introduction

Post-earnings-announcement drift (PEAD) is the tendency for a stock price to drift in the direction of an earnings surprise in the period following an earnings announcement. The drift is also commonly referred to as the FE (forecast error) effect and appears to be a persistent feature of stock returns. Researchers have proposed three general explanations for the FE effect. Some believe the apparent drift is due to methodological shortcomings of the studies that document it while others argue that the drift represents systematic misestimation of expected returns following earnings surprises. Still others think the drift is the result of investors who underreact to value-relevant earnings information. The third explanation, however, raises the question of why unbiased investors (professional investors) do not or cannot eliminate the underreaction and enforce market efficiency. Based on the unique data set of streaming news disseminated by Bloomberg, we focus on the limited attention of professional investors. We test the hypothesis that their limited attention to extraneous news causes underreaction.

Recent theoretical models in the literature show how constraints on processing information affect beliefs, perceptions, and stock prices.[1] These models imply that investor inattention can lead to serial correlation in asset return volatility (Peng, Xiong, and Bollerslev [2006]), excessive asset co-movement (Peng and Xiong [2006]), and neglect of long-term public information (DellaVigna and Pollet [2007]). DellaVigna and Pollet (2009) and Hirshleifer and Teoh (2005) model a subset of investors who neglect information contained in a firm's latest earnings realization regarding future profitability. In equilibrium, stock prices underreact to earnings surprises, so that prices are on average too low after favorable surprises and too high after unfavorable ones. As a result, positive surprises predict high subsequent returns and negative surprises predict low subsequent returns. A further empirical implication of their models is that when the amount of attention investors direct toward a firm decreases, there should be more severe underreaction to its earnings surprises, intensifying subsequent drift.

Based on a large streaming news data set for Japanese corporations, we created a proxy for professional investor attention. We argue here that the amount of attention toward a given firm is likely to be higher when more streaming news about the firm is disseminated, attracting the attention of professional investors.[2] The streaming news is specifically disseminated to Bloomberg terminal users who are likely to be professional traders and fund managers. Therefore, a greater amount of streaming news implies stronger attention to a firm and less severe underreaction to any earnings surprise on the part of the firm.

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[1] Research that examines the effects of limited attention on individual decisions such as trading include Sims (2003), Gabaix, Laibson, Moloche, and Weinberg (2006), and Gabaix and Laibson (2004).

[2] A large amount of streaming news may also create information processing bottlenecks for professional traders. For example, the job of evaluating a firm becomes harder when trading involves more information to process for other firms.

The stock market's processing of a firm's earnings announcements provides an attractive testing ground for whether professional investors are able to discount value relevant news. First of all, earnings announcements are frequent, quantifiable, and directly associated with firm value. Secondly, several pieces of evidence suggest that limited attention affects stock price reaction to a firm's earnings announcements. Furthermore, there is evidence that market reaction to earnings announcements is more prompt and complete when there is reason to think investors are paying attention to earnings: during trading hours rather than non-trading hours (Francis, Pagach, and Stephan (1992), Bagnoli, Clement, and Watts [2005]), on weekdays other than Friday which sees the weekend approaching (DellaVigna and Pollet [2009]), on days when there are fewer firms reporting earnings announcement rather than on days with many other announcements (Hirshleifer, Lim, and Teoh [2009]), and during up markets rather than down markets (Hou, Peng, and Xiong [2006]).

Our study adds to recent literature that provides evidence suggesting that limited attention may affect both market prices and the decisions of financial professionals. There is evidence that suggests limited attention may cause investors to neglect public information. Hong, Torous, and Valkanov (2007) find that information seems to diffuse across industries and argue that because investors have limited ability in information processing, they are unable to process all information and thus their rationality is bounded. Klibano, Lamont, and Wizman (1998) find that in typical weeks closed-end country fund prices underreact to shifts in net asset value (NAV), but underreact much less during weeks in which news about the country appears on the front page of the *New York Times*. They argue that this news is redundant given NAV (which is publicly observable), and therefore suggest that publicity about the country causes the greater reaction in fund price. Huberman and Regev (2001) analyze in detail a case of a particular company in which salient reporting of already-public information in the news media about it led to extreme price reaction. DellaVigna and Pollet (2009) and Hirshleifer et. al (2009) demonstrate that their investor attention proxy negatively correlates with post-earnings-announcement drift.

Our contribution in this paper is that we document the fact that financial professionals' attention matters more than the general attention of the market. We investigate 9,390 quarterly earnings announcement events for the period between January 2010 to December 2013. Our results indicate that professional investor attention to earnings significantly reduces abnormal returns in the post-earnings announcement period. Attention proxy variables based on the idea of DellaVigna and Pollet (2009) and Hirshleifer et. al (2009) show no significance in our data. Our result is robust after controlling for factors that are documented to have effect on post-earnings-announcement drift.

This paper is organized as follows. In section II, we describe our data and explain our explanatory variables including our proxy for investor attention. In section III, we discuss our regression results and implication. In section IV, we conduct a calendar time portfolio simulation to demonstrate the robustness of our findings. In section V, our conclusions are given.

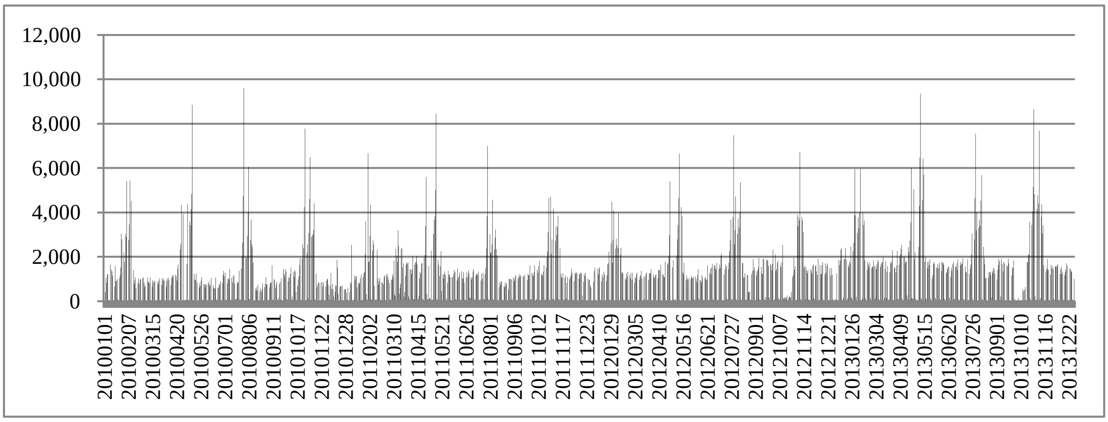
II Data and Methodology

II-1 News data

Bloomberg is a financial data provider widely subscribed by fund managers and traders. To shed light on the attention of professional traders, we create an attention proxy from the streaming news disseminated from Bloomberg terminals. We collected a total of 1,742,065 streaming news items with company stock code for the period between January 2010 to end-2013. Figure 1 shows the daily total number of streaming news items for the four-year period. As shown, the number of news items spikes in quarterly earnings announcement seasons. This is because the earnings announcement of each listed firm is disseminated as streaming news.

The average number of streaming news items with company stock code per day is 1,661. Reflecting the recovery of the Japanese stock market in 2013, average news items in 2013 are higher than in the previous three years; double compared to that of 2010.

Figure 1 Streaming News Items Disseminated from Bloomberg Terminals



Our test sample consists of all-firm quarterly observations for which complete data is available. The primary sample consists of 45,667 firm-quarter observations between the fourth quarter of 2010 through the third quarter of 2013. The study uses 9,390 all-firm quarterly observations due to the lack of coverage by streaming news. Table 1 summarizes our sample by year.

Table 1 Sample Firms

	2010	2011	2012	2013	Total
Firms with earnings announcement	11,623	11,391	11,291	11,362	45,667
Number of streaming news items	374,302	413,083	428,104	526,576	1,742,065
Firms with no news coverage	8,949	9,051	8,728	9,457	36,185
Firms with corporate news after earnings announcement	17	30	28	17	92
Clean sample	2,657	2,310	2,535	1,888	9,390
Large caps	335	347	314	362	1,358
Mid-caps	884	956	996	807	3,643
Small caps	1,338	1,007	1,225	719	4,389

II-2 Description of variables

A. Earnings surprise

We use quarterly earnings announcement data from the Bloomberg database from 2010 to 2013. Because the announcement date is confirmed with the streaming news, we assume the announcement date used in our sample is accurate. Our sample firms are limited to those that have IBES coverage; we therefore expect very accurate announcement dates for our sample.

To estimate forecast error (FE) as a measure of the earnings surprise, we calculate the difference between announced earnings as reported by IBES ($E_{i,q}$) and the consensus earnings forecast, $\overline{E_{i,q}}$ defined as the median of the most recent forecasts from individual analysts. To exclude stale forecasts when we calculate the consensus forecast, we only include 1- or 2-quarter ahead forecasts issued or reviewed in the last 60 calendar days before earnings announcement. If an analyst made multiple forecasts during that period, we take his/her most recent forecast. The difference between announced earnings and consensus forecast is normalized by the stock price at the end of the corresponding quarter ($P_{i,q}$), where earnings, forecasts, and stock prices are all split adjusted.

$$FE_{i,q} = \frac{E_{i,q} - \overline{E_{i,q}}}{P_{i,q}} \qquad (1)$$

B. Streaming news-based attention proxy (ATTN)

How can we measure the extent to which earnings news grabs investor attention? A direct measure would be to go back in time and, each day, question the hundreds of thousands of financial professionals as to which earnings announcements they thought about that day. Since we cannot measure the daily attention paid to earnings news directly, we do so by observing the occurrence of streaming news about a company. The basic idea is that the greater the attention, the more frequent news will be.

Bloomberg is one of the most dominant financial information vendors providing seamless financial information to professional traders and fund managers. It releases market streaming news on screen showing only the news title; viewers click the item if they wish to read the whole story. Approximately 6,800 streaming news items on average are released daily in Japanese alone. Each is accompanied by a stock code and category code that shows the respective news category. Our focus is news with a four-digit stock code allocated by the TSE. These items carry stories about specific companies. For example, if an item is about Toyota Motor's production line in the US, the article has a stock code of '7203'.

We define 'attention of a firm' as the relative number of streaming news items about the firm. If we simply compare the absolute number of streaming news items of each firm, the attention proxy is likely to be affected by firm size or whether the firm is in vogue. Therefore, we create a proxy based on the firm's relative number of news items on the day of earnings announcement to its past.

$$ATTN_i = Log\left(\frac{n_{i,0}}{\sum_{t=-1}^{t=-60} n_{i,t}}\right)$$

where $n_{i,0}$ is the number of streaming news items for firm i at the time of earnings announcement.

C. Arbitrage risk (ARBRISK)

Wurgler and Zhuravskaya (2002) use two different hedging assumptions to estimate the company-specific risk an arbitrageur faces when owning or shorting a particular stock. The first assumption is that hedgers use the futures market of the stock index. The second assumption is that hedgers hedge with equivalent control firms based on size and book-to-market ratio. They estimate a firm's arbitrage risk as the residual variance from a regression of its excess returns on these two substitutes. In the first assumption, the independent variable is simply a market index. In the second assumption, independent variables are the excess return on those control firms. Wurgler and Zhuravskaya (2002) demonstrate that the correlation between the two arbitrage risk estimates calculated from two different regression equations is very high (0.98). This suggests that arbitrage risk can be usefully estimated by a simple residual variance from a market model regression.

We therefore estimate our sample's arbitrage risk as the residual variance from a regression of its returns on those of the Tokyo Stock Price Index (TOPIX) estimated over 250 trading days ending 20 days prior to earnings announcement.

D. Transaction cost proxies (PRICE, VOLUME)

Securities prices may rationally differ from ‘frictionless prices’ by as much as round trip transactions costs. Although such costs have been declining steadily as electronic trading prevails, the magnitude of drift could be positively related to the costs of trading the security. Stoll (2000) shows that both recent stock price and recent dollar trading volume are significantly associated with the bid-ask spread. Bhushan (1994) contends that stock price is negatively related to commissions and argues that dollar trading volume is negatively associated with trading costs such as price pressure and the time required to fill an order.

For these reasons, we include the explanatory variables PRICE (Bloomberg closing stock price 20 days prior to earnings announcement) and VOLUME (daily closing price times daily shares traded averaged over days -50 to -20 relative to announcement date).

E. Investor sophistication proxies (INST)

Hand (1990) shows that the likelihood prices properly reflect a certain type of information depends on the probability that the marginal investor is ‘sophisticated’ as opposed to being ‘naïve.’ The underreaction hypothesis of the drift may be interpreted as suggesting that naïve investors underestimate the implications of current earnings innovations for future earnings levels while sophisticated investors do not. Hand’s model in the post-earnings announcement anomaly suggests that when the marginal investor is sophisticated drift is small. To proxy the investor sophistication for a given sample, we use the fraction of shares held by institutions. This is intuitive because more institutional holdings would heighten the probability that the marginal investor for the stock is sophisticated. We also take the number of analysts who follow the stock as a proxy for investor sophistication. As Bhushan (1994) suggests, analysts tend to follow stocks that institutional investors would consider trading.

F. Other attention proxies and control variables (NOA, FRIDAY, SIZE, PBR)

Hirshleifer et. al (2009) present evidence that the presence of a large number of competing earnings announcements by other firms is associated with a weaker announcement-date price reaction to a firm's own earnings surprise, a lower volume reaction, and stronger subsequent post-earnings-announcement drift. To control for their distraction hypothesis, we count a number of firms that make earnings announcements on the same day.

DellaVigna and Pollet (2009) compare the reaction to earnings announcements on Friday to the reaction on other weekdays. They argue that on Friday, investors are distracted from work-related activities and thus cause underreaction to earnings information. We also control this effect using a dummy variable, FRIDAY.

Previous research shows that investor reaction to earnings news varies with firm size and book-to-market ratios.

III Empirical Results

To allow for time trends in variables, Bartov et al. (2000) use within-year rank scores for some of their explanatory variables. Following them, we transform explanatory variables based on the observation's decile rank for the variable among all observations occurring within the same calendar quarter. The ranks are then transformed to range between -0.5 to +0.5.

Since a regression slope coefficient is the expected change in the dependent variables for a unit change in the independent variables, transforming FE in deciles from -0.5 to +0.5 allows interpretation of the coefficient on FE as the average difference in abnormal returns between observations in the highest and lowest-FE deciles. The variable of focus in this paper is ATTN.[3] We estimate four different regression models as follows.

$$CAR = \beta_1 FE + \beta_2 ATTN + \beta_3 SIZE + \beta_4 PBR \quad (Model 1)$$

$$CAR = \beta_1 FE + \beta_2 ATTN + \beta_3 SIZE + \beta_4 PBR + \beta_5\, ARBRISK + \beta_5 PRICE + \beta_6 VOLUME \quad (Model\ 2)$$

$$CAR = \beta_1 FE + \beta_2 ATTN + \beta_3 SIZE + \beta_4 PBR + \beta_5\, ARBRISK + \beta_5 PRICE + \beta_6 VOLUME + \beta_7 NOA + \beta_8 FRIDAY \quad (Model\ 3)$$

$$CAR = \beta_1 FE + \beta_2 ATTN + \beta_3 SIZE + \beta_4 PBR + \beta_5\, ARBRISK + \beta_5 PRICE + \beta_6 VOLUME + \beta_7 NOA + \beta_8 FRIDAY + \beta_9 INST \quad (Model\ 4)$$

The results are summarized in Table 2. Panel A shows the explanatory variables' coefficients for announcement day abnormal return (CAR[0,1]) and Panel B for post-earnings-announcement drift (CAR [1,21]). The coefficient on FE of 0.005 in Panel A Model 1 indicates that, for observations with median firm characteristics, the abnormal returns of those in the highest-FE decile exhibited 1-day abnormal returns 0.5 percentage points higher than those in the most-negative FE deciles. The coefficient on FE in Panel B Model 1 indicates that the highest FE decile portfolio performs 2.2 percentage points better than the lowest.

[3] The interpretation of the coefficient is not the average difference in abnormal returns between observations in the highest and lowest ATTN deciles.

ATTN is our focus of analysis and its coefficient in Model 1 Panel B is negative and statistically significant. Holding other explanatory variables constant, the abnormal returns of those in the highest ATTN decile exhibited abnormal returns 0.7 percentage points lower than the lowest ATTN deciles. The coefficient is not significant in Panel A, which means the initial price reaction is primarily due to the earnings surprise, however the post-earnings-announcement drift (CAR [1,21]) has a negative correlation with the degree of professional investors' attention. This is consistent with the view that even professional investors only trade right when they are paying attention to the stock. When their level of attention is low, the stock is more likely to be left undervalued.

To control for arbitrage risk and transactions cost, we add three proxies: ARBRISK, PRICE, and Volume in Model 2. The coefficient on ARBRISK is not different from zero in Panel B, indicating that availability of a substitute for the stock has no impact on its post-earnings-announcement return. The coefficients on PRICE and VOLUME are significantly different from zero and negative, which is consistent with the findings in prior research on US Data. (e.g. Mendenhall [2004]).

In Model 3, we add two more attention proxy variables documented in the US. The first is NOA, which represents the competition for investor attention using the number of other stocks' earnings announcements (Hirshleifer et. al [2009]). The higher the number the less attentive investors become. The second attention proxy is FRIDAY, which represents competition for investor attention based on day of the week. If announcement is made on Friday, it is taken that that investor attention level has diminished (DellaVigna and Pollet [2009]). Neither coefficient of these variables is significantly different from zero. We confirm in Model 3 that our attention proxy is more relevant. We conjecture that what makes post-earnings-announcement drift significant is that professional investors are not paying attention to a subset of firms whose fundamental value is undervalued.

In Model 4, we add a proxy variable for investor sophistication, which is created from institutional holdings of the stock.

Across all four regression models, the coefficient of ATTN remained stable (negative 0.7 – 0.8 percentage points) and is significantly different from zero.

Table 2 **Determinants of Post-Earnings Announcement Drift**

	Model 1		Model 2		Model 3		Model 4	
Panel A	CAR(0,1)		CAR(0,1)		CAR(0,1)		CAR(0,1)	
FE	0.005	***	0.005	***	0.005	***	0.005	***
ATTN	0.001		0.001		0.001		0.001	
SIZE	-0.001		0.006	***	0.006	***	0.006	***
PBR	0.002	***	0.003	***	0.003	***	0.003	***
ARBRISK			0.003	**	0.003	**	0.002	**
PRICE			-0.003	***	-0.003	***	-0.003	***
VOLUME			-0.006	***	-0.006	***	-0.006	***
NOA					-0.002	**	-0.002	**
FRIDAY					-0.001		-0.001	
INST							0.001	
Intercept	0.002	***	0.002	***	0.002	***	0.002	***
Sample (n)	9,390		9,390		9,390		8,944	
R squared	0.006		0.008		0.01		0.01	
Panel B	CAR(1,21)		CAR(1,21)		CAR(1,21)		CAR(1,21)	
FE	0.022	***	0.022	***	0.022	***	0.022	***
ATTN	-0.007	**	-0.007	**	-0.007	**	-0.008	***
SIZE	-0.005	*	-0.012	*	-0.012	*	-0.010	
PBR	-0.010	***	-0.010	***	-0.010	***	-0.008	***
ARBRISK			-0.004		-0.004		-0.004	
PRICE			0.000		-0.001		-0.001	
VOLUME			0.006		0.006		0.001	
NOA					-0.001		-0.001	
FRIDAY					0.000		0.000	
INST							0.008	***
Intercept	0.002	**	0.002	**	0.002	*	0.002	
Sample (n)	9,389		9,389		9,389		8,943	
R squared	0.01		0.01		0.01		0.01	

Notes: Panel A indicates coefficient estimates for determinants of abnormal return on the announcement period. Panel B shows estimated coefficients for post-earnings-announcement drift. CAR (0,1) is the stock's return from day -1 relative to earnings announcement through the opening price after announcement. CAR (1,21) is the stock's return from day +1 relative to earnings announcement through day +21. ATTN is the professional investor's attention proxy based on number of streaming news items for the stock. SIZE is market capitalization and PBR the price-to-book ratio of the stock. ARBRISK is residual variance from a market model regression of the stock's monthly return on those of TOPIX (Tokyo Stock Price Index, a free-float adjusted market capitalization-weighted index for the 48 months ending 1 month prior to the announcement. PRICE is the closing price of the stock on day -20 relative to earnings announcement. VOLUME is average traded value (price times volume of the day) between day -50 and day -20 relative to earnings announcement. NOA is the number of earnings announcements released on the day of the stock's earnings announcement. FRIDAY is the dummy variable that takes 1.0 if the stock's earnings announcement is released on Friday, zero otherwise. Here, ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

IV Calendar-time Portfolio Strategies.

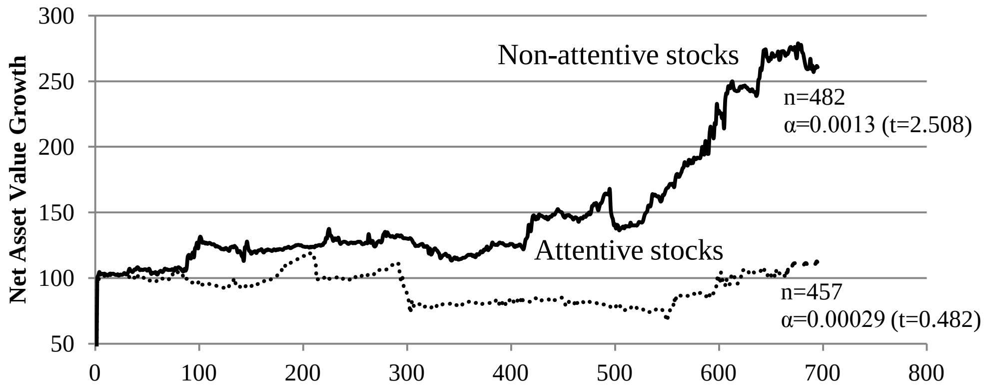
We now test whether investors can use the *inattentional blindness* effect to form better portfolios. Based on the previous results, we expect investors to be able to achieve superior returns by combining earnings surprise information with information about flow of streaming news, as measured by the relative number of tagged streaming news items.

At the end of each announcement day from January 2010 until December 2013, we independently sort stocks into two groups based on whether earnings beat the analyst consensus. We then calculate the number of streaming news items of each stock on announcement date and compare with the average number of streaming news items disseminated during the 60 days before announcement. We take the ratio of the two numbers and look for the previous year's deciles. If the ratio falls between the top decile and the fifth (ATTN-1-ATTN-5), we deem it a high attentive stock. If the ratio falls between the sixth decile and bottom decile (ATTN-5 – ATTN10), a low attentive stock.

Because professional investor attention eliminates undervaluation of the earnings surprise, investors strategically purchase low attentive stocks with positive earnings surprise. In the simulation below, we assume investors put all their wealth in the stock(s) that satisfy these criteria and hold them for 20 business days.

Figure 2 demonstrates the wealth growth path of investors who follow this strategy.

Figure 2 Difference in Wealth Between Investors Who Trade Non-attentive Stocks and Attentive Stocks



V Conclusion

Some researchers believe that post-earnings-announcement drift is a result of methodological limitations, while others maintain it is caused by researchers who systematically misestimate expected returns following earnings announcements. A third typical explanation is that drift reflects slow market reaction to earnings information. The underreaction explanation apparently violates market efficiency. Since this anomaly has survived for several decades, many researchers are reluctant to accept an explanation that is inconsistent with market efficiency. Shleifer and Vishny (1997) argue that ‘limits of arbitrage’ is the reason for the seemingly profitable anomaly to remain and Wurgler and Zhuravskaya (2002) put it down to the existence of arbitrage risk Mendenhall (2004) confirms that ‘limits of arbitrage’ is indeed causing post-earnings-announcement drift.

In this paper, we use the unique data set for the streaming news disseminated to professional investors around the world. We create our professional investors’ attention proxy around the earnings announcement date and indicate that it has a significant effect on post-earnings-announcement abnormal returns. Controlling for a wide range of firm-specific characteristics, including arbitrage risk and ownership characteristics, we find that the magnitude of post-earnings-announcement drift is significantly negatively related to our professional investors’ attention proxy. We also controlled for two different attention proxies that are documented to have effect on undervaluation in the US. Our result is robust after controlling these proxies. This new evidence supports the view that the lack of professional attention matters for the persistent anomaly.

In order to check whether our result is not cross-sectionally dependent, we conducted a calendar time portfolio strategy based on the professional investors’ proxy. An investor who strategically invests in low-attention stocks continuously outperformed the opposite investor who invests in high-attention stocks. The difference of the two groups is statistically and economically significant. Investors may fail to incorporate all the fundamental information upon arrival and the state of undervaluation would not be immediately corrected when professional investors are inattentive.

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