Trading Volume Reactions to Earnings Announcements and Future Stock Returns

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April, 2015

* I thank Mary E. Barth, Ron Kasznik, and Charles M. C. Lee for their guidance on this paper. I also appreciate the helpful comments of David Aboody, Felipe Aldunate, Erjie Ang, Anne Beyer, George Foster, Joe Piotroski, Youfei Xiao, and seminar participants at Stanford Graduate School of Business, the Interdisciplinary Center (IDC) Herzliya, and Menta Capital LLC. Any errors are my own.

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Abstract

This study examines the relation between abnormal trading volume (ATV) around earnings announcements (EAs) and future stock returns. In particular, I investigate whether firms with higher ATV around EAs outperform those with lower ATV over the short and long terms following the EA. In addition, I address whether any positive relation between ATV around EAs and future stock returns is weaker for firms with a higher proportion of shares held by sophisticated investors. Consistent with theories that attribute ATV around public announcements primarily to differing investor interpretations of the news and that link differential interpretation to future returns, I find that, for several quarters after an EA, firms in the highest decile of ATV significantly outperform those in the lowest decile. Further, I find that ATV and earnings surprises explain future returns incremental to the three Fama and French (1993) and momentum risk-factors. Next, consistent with the proportion of ATV driven by lack of consensus regarding the price being lower when the presence of rational investors is higher, I document that the level of investor sophistication–a proxy for investor rationality–attenuates the positive relation between ATV and future returns. Taken together, my study lends support to and links two streams of theories from financial economics, and demonstrates that trading volume reactions to EAs provide information about future returns that cannot be deduced from the price reactions or the magnitudes of earnings surprises. My study also documents that while the positive relation between ATV and future returns is prolonged and persistent, it is sensitive to the level of security holdings of sophisticated investors.

JEL Classification: G12, G14, G30, M41

Keywords: Abnormal trading volume; Trading volume reactions; Earnings announcements; Future returns; Investor sophistication; Earnings surprises.

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1. Introduction

Earnings announcements (EAs) result in investor reactions on two dimensions: price reactions and trading volume reactions. A growing body of literature asserts that the primary driver of trading volume reactions to public announcements is investor heterogeneity in the form of differential interpretation of the news (e.g., Beaver 1968; Harris and Raviv 1993; Kandel and Pearson 1995; Bamber et al. 1997, 1999; Bamber et al. 2011). Another stream of literature offers a link between the level of investors' differential interpretations of public news and future firm performance (e.g., Varian 1985; Epstein and Schneider 2008; Banerjee and Kremer 2010). I adopt insights from these streams of literature and examine the relation between abnormal trading volume (ATV) around EAs and future stock returns.

Specifically, I investigate whether firms with higher abnormal trading volume (ATV) around EAs outperform those with lower ATV over the short and long terms following the EA. In addition, entertaining the idea that the proportion of trading volume reactions to EAs that is driven by investors' differential interpretations of the news is lower when the presence of rational investors is higher (e.g., Aumann 1976; Varian 1989), I address whether any positive relation between ATV and future returns is weaker for firms with a higher proportion of shares held by sophisticated investors–a proxy for investor rationality.

The information content of price reactions to firms' public announcements, in particular EAs, has been a subject of numerous studies in the accounting and finance literatures (e.g., Foster et al. 1984; Bernard and Thomas 1989, 1990; Chan et al. 1996). However, to date little is known about the information content of trading volume reactions to firms' information events such as EAs (e.g., Verrecchia 1981; Bamber et al. 2011). This is a significant void because trading volume reactions are equally relevant in understanding investors' perceptions of public news (e.g., Ross 1989), and prior literature finds that investors' reactions to EAs generate ATVs that are unrelated to the magnitude of price changes (e.g., Bamber and Cheon 1995; Kandel and Pearson 1995). Answers to the questions I address in this study are of obvious importance because, besides shedding light on the information content of another dimension of market reaction to EAs, they help connect two streams of theories from financial economics and provide empirical evidence in support of their predictions. Moreover, knowledge of the information content of ATV extends our understanding of the implications of investors' trading activity for future firm performance – as reflected in stock price movements – which today is limited to the raw magnitude of trading volume (e.g., Lee and Swaminathan 2000; Hong and Stein 2007).

I raise and test three hypotheses concerning the relation between the cross-sectional variation of ATV around EAs and future stock returns. Building on the growing literature indicating that the dominant driver of trading volume reactions to EAs is investors' differential interpretations of earnings news (e.g., Beaver 1968; Kandel and Pearson 1995; Bamber et al. 1997, 1999; Bamber et al. 2011), as well as on the offered link between investors' differential interpretations and future stock returns (e.g., Varian 1985; Banerjee and Kremer 2010), I first hypothesize that there is a positive relation between ATV around EAs and future stock returns.

My second hypothesis concerns the relation between trading volume reactions to EAs and the widely explored post-earnings announcement drift (PEAD). PEAD is a capital markets phenomenon such that EAs with large positive (negative) unexpected earnings are followed by upward (downward) drifts in security prices, with most of the drift concentrated in the 240-day period following EA (e.g., Foster et al. 1984; Bernard and Thomas 1989). Prior research attributes the PEAD phenomenon to investors' underreaction to information in earnings news (e.g., Bernard and Thomas 1990; Ball and Bartov 1996). Higher ATV around EAs might be an indication that the price change has incorporated the earnings news fully (e.g., Verrecchia 1981; Diamond and Verrecchia 1987). Alternatively, higher ATV around EAs might indicate a lack of investor consensus about interpretation of the earnings news, suggesting that the price reaction to earnings news is less complete than if it were accompanied by lower ATV. Because of these competing explanations, I posit that the returns associated with trading volume reactions to EAs are incremental to those associated with earnings surprises.

Next, observing that trading volume reactions to EAs are driven also by differences in information and/or heterogeneous risk preferences (e.g., Verrecchia 1981; Kim and Verrecchia 1994, 1997; Barron et al. 2005), and using Aumann's (1976) argument that two investors for whom rationality is common knowledge cannot "agree to disagree," my third hypothesis asserts that the posited positive relation between ATV and future returns is weaker for firms with a higher proportion of shares held by sophisticated investors – a proxy for investor rationality.

To conduct my analyses, I focus on quarterly EAs of a sample of firms listed on NYSE, AMEX, or NASDAQ with sufficient data: a full sample of 6,844 firms (325,842 firm-quarters) spanning 1976-2011. I measure ATV around quarterly EAs in two ways: controlling for the price change around EAs (e.g., Grabbe and Post 1994), and controlling for the average stock trading volume during the 50-day period prior to EA. Earnings surprises are calculated using time-series- and analysts-based forecasts. To measure the extent of investor sophistication contained in the firm's investor base, I follow prior research and use the proportion of firm shares held by institutional investors (e.g., Bartov et al. 2000; Doyle et al. 2006). All my analyses are conducted using size-adjusted, buy-and-hold stock returns measured over periods of up to 1 year after the EA date.

To test my first hypothesis I conduct three sets of analyses. First, within each calendar quarter, I form decile portfolios based on the level of ATV around EAs and compute for each portfolio the mean size-adjusted, buy-and-hold stock returns over the periods of up to 240 trading days starting two days after a quarterly EA. Consistent with my first hypothesis, I find that firms in the highest decile of ATV significantly outperform those in the lowest decile over all return measurement periods. To rule out the possibility that differential risk drives the hedge portfolio returns, I regress returns for each decile portfolio on the three Fama and French (1993) and momentum risk-factors and find that the differences between intercepts belonging to firms in the highest and lowest deciles of ATV are significantly positive, suggesting that commonly known risk factors cannot explain the returns difference. Next, I estimate multivariate regressions with size-adjusted, buy-and-hold stock returns over the periods of up to 1 year after the quarterly EA as the dependent variable. I find that firms in the highest decile of ATV outperform those in the lowest decile for both full and reduced samples, after controlling for price reaction, size, book-to-market, momentum, earnings uncertainty, bid-ask spread, price impact, and past-year turnover.

To test my second hypothesis I conduct a three-step analysis similar to the one outlined above for the first hypothesis, except that, in the portfolio tests, I independently sort firms into quantiles of ATV and deciles of earnings surprises. Consistent with the second hypothesis, I find that for both samples of firms, returns associated with ATV are incremental to those associated with earnings surprises. Moreover, hedge portfolio returns to a combined strategy based on ATV around EAs and earnings surprises are much larger and persist much longer than those that are based on earnings surprises only. As with ATV only, these returns cannot be explained by the three Fama and French (1993) and momentum risk-factors, or by other potential variables in multivariate regression tests.

I test my third hypothesis using a difference-in-differences design. First, within each calendar quarter, I independently form quantile and decile portfolios of measures of investor sophistication and ATV and compute portfolios' mean abnormal stock returns over the periods of up to 1 year after the quarterly EA. Consistent with my third hypothesis, I find that the portfolio returns from taking a long position in firms in the highest decile of ATV and a short position in those in the lowest decile are highest for firms that have lower institutional holdings, and are lowest for firms that have higher institutional holdings. This suggests that the positive relation between ATV and future returns is weaker for firms with a higher proportion of shares held by sophisticated investors. This inference is strengthened in the multivariate regression setting when I control for both the effect of earnings surprises and the other variables that are shown to be associated with future returns.

My inferences concerning the relation between ATV around EAs and future stock returns over short and long terms after the EAs are robust to alternative specifications, proxies for the key variables, and alternative explanations. For example, my inferences are not affected by sample selection procedures, controlling for the industry concentration in the most extreme portfolios of ATV, time concentration of the relation between ATV and future returns, the accrual anomaly, and the effect of investor sophistication on the relation between earnings surprises and future returns. Moreover, analyses of the time series changes in the composition of portfolios with extreme levels of ATV around EAs reveal that sorting firms based on ATV does not simply identify, quarter-after-quarter, two groups of the same firms that, ex-post, demonstrate significantly different stock returns and financial performance over my sample periods. Specifically, I find that more than 80% of firms change the ATV portfolios from quarter to quarter.

My study is related to work by Garfinkel and Sokobin (2006) who finds a positive relation between ATV around EAs and future 60-day period returns. My study differs from Garfinkel and Sokobin (2006) and complements it in several important respects. First, Garfinkel and Sokobin (2006) focus on 60-days post-EA returns only, and it is unclear whether their results indicate short term return differential that reverses in the future or rather a long term, persistent effect. Second, Garfinkel and Sokobin (2006) tests have a look-ahead bias, which arises because of the use of information after the EA to form portfolios. Third, Garfinkel and Sokobin (2006) are silent about the role of investor sophistication for the observed relation between ATV and future returns. Fourth, Garfinkel and Sokobin (2006) do not control for earnings surprises in their analyses, which prior literature shows is important to control for in studies that attempt to offer a new EA related measure that can predict future post-EA returns (e.g., Chan et al. 1996; Brandt et al. 2008).[1] Hence, based on Garfinkel and Sokobin (2006) only it is unclear whether the relation they document is due to earnings news (i.e., a widely explored PEAD phenomenon).

Taken together, my study offers contributions along several lines of inquiry. First, I show that trading volume reactions to EAs contain information about future stock returns incremental to that provided by the price reactions and the magnitudes of earnings surprises, the focus of the PEAD literature. Second, I show that the positive relation between ATV and future returns, is prolonged and persistent, which provides evidence that lends support to and links two streams of prior literature: the primary driver of ATV around EAs is investors' differential interpretations of the news, and such differential interpretations are positively related to future stock returns (i.e.,

[1] Specifically, they do not control for earnings-based measures of earnings surprise and instead control for abnormal stock returns around EAs. As the prior PEAD literature indicates (e.g., Foster et al. 1984; Chen et al. 1996), abnormal stock returns around EA do not fully capture the magnitudes of earnings surprises.

there are no reversals in return differential over the 60 days following the EA). Third, by showing that the positive relation between ATV and future returns is weaker for firms with a higher proportion of shares held by sophisticated investors, I highlight the importance of a firm's investor base for the relation between trading volume reactions around EAs and future returns.

The rest of the paper is organized as follows. Section 2 discusses the related literature and develops the hypotheses. Section 3 presents the research design. Section 4 outlines the sample selection procedure and describes the data. Sections 5 and 6 report the main results and results from additional analyses. I conclude in section 7.

2. Related literature and hypothesis development

Recent investigations of the relation between trading volume and price reactions to EAs suggest that the two are not necessarily closely related and as a result may not capture the same aspect of market reaction. For example, Bamber and Cheon (1995) present evidence that nearly 25% of EAs generate price and volume reactions of different magnitudes. Similarly, Kandel and Pearson (1995) show that even when there is little price change, considerable ATV exists around EAs. These findings suggest that an investigation of trading volume reactions to EAs has the potential to yield insights about the patterns of a firm's stock returns and financial performance following EAs. Yet, as Bamber et al. (2011: 432-433) assert in a recent review of research on trading volume responses to EAs and other financial disclosures, to date, little is known about the information content of trading volume reactions to EAs.

Collectively, prior research identifies three major sources of ATV at EA, all stemming from some form of heterogeneity among investors: 1) differences in information (e.g., Varian 1989; Holthausen and Verrecchia 1990; Kim and Verrecchia 1991a, 1991b, 1994, 1997; Barron et al.

2005); 2) differing risk preferences (e.g., Beaver 1968; Verrecchia 1981), and 3) differences in opinion, i.e., differential interpretation of the earnings news (e.g., Beaver 1968; Varian 1989; Harris and Raviv 1993; Kandel and Pearson 1995; Bamber et al. 1997, 1999; Hong and Stein 2007; Bamber et al. 2011). [2] Research that attributes a component of ATV to differences in information rests on the insights that (i) market participants possess pre-EA earnings signals of different precision, and/or (ii) some investors can make more informed judgments about a firm's performance than others on the basis of an EA. These differences in precision of pre-EA earnings signals and/or informed judgments lead to an increase in trading volume around EAs.

Research that assigns a component of ATV to investors' heterogeneous risk preferences is guided by Verrecchia's (1981) argument that volume reaction to public information may be induced by investors' different risk tolerances (i.e., the inverse of risk aversion). Hence increases (decreases) in an asset's risk can lead to trade in which agents less (more) tolerant of risk sell (buy) the risky asset to (from) more risk-tolerant agents who end up holding more (less) of the asset.

Following Kandel and Pearson (1995), a growing body of accounting and finance literature asserts that the most dominant driver of trading volume reactions to EAs is differences in interpretation of the earnings information (e.g., Hong and Stein 2007; Bamber et al. 2011). The sources of such differential interpretations are rooted in the presumption that market participants use different priors, likelihood functions, or models to interpret the earnings news and determine a firm's value. For example, the EA can be thought of as a public signal that reveals the intrinsic

[2] In contrast to rational expectations (RE) models in which investors share common priors and disagree due to asymmetric information, investors in differences-of-opinion models have heterogeneous priors and so may "agree to disagree" even if they have the same information. The "No-Trade Theorem" (e.g., Milgrom and Stokey, 1982) rules out trade when investors share common priors, even in the presence of asymmetric information. Noisy RE models overcome this result by introducing noise traders, or aggregate liquidity shocks (e.g., Grossman and Stiglitz 1980; Pfleiderer 1984; Kyle 1985; Admati and Pfleiderer 1988; Grundy and McNichols 1989).

value of a firm plus a random error, but investors disagree about the mean of the error. This disagreement causes investors to have different interpretations of the earnings news: one can interpret the EA more positively or negatively than the other, or treat the earnings news as a permanent or a temporary signal. Kandel and Pearson (1995) consider possible sources of ATV around EAs and, in the light of the finding that abnormally high trading volume is generated for every level of return (e.g., even when no price change is observed), they conclude that the most plausible cause for trading volume reactions is differential interpretation of the earnings news.[3]

Varian (1985) and Banerjee and Kremer (2010) suggest that differential interpretation of earnings news as reflected in ATV around public announcements may yield insights into differences between the intrinsic and the contemporaneous value of a security (see also Bamber et al. 2011). Specifically, Varian (1985) shows that under reasonable conditions, asset prices are lower when investors' opinions are more dispersed.[4] Banerjee and Kremer (2010) show that expected returns increase with the level of investor disagreement. This is because a higher level of disagreement among investors leads to more uncertainty, which leads investors to take less aggressive positions in the securities, i.e., requiring higher expected returns.[5] These insights as well as GS findings lead to the following hypothesis:

[3] Kandel and Pearson (1995) consider, among others, the: Kim and Verrecchia (1991a, 1991b) model, which implies that volume must be zero if the price change is zero; "life cycle" or concentration of liquidity trading around earnings announcements; a switch from a partially to a fully revealing rational expectations equilibrium (e.g., Grundy and McNichols 1989); and trade due to wealth changes.

[4] The conditions take the form of restrictions on utility functions; (i) the constant absolute risk aversion (CARA) utility; (ii) quadratic utility, and (iii) constant relative risk aversion (CRRA) with a coefficient of relative risk aversion greater than one, all satisfy the conditions.

[5] The predictions of Varian (1985) and Banerjee and Kremer (2010) are in contrast to Miller (1977), who suggests a negative relation between divergence of opinion (when accompanied by short-sale constraints) and future stock returns. As Varian (1985, 1989) shows, the relation between divergence of opinion and asset prices depends on the curvature of demand function. Hence, increase in divergence of opinion will decrease or increase asset price depending on whether demand is a concave or convex function of the opinion variable. Considering the conditions on demand functions that are likely to be met in practice, increased dispersion of beliefs will be generally associated with reduced asset prices. As Varian (1989) illustrates, Miller's (1977) result is driven by the assumption that the demand is a linear function of price. To estimate models where differences of opinion are important, one must allow for arbitrary curvature of demand function. In addition, the relation between expected returns and disagreement is

H1: There is a positive relation between abnormal trading volume around earnings announcements and future stock returns.

The relation between earnings surprises and future stock returns has been subject of numerous studies, collectively named the PEAD literature. The PEAD market inefficiency appears to be caused by investors' inability to fully incorporate the future predictability of the true earnings time-series into their decisions at the EA date, because they either use a naïve expectation model (Bernard and Thomas 1990; Walther 1997), underestimate the serial correlation in seasonal differences (e.g., Ball and Bartov 1996), underestimate the time-series properties of accounting conservatism (Narayanamoorthy 2006), or fail to take inflation into account (Chordia and Shivakumar 2005).

Trading volume reactions to EAs potentially have two effects on PEAD. Higher ATV might indicate that the price change has incorporated fully the earnings news (e.g., Verrecchia 1981; Diamond and Verrecchia 1987). Alternatively, higher ATV might indicate a lack of investor consensus about interpretation of the earnings news, suggesting that the price reaction to earnings news is less complete than if it were accompanied by low ATV.

To the extent that the increase in ATV around EAs is explained by more information-based trading and/or different risk preferences (e.g., Verrecchia 1981; Holthausen and Verrecchia 1990; Kim and Verrrecchia 1994, 1997; Barron et al. 2005), one should expect more complete price reaction and less underreaction. Thus, higher ATV might be associated with faster adjustment of stock prices to earnings news and less drift. However, to the extent that higher ATV is driven by differential interpretation of the news (e.g., Beaver 1968; Kandel and Pearson 1995; Bamber et al. 1994, 1997; Hong and Stein 2007; Bamber et al. 2011), stock prices will adjust to earnings news more slowly, implying more drift for both positive and negative earnings

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empirically unclear. While some studies claim to document a negative relation (e.g., Diether et al. 2002; Hong and Stein 2003), others find a positive relation between the two (e.g., Qu et al. 2004; Banerjee 2011).

news when higher ATV is observed. These competing explanations lead to my second hypothesis:

> **H2:** Returns associated with trading volume reactions to earnings announcements are incremental to those associated with earnings surprises.

Varian (1989) notes that the existence of differential interpretation of earnings news entails an assumption that some market participants behave in apparently irrational ways. The intuition behind this argument is rooted in the "No-Trade Theorem" (e.g., Milgrom and Stokey 1982), according to which a rational agent would not want to trade with anyone who would be willing to trade with her. This is true in light of Aumann's (1976) argument that agents for whom rationality is common knowledge cannot "agree to disagree." This reasoning suggests that the amount of ATV around EAs that is driven by investors' differential interpretation of the news should be lower when the presence of rational investors is higher, implying that in such cases the ATV around EAs will be primarily driven by differences in information and/ or heterogeneous risk preferences. Consequently, to the extent that differential investor interpretations have a positive relation with future returns (but the other sources do not), such a relation should be attenuated for firms whose investor base has a higher proportion of rational investors.

It seems reasonable that the extent to which investors "agree to disagree" will be lower for firms with a higher proportion of shares held by sophisticated investors. According to Varian (1989) the extent to which one agent's beliefs are capable of influencing another agent's beliefs determines the extent to which one agent conveys information or opinion to the others. For example, if one person tells another person something that is perceived as information, the second person will adjust his views to incorporate the new information. If one person tells another something that is perceived as "just opinion," then no adjustment in views will take place. Thus, I conjecture that the opinions of sophisticated investors are more likely to be viewed as information by other investors, whereas opinions of other investors are more likely to be viewed as "just opinion." As a result, ATV of firms with a higher proportion of shares held by sophisticated investors will tend to be driven more by factors other than differential interpretation (i.e., differences in information/risk preferences). This reasoning leads to my third hypothesis:

> **H3:** The positive relation between abnormal trading volume around earnings announcements and future stock returns is weaker for firms with a higher proportion of shares held by sophisticated investors.

3. Research design and variable measurement

I conduct three types of analyses to test the hypotheses raised in chapter 2. To test hypothesis 1 (hereafter, "H1") and hypothesis 2 (hereafter, "H2"), I perform portfolio tests, regress future returns on the three Fama and French (1993) and momentum risk-factors, and estimate a set of multivariate regressions. To test hypothesis 3 (hereafter, "H3"), I use a difference-in-differences design to perform portfolio tests and estimate a set of multivariate regressions. All tests are based on firm-quarter observations grouped into calendar quarters based on a firm's EA date.[6] All variables are defined in the Appendix.

3.1 Measurement of key variables

3.1.1 Future abnormal returns

To maintain comparability with prior studies (e.g., Foster et al. 1984; Bernard and Thomas 1989; 1990) and to mitigate concerns that the pattern of predictable returns is attributable to portfolio rebalancing costs, future abnormal returns are measured as size-adjusted, buy-and-hold stock returns (*SAR*), inclusive of dividends and other distributions (hereafter "abnormal

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[6] Sorting firms each calendar quarter creates a look-ahead bias because at the EA date for a particular firm, the variables of interest for all other firms in that quarter may not yet be known. To avoid this bias I use the cutoff values that define the deciles and/ or quintiles of variables of interest from the previous calendar quarter to sort the variables for current calendar quarter into ten and/or five portfolios.

returns"),[7] beginning two days after the EA for quarter q and extending 60, 120, 180, and 240 days into the future (hereafter "60-day abnormal returns," "120-day abnormal returns," "180-day abnormal returns," and "240-day abnormal returns," respectively).[8] In addition, to avoid survivorship bias, I calculate the subsequent returns for all firms that were listed at the time of portfolio formation, regardless of whether they were subsequently delisted.

I calculate abnormal returns for portfolio P, $SAR_{q,w}^{P}$, using the following formula:

$$SAR_{q,w}^{P} = \frac{1}{NUM\_P} \times \sum_{i=1}^{NUM\_P} \left\{ \left[\prod_{\tau=1}^{w} (1 + RET_{\tau}^{P,i}) - 1 \right] - \left[\prod_{\tau=1}^{w} (1 + RET_{\tau}^{BM,i}) - 1 \right] \right\} \quad (1)$$

where $RET_{\tau}^{P,i}$ denotes the raw return for firm i in portfolio P on day τ, $RET_{\tau}^{BM,i}$ denotes the equally weighted mean return for firms listed on NYSE, AMEX, or NASDAQ in the same size decile as firm i on day τ, and NUM_P is the number of stocks in portfolio P. q represents the calendar quarter within which EA is made and w denotes the security holding period, which starts two days after the EA for quarter q and extends 60, 120, 180, and 240 days. Following Piotroski (2000), among others, if a firm delists, I assume the delisting return is zero.[9]

3.1.2 Abnormal trading volume

I use two proxies for ATV. The first is the "Standardized Unexplained Volume" (*SUV*), calculated using a methodology that mirrors the market model approach to estimating abnormal returns, to control for the EA period price reaction (e.g., Grabbe and Post 1994; Garfinkel and Sokobin 2006). $SUV_{i,q}$ and $SUV_{i,t,q}$ for firm i in quarter q, where t denotes the day relative to the

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[7] In contrast to the "Cumulative Abnormal Return" approach, which implies daily rebalancing (when calculated based on daily returns), the buy-and-hold calculation implies no rebalancing costs over the entire return horizon.

[8] I treat the 60-day abnormal returns and 240-day abnormal returns as returns pertaining to 1-quarter and 1-year after the EA and use these terms interchangeably. This approach maintains comparability with prior literature, especially those studies that investigate returns associated with earnings surprises, i.e., the PEAD literature (e.g., Foster et al. 1984; Bernard and Thomas 1989; 1990), and also facilitates the empirical analyses. My inferences are the same when I calculate the returns using the quarters- and years-time-periods after the EAs (untabulated).

[9] The inferences are the same when I calculate the delisting returns as recommended in Shumway (1997), Shumway and Wartner (1999), and Beaver, McNichols, and Price (2007).

EA in quarter q, are estimated separately for each firm-quarter using the following system of equations:

$$\ln VOL_{i,t,q} = \alpha_{i,q,0} + \alpha_{i,q,1}\left|RET_{i,t,q}\right|^{+} + \alpha_{i,q,2}\left|RET_{i,t,q}\right|^{-} + \varepsilon_{i,t,q}, \qquad t = -54, \ \dots \ , -5 \tag{2}$$

$$E[\ln VOL_{i,t,q}] = \hat{\alpha}_{i,q,0} + \hat{\alpha}_{i,q,1}\left|RET_{i,t,q}\right|^{+} + \hat{\alpha}_{i,q,2}\left|RET_{i,t,q}\right|^{-}, \qquad t = -4, \ \dots \ , 10 \tag{3}$$

$$UV_{i,t,q} = lnVOL_{i,t,q} - E[lnVOL_{i,t,q}], \qquad t = -4, \ \dots \ , 10 \tag{4}$$

$$STDV_{i,q} = \frac{\sum_{t=-54}^{-5}(\varepsilon_{i,t,q}^{2})}{47} \tag{5}$$

$$SUV_{i,q} = \frac{\sum_{t=-1}^{1} UV_{i,t,q}}{\sqrt{3} \times STDV_{i,q}} \tag{6A}$$

$$SUV_{i,t,q} = \frac{UV_{i,t,q}}{STDV_{i,q}} \tag{6B}$$

where *VOL* is daily trading volume (i.e., number of shares traded during day *t*), *RET* is a stock's daily raw return, ln is the natural logarithm, *E[.]* is the expectation operator, and the plus (minus) superscripts on the absolute valued returns indicate positive (negative) returns that take the value of zero when the daily return is negative (positive). $STDV_{i,q}$ is the standard deviation of the residuals obtained from estimating Eq. (2), calculated over the estimation period (i.e., the 50-day period ending 5 days prior to an EA), where 0 is the EA date.

I compute expected volume for day t by applying the coefficients $\hat{\alpha}_{i,q,0}$, $\hat{\alpha}_{i,q,1}$, and $\hat{\alpha}_{i,q,2}$, obtained from estimating Eq. (2) over the 50-day period ending 5 days prior to an EA date, to day t stock returns. I calculate daily unexplained volume ($UV_{i,t,q}$) by subtracting expected volume from actual volume on day t. To get $SUV_{i,q}$ for firm i in quarter q, I sum individual daily $UV_{i,t,q}$ during the 3 days around the EA, i.e., [-1, 1], and scale them by the product of square root of 3 and $STDV_{i,q}$. To get $SUV_{i,t,q}$ for firm *i* during day *t* in quarter *q*, I scale individual daily $UV_{i,t,q}$ by $STDV_{i,q}$.

The second measure of ATV is "Turnover Ratio" (*TR*), calculated separately for each firm-quarter as follows:

$$TR_{i,q} = \frac{1}{3} \times \sum_{t=-1}^{1} \left(\frac{VOL_{i,t,q}}{CSHROUT_{i,t,q}} \right) \Bigg/ \frac{1}{50} \times \sum_{t=-54}^{-5} \left(\frac{VOL_{i,t,q}}{CSHROUT_{i,t,q}} \right) \tag{7A}$$

$$TR_{i,t,q} = \frac{VOL_{i,t,q}}{CSHROUT_{i,t,q}} \Bigg/ \frac{1}{50} \times \sum_{t=-54}^{-5} \left(\frac{VOL_{i,t,q}}{CSHROUT_{i,t,q}} \right), \qquad t = -4, \ \ldots \ ,10 \tag{7B}$$

where $CSHROUT_{i,t,q}$ denotes the number of shares outstanding for security *i* on day *t*, relative to its EA date, i.e., 0, of quarter *q*, and $VOL_{i,t,q}$ is defined above. Hence, $TR_{i,q}$ is the ratio of average daily share turnover estimated over the 3 days around the EA (i.e., days −1, 0, and +1) and average daily share turnover estimated over the 50-day period ending 5 days prior to an EA date, 0. Similarly, $TR_{i,t,q}$ is the ratio of daily share turnover and average daily share turnover of firm *i* during day *t* relative to EA date in quarter *q*.[10]

3.1.3 Earnings surprises

My main measure of earnings surprise is "Standardized Unexpected Earnings" (*SUE*) (e.g., Chan et al. 1996), measured as the difference between the current quarter's earnings per share and the earnings per share from the corresponding quarter of the prior year, scaled by the standard deviation of this difference during the last eight quarters, including the current quarter:

$$SUE_{i,q} = \frac{EPS_{i,q} - EPS_{i,q-4}}{\sigma(EPS_{i,q} - EPS_{i,q-4})} \tag{8}$$

[10] These measures of ATV overcome the fact that trading volume for NASDAQ stocks is inflated relative to NYSE and AMEX stocks because of the double counting of dealer trades (Gould and Kleidon, 1994). This could be a problem because I rank firms by abnormal trading volume, and pooling NASDAQ and NYSE firms would result in inconsistent treatment of firms across these different markets.

where, $SUE_{i,q}$ and $EPS_{i,q}$ ($EPS_{i,q-4}$) denote firm *i*'s standardized unexpected earnings and realized earnings per share in quarter *q* (four-quarters ago) and σ is the standard deviation operator.[11]

3.1.4 Investor sophistication

Following prior research (e.g., Hand 1990; Utama and Cready 1997; Walther 1997; Bartov et al. 2000; Doyle et al. 2006), I use institutional investor holdings of common equity as my proxy for the sophistication of the firm's ownership, or the presence of rational investors in a firm's investor base. Institutional investors have a relative advantage in gathering and processing information and, thus, they are generally better informed than individual investors and even market specialists.

I measure investor sophistication of firm *i* in quarter *q*, $INST_{i,q}$, as the percentage of firm *i*'s common share institutional ownership at the beginning of calendar quarter *q* (i.e., the ratio between the number of common shares held by all section 13(f) filers at the beginning of quarter *q* and the number of common shares outstanding on that date).

3.2 Three types of tests

3.2.1 Portfolio tests

Portfolio tests are based on the decile ranking of variables of interest within each calendar quarter and computing the equally weighted average 60-day, 120-day, 180-day, and 240-day abnormal returns (e.g., Bernard and Thomas 1990; Ball and Bartov 1996; Livnat and Mendenhall 2006; Cao and Narayanamoorthy 2012). When portfolios are based on the rankings of two variables, I rank independently all eligible stocks within each calendar quarter and assign them to

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[11] Recent studies on PEAD document that the relation between earnings surprises and future returns is stronger and persists longer when earnings surprises are based on analysts' forecasts rather than time-series forecasts (e.g., Liang 2003; Doyle et al. 2006; Livnat and Mendenhall 2006). To control for this effect without limiting my focus only to firms covered by analysts, in the main tests I use the *SUE* measure of earnings surprises. In robustness tests (untabulated) I also use another measure of earnings surprises, which is based on analysts' forecasts of quarterly earnings. As discussed in section 6.3.1 my inferences remain the same.

one of 5 portfolios (i.e., quantiles) based on one of the variables and one of 10 portfolios (i.e., deciles) based on the other variable, resulting in the 5×10 portfolios combination (i.e., 50 portfolios). I use the 5×10 and not 10×10 combination to avoid drawing inferences on portfolios with few stocks. Also, I rank the stocks independently in order to be able to draw unconditional inferences on the effects of each of the variables (e.g., Lee and Swaminathan 2000).[12] I focus my attention on the extreme top and bottom portfolios.

To test H1, I form portfolios based on deciles of $SUV_{i,q}$ or $TR_{i,q}$, and test whether the hedge returns, computed as the difference between top and bottom mean portfolio returns, are significantly positive and persistent. To test H2, I perform a two-stage portfolio analysis. First, I form portfolios based on deciles of $SUE_{i,q}$ only and analyze the hedge returns to strategies that are based on earnings surprise data only. Next, I sort independently stocks into quantiles based on $SUV_{i,q}$ or $TR_{i,q}$ and deciles based on $SUE_{i,q}$. If H2 is correct, the returns to the combined strategy of ATV and earnings surprises will be larger than the returns to the earnings surprise strategy.

To test H3 I sort independently stocks into quantiles of $INST_{i,q}$ and deciles of $SUV_{i,q}$ or $TR_{i,q}$. Then, for each quantile of $INST_{i,q}$ I compute the difference between top and bottom $SUV_{i,q}$ or $TR_{i,q}$ mean portfolio returns. If H3 is correct, the hedge portfolio returns within each quantile of $INST_{i,q}$ will decrease as the quintile of $INST_{i,q}$ increases. For example, the return difference between the top and bottom deciles of $SUV_{i,q}$ will be significantly lower across the highest quintile than within the lowest quintile of $INST_{i,q}$.

3.2.2 Four-risk-factor adjustment tests of H1 and H2

[12] My inferences are the same when I use different rankings/ combinations approaches. Specifically, my inferences are the same when I use 10×5 or 5×5 or 10×10 combinations (untabulated). If anything, results are stronger when 10×10 combinations are used in the univariate portfolio tests.

To ensure that the hedge returns for strategies based on $SUV_{i,q}$ and $TR_{i,q}$ (i.e., H1) and for strategies based on combinations of $SUV_{i,q}$ or $TR_{i,q}$ and $SUE_{i,q}$ (i.e., H2) do not simply capture differential risk across the portfolios, I test whether the returns difference can be explained by the three Fama and French (1993) and the momentum risk-factors. Specifically, in the context of H1 (H2), I estimate the following regression model for each portfolio based on deciles of $SUV_{i,q}$ or $TR_{i,q}$ (independently ranked quantiles of $SUV_{i,q}$ or $TR_{i,q}$ and deciles of $SUE_{i,q}$ or $AFE_{i,q}$): [13]

$$RET^{p}_{q,w} - RET^{f}_{q,w} = \alpha^{p} + \beta^{p}_{1}(RET^{mkt}_{q,w} - RET^{f}_{q,w}) + \beta^{p}_{2} HML_{q,w} + \beta^{p}_{3} SMB_{q,w} + \beta^{p}_{4} UMD_{q,w} + \varepsilon_{w} \quad (10)$$

where $RET^{p}_{q,w}$ is the equal-weighted raw return on stocks in a given portfolio, $RET^{f}_{q,w}$ is the risk-free rate, and $RET^{mkt}_{q,w}$ is the market return during the portfolio holding period after the EA, and $w \in \{60, \ 240\}$. $HML_{q,w}$, $SMB_{q,w}$, and $UMD_{q,w}$ correspond to window w returns associated with high-minus-low market-to-book, small-minus-big, and high-minus-low momentum strategies (e.g., Fama and French 1993; Carhart 1997).

If H1 (H2) is correct and is not driven by previously documented four risk factors, then the intercepts (i.e., α^{p}) in the top decile (quantile and decile) portfolios will be significantly larger than those in the bottom decile (quantile and decile) portfolios.

3.2.3 Multivariate regression tests

The last set of tests is based on estimating variants of a multivariate regression model shown below. To ensure that the hedge returns for strategies based on $SUV_{i,q}$ and $TR_{i,q}$ (i.e., H1) and for strategies based on combination of $SUV_{i,q}$ or $TR_{i,q}$ and $SUE_{i,q}$ (i.e., H2) continue to hold in a multivariate setting after controlling for some other factors, and to ensure that investor

[13] This model extends the Fama and French (1993) three-factor model with the addition of a momentum factor (e.g., Carhart 1997).

sophistication attenuates the positive relation between ATV and future returns (i.e., H3), I estimate variants of the following equation:

$$SAR_{i,q,w} = \alpha_{0,w} + \beta_{1,w}ATV_{i,q} + \beta_{2,w}SUE_{i,q} + \beta_{3,w}INST_{i,q} + \beta_{4,w}INST_{i,q} \times ATV_{i,q} + \beta_{5,w}ABR_{i,q} + \beta_{6,w}SIZE_{i,q} + \beta_{7,w}BTM_{i,q} + \beta_{k,w}\sum_{k} CONTROLS_{k,i,q} + \varepsilon_{i,q,w} \quad (11)$$

where $SAR_{i,q,w}$ denotes size-adjusted, buy-and-hold returns of firm i measured over period of w days ($w \in \{60, 240\}$) starting two days after an EA day of quarter q. $ATV_{i,q}$, $SUE_{i,q}$, and $INST_{i,q}$ denote the proxies for ATV (i.e., $SUV_{i,q}$ or $TR_{i,q}$) , earnings surprise, and investor sophistication, respectively, for firm i during calendar quarter q, measured as defined above. To control for the effect of price reactions around EAs, I include $ABR_{i,q}$ which represents the size-adjusted, buy-and-hold return calculated from one day before to one day after firm i's quarter q EA (e.g., Bernard and Thomas 1989, 1990; Garfinkel and Sokobin 2006). Following Fama and French (1992) I also include $SIZE_{i,q}$ and $BTM_{i,q}$, denoting the market value of equity of firm i at the end of fiscal quarter q and the book-to-market ratio, i.e., the book value of equity at the end of firm i's fiscal quarter q divided by $SIZE_{i,q}$ (e.g., Doyle et al. 2006).

The $CONTROLS_k$ variable represents six variables that help ensure that the relation between ATV and future returns I document using portfolio and four-risk-factor adjustment tests are due to trading volume reactions to EAs and not some other previously documented effects. Specifically, I control for momentum, $MOMEN_{i,q}$ (e.g., Chan et al. 1996; Lee and Swaminathan 2000), earnings volatility, $EVOL_{i,q}$ (e.g., Dichev and Tang 2009; Cao and Narayanamoorthy 2012), size-adjusted stock return volatility, $SARVOL_{i,q}$ (e.g., Berkman et al. 2009), the relative bid-ask spread, $SPREAD_{i,q}$, the Amihud (2002) illiquidity or price impact measure, $AMIHUD_{i,q}$, and the stock's mean turnover during the last four quarters (including quarter q) prior to EA,

$PY\_TURN_{i,q}$ (e.g., Bhushan 1994; Lee and Swaminathan 2000). All these variables are measured as defined in the appendix.[14] Figure 1 presents the timeline of events.

According to my predictions, $\beta_{1,w}$ and $\beta_{2,w}$ are significantly positive (i.e., H1 and/ or H2), and $\beta_{4,w}$ is significantly negative (i.e., H3). To mitigate the impact of outliers and facilitate interpretation of the regression coefficients, all of the independent variables are sorted independently into deciles within each calendar quarter, scaled to range from −0.5 to 0.5 (e.g., Narayanamoorthy 2006; Livnat and Mendenhall 2006; Cao and Narayanamoorthy 2012).[15] Whenever a variable is used in the decile (quantile) rank adjusted form, a letter "d" ("q") is added to its name.

To control for cross-sectional and intertemporal correlation of residuals, I base reported t-statistics from estimating variants of Eq. (11) on standard errors clustered by firm and calendar quarter (e.g., Petersen 2009; Gow et al. 2010). Because tests using analysts' data are subject to concerns related to selection bias, and because analyst coverage may change the information environment of firms in ways that affect the relation between ATV and future returns (e.g., Crawford et al. 2012), I conduct all of my multivariate regression tests on a full sample of firms and on a sample of firms covered by analysts.[16]

4. Sample selection and descriptive statistics

The least restrictive sample consists of 6,844 firms (325,842 firm-quarters) whose shares are listed on NYSE, AMEX, or NASDAQ, at the intersection of Compustat and CRSP, from the first

[14] For notational simplicity, in the next chapters, I suppress the subscripts "$_{i,q}$" from all variables measured on a firm-quarter level.

[15] The advantage of the ranking procedure is that by regressing returns on these transformed variables, the coefficient on the independent variable corresponds to the return earned on an equally weighted portfolio that takes a long position in the top decile of the variable (coded as −0.5) and a short position in the bottom decile of the variable (coded as 0.5). As discussed in chapter 6.3.2, the inferences are the same when I use continuous variables.

[16] I avoid a look-ahead bias by using only information that would have been known at the time the portfolios were formed (when I conduct portfolio or four-risk-factor adjustment tests) or the multivariate regressions were estimated.

calendar quarter of 1976 to the fourth calendar quarter of 2011.[17] I construct my primary sample as follows. First, from the universe of firms at the intersection of Compustat and CRSP, I exclude stocks that do not have a CRSP share type code of 10 or 11 (e.g., ADRs; REITs; foreign companies; closed-end funds). Second, to avoid the undue effect of very small firms, I eliminate firms whose book value of equity, or share price, or market value of equity, or total assets, at the end of fiscal quarter q is below 0, or \$1, or \$5 million, or \$10 million (e.g., Livnat and Mendenhall 2006; Cao and Narayanamoorthy 2012). Third, because the estimation of *SUE* requires earnings data from the past 11 quarters, I eliminate firms with fewer than 12 consecutive quarters of data. Finally, because interim financial reports are only available starting in 1976, I restrict my analyses to firm-quarters with sufficient data to compute (i) size-adjusted, buy-and-hold returns, (ii) one of the two measures of ATV (i.e., *SUV* or *TR*), (iii) and *SUE*, from the first quarter of 1976 to the fourth quarter of 2011.[18] These steps result in a sample of 325,842 firm-quarters from 6,844 firms, spanning 1976-2011.

I obtain data on institutional investor holdings from the Thomson Financial Institutional Holdings (13f) database starting from 1980 (the earliest available) to 2011.[19] All factor returns are obtained from Ken French's data library via WRDS. Data limitations for observations in both the full and analyst-forecast samples reduce the sample size for some analyses.

Untabulated descriptive statistics of *SUV* and *TR* for each year in the sample indicate that the number of firms varies from a low of 1,177 firms in 1976 to a high of 3,521 firms in 1998. Consistent with Landsman and Maydew (2002), ATV at quarterly EAs increased significantly

[17] I use the terms "calendar quarter" and "quarter" interchangeably.
[18] More precisely, to increase the sample, I start the measurement of *SUE* from the second calendar quarter of 1973 and measure the size-adjusted, buy-and-hold returns up to the third calendar quarter of 2012.
[19] Section 13(f) of the Securities and Exchange Act of 1934, enacted by Congress on June 4, 1975, requires all institutional investors managing at least \$100 million in securities (or a lesser amount as the Commission may determine, but not less than \$10 million) to file a quarterly report of their holdings that are in excess or 10,000 shares or \$200,000 in market value.

over the period 1976-2011, the mean *SUV* (*TR*) in 1976 was 0.53 (1.56) compared to 1.61 (1.90) in 2011.

Panel A of table 1 presents distributional statistics for main variables used in the analyses. The means of size-adjusted, buy-and-hold returns are positive and the medians are negative due to the well-documented skewness in returns. Because I focus on returns to hedge portfolios that have equal long and short positions, the size adjustment to the returns has no effect. However, it aids in interpreting and comparing the returns to unhedged portfolios (e.g., a portfolio that invests only in the lowest decile of *SUV*).[20]

Panel B of table 1 presents the Pearson and Spearman correlation matrices. The correlations between *SUV* and *TR* are high (ranging from 0.38 to 0.85), consistent with them capturing the same underlying construct. At the same time, the correlations of these variables with *SUE* or *ABR* are low (ranging from −0.04 to 0.13), implying that trading volume reactions to EAs contain information not provided by price reactions or the magnitudes of earnings surprises.

Starting with Beaver (1968), a large number of studies document that ATV before an EA is low, but that it spikes on the announcement day and decreases slowly over the next several days (e.g., Landsman and Maydew 2002; Chae 2005; Hong and Stein 2007). This behavior of ATV is duplicated in panel A of figure 2. The figure shows the means of daily measures of ATV (i.e., $SUV_{i,t,q}$ and $TR_{i,t,q}$) during the period from 4 days before to 10 days after EAs. A closer investigation of the cross-sectional distribution of quarterly measures of ATV used in my analyses (i.e., $SUV_{i,q}$ and $TR_{i,q}$) reveals that, as shown in panel B of figure 2, there is a large cross-sectional variation in trading volume reactions to EAs across firm-quarters. Hence, although on average ATV spikes around earnings releases, for some firm-quarters ATV is low (i.e., lower than during the non-announcement periods) and for others it is high. This empirical

[20] My inferences remain the same when I use equally weighted or value-weighted market-adjusted returns.

observation calls into question whether and how this variation relates to investors' differential interpretation of earnings news and, thus, to future firm financial performance.

5. Results

5.1 H1: Abnormal trading volume and future returns

Table 2 presents the results of the portfolio tests, showing that, for both measures of ATV, the equally weighted mean abnormal returns across the top decile portfolios are significantly higher than those in the lowest deciles and are almost perfectly ordered for all returns horizons. The return difference is statistically significant at the 1% level and persists during the 240 trading-day (i.e., 1-year) period starting two days after an EA.[21]

As shown in table 2, the hedge portfolio returns to investment strategy based on *SUV* (*TR*) are 2.35% and 5% (3.78% and 6.68%) over the 60-day (240-day) periods, after an EA. On an annual basis, this implies that firms with higher *SUV* (*TR*) around EA significantly outperform those with lower *SUV* (*TR*) by 9.74% (16.00%). The hedge portfolio returns to investment strategy based on *TR* are almost twice those based on *SUV*.[22] As is shown in table 4 and discussed below, this return difference diminishes when I control for *ABR* and other variables.

Table 3 presents the Intercepts (hereafter "alphas") and factor loadings (i.e., *BETA*, *HML*, *SMB*, and *UMD*) corresponding to portfolios based on taking a long position in firms with higher *SUV* or *TR* and a short position in those with lower *SUV* or *TR*, obtained by estimating eq. (10). The alphas provide the proportion of hedge portfolio returns reported in table 2 that cannot be explained by the three Fama and French (1993)−*BETA*, *HML*, and *SMB*−and momentum−*UMD*−risk factors. As is shown in table 3, for both *SUV* and *TR*, the alphas for all returns measurement horizons are significantly positive (at least at the 5% level) and are

[21] In untabulated results, I find that the return difference for the 2- or 3-year (i.e., the 480- or 720-day) periods starting two days after an EA is not significantly different from that for the 1-year (i.e., 240-day) period.

[22] This seems to be due to the fact that *TR* captures both the trading volume and price reactions to EAs' effects on future returns, whereas *SUV* captures mostly the trading volume reactions' effect on future returns.

comparable to the hedge portfolio returns of table 2. For example, comparing the alphas in panel A (panel B) of table 3 to the hedge portfolio returns presented in table 2, for the 240-day period after an EA, i.e., 1-year period, 87.57% = 2.96/3.38 (78.44% = 5.24/6.68) of hedge returns obtained by taking a long position in firms with high *SUV* (*TR*) and short position in those with low *SUV* (*TR*) cannot be explained by the commonly used four risk factors.

Table 3 also reveals that, on average, firms with high ATV around EAs have higher *BETA*s (the differences range from 0.15 to 0.26), lower *HML*s (the differences range from −0.48 to −0.21), and statistically similar *UMD*s factor loadings than those with low ATV. This implies that firms with higher ATV around EAs tend to have slightly higher return co-movement correlation with the market, lower book-to-market ratios, and similar recent stock return performance than firms with lower ATV around EAs.

Table 4 present results from estimating several versions of eq. (11), where *SAR[2, .]* is the dependent variable, measured over periods of 60 days (columns (1)-(4) representing a 1-quarter period) and 240 days (i.e., columns (5)-(8), representing a 1-year period), starting two days after an EA. For instance, column (1) of table 4 contain the results of regressing *SAR[2, 61]* on deciles of *SUV* and deciles of *ABR*, *SIZE*, and *BTM* as control variables. As shown in table 4, for all return horizons (i.e., 1-quarter and 1-year, represented by returns measured on days 2 to 61 and 2 to 241 relative to EA), the coefficients on d*SUV* and d*TR* are significantly positive at the 1% level. The coefficients on d*SUV* (d*TR*), represent percentage hedge portfolio returns from taking a long position in stocks in the highest decile of *SUV* (*TR*) and a short position in those in the lowest decile. As table 4 shows, for 60-day and 240-day periods, starting two days after an EA, the hedge returns for *SUV* (*TR*) range from 2.79 to 2.93 (3.13 to 3.20) and 5.23 to 5.47 (5.79 to 6.09) percent, respectively.

Table 4 reveals that the hedge returns based on *SUV* and *TR* are close to each other and in contrast to the univariate analyses findings in table 2 the difference between the returns is negligible. Moreover, table 4 shows that, controlling for *MOMENTUM*, *EVOL*, *SARVOL*, *SPREAD*, *AMIHUD*, and *PY_TURN* does not affect the inference that firms with higher ATV around EAs outperform those with lower ATV over the short and long terms after an EA.

Comparing hedge portfolio returns associated with price reactions to EAs (represented by coefficients on d*ABR*) to those associated with trading volume reactions, table 4 reveals that the magnitudes of returns associated with trading volume reactions are significantly higher (at the 1% level). For example, the coefficient estimates on d*SUV*/d*TR* range from 2.79 to 6.09 whereas those on d*ABR* range from 2.02 to 4.39.

Prior research suggests that the coefficients on d*ABR* represent returns associated with market underreaction to earnings news (e.g., Foster et al. 1984, Chan et al. 1996, Garfinkel and Sokobin 2006). As is shown in table 4, the significant association between ATV (both *SUV* and *TR*) and future abnormal returns persists over all horizons and is much stronger than that of *ABR*. This result suggests that focusing on the price reactions to EAs to study patterns in post EA returns or investor perception of the earnings news, as in prior research, and overlooking the trading volume reactions, misses an important market phenomenon to understand investor behavior and patterns in firms' future returns.

Taken together, tables 2 to 4 provide evidence consistent with H1 that firms with higher ATV (measured either by *SUV* or *TR*) around EAs outperform those with lower ATV over short and long terms after the EA. Moreover, the positive relation between ATV and future returns cannot be explained by the three Fama and French (1993) and momentum risk-factors and is robust to controlling for various variables, including the price reaction to EAs.

5.2 H2: Abnormal trading volume, earnings surprises, and future returns

Panel A of table 5 presents results of portfolio tests based on measures of earnings surprises only. Consistent with prior literature (e.g., Foster et al. 1984; Bernard and Thomas 1989, 1990; Johnson and Schwartz 2005), the equally weighted mean abnormal returns for stocks in top decile portfolios are significantly higher than those in bottom deciles. Sorting firm-quarters based on *SUE*, one achieves return difference of 2.98% and 5.52% for the 60-day (i.e., 1-quarter) and 240-day (i.e., 1-year) periods, respectively, after an EA. All return differences are statistically significant at the 1% level.

Panel B of table 5 presents results of portfolio tests based on double sorting of firms into quintiles of *SUV* or *TR* and deciles of *SUE*. Consistent with H2, panel B of table 5 reveals that returns to combined strategies based on ATV and earnings surprises are much larger than those shown in table 2 for portfolios based on *SUV* or *TR* only or in panel A of table 5 for portfolios based on *SUE* only.

As is shown in panel B of table 5, an investment strategy based on taking a long position in stocks within the highest quintile of *SUV* and decile of *SUE* (quantile of *TR* and decile of *SUE*) and a short position in stocks within the lowest quantiles and deciles, generates significant abnormal returns (at the 1% level) of 5.17% and 8.17% (6.56% and 12.10%) over the 60-day and 240-day periods, respectively, after the EA. These returns are comparable to the sum of the hedge portfolio returns shown in table 2 for *SUV* (*TR*) only–i.e., 2.35% and 3.38% (3.78%, and 6.68%)–and those in table 5, panel A for *SUE* only–i.e., 2.98% and 5.52%–over the same horizons. Hence, returns associated with measures of ATV are not subsumed by those associated with earnings surprises. If anything, the combined sum is higher for longer horizons. On an annual basis the hedge returns to q*SUV*,d*SUE* (q*TR*,d*SUE*) investment strategy are 22.34%

(28.94%) compared to 9.74% (16.00%) when using *SUV* (*TR*) strategy only or 12.46% when using *SUE* strategy only.

Table 6 presents (similar to panels A and B of table 3), portfolio alphas and factor loadings corresponding to portfolios based on taking a long position in firms within the highest quintile of *SUV* (*TR*) and decile of *SUE* and a short position in those within lowest quintiles and deciles, obtained by estimating eq. (10). The alphas presented in table 6 provide the proportion of hedge portfolio returns reported in panel B of table 5 that cannot be explained by the three Fama and French (1993)−*BETA*, *HML*, and *SMB*−and momentum−*UMD*−risk-factors. As is shown in table 6, the alphas for all the returns measurement horizons are significantly positive (at least at the 5% level) and are comparable to the hedge portfolio returns reported in table 5. For example, for the 240-day (i.e., 1-year) period after an EA, 97.80% = 7.99/8.17 and 89.00% = 10.77/12.10 of hedge returns obtained by taking a long (combined with a short) position in firms within the highest (lowest) quintiles and deciles of *SUV* and *SUE*, and *TR* and *SUE*, respectively, cannot be explained by the commonly used four-risk factors.

Table 7 (similar to table 4) present results from estimating several versions of eq. (11), with *SUE* added as an additional control variable, where *SAR[2, .]* is the dependent variable, measured over periods of 60 days (i.e., columns (1)-(4), representing a 1-quarter period) and 240 days (i.e., columns (5)-(8), representing a 1-year period) starting two days after an EA. For all return measurement horizons the coefficients on *SUV* and *TR* are significantly positive at the 1% level for firm-quarters, even after controlling for *SUE* (which, consistent with prior literature, is also significantly positive at the 1% level).

As table 7 shows, controlling for *SUE*, the coefficients on *SUV* (*TR*) range from 2.50 to 2.58 (2.89 to 2.95) and 4.60 to 5.30 (5.56 to 6.11), when measured over 60-day and 240-day periods, respectively, after an EA. These hedge portfolio returns are comparable to those presented in table 4 for the corresponding horizons.

Collectively, tables 5 to 7 present evidence consistent with H2, i.e., returns associated with trading volume reactions to EAs are incremental to those associated with earnings surprises.

5.3 H3: Abnormal trading volume, investor sophistication, and future returns

Table 8 presents results of portfolio tests based on double sorting of firms into quintiles of *INST* and deciles of *SUV* or *TR*, using the difference-in-differences design. Consistent with H3 that the positive relation between ATV and future returns is weaker for firms with a higher proportion of shares held by sophisticated investors, table 8 shows that the difference between mean equal-weighted returns in top and bottom deciles of *SUV* or *TR* is decreasing when the quintile of INST is increasing. Within the lowest (highest) quintile of INST, the hedge portfolio returns for *SUV* or *TR* over the 60-day (i.e., 1-quarter) and 240-day periods after an EA are 6.66% or 6.43% (1.34% or 2.52%) and 13.05% or 12.91% (1.77% or 2.33%), respectively. Moreover, the return difference for both *SUV* and *TR* within the lowest quantile of *INST* is significant at the 1% level for all return measurement horizons. In contrast, the return difference within the highest quintile of *INST* is weakly significant (i.e., at the 10% level) for the longer horizons (i.e., over 240-day period after the EA).

Table 9 present results from estimating several versions of eq. (11), similar to those presented in tables 4 and 7, except that in table 9 I include d*INST* and an interaction term between d*INST* and d*SUV* or d*TR* as additional variables. Table 9 reveals that consistent with H3, the coefficients on the interaction term between d*INST* and d*SUV* or d*TR* is significantly negative across all regression specifications. This evidence indicates that, consistent with the results obtained in the portfolio tests and presented in table 8, the return difference between firms with high and low ATV around EAs is smaller for firms with a higher proportion of shares held by sophisticated investors. The effect is also economically large. For example, as shown in column (5) of panel A, table 9, the coefficient on d*SUV* is 6.31 and on d*SUV*× d*INST* is −11.05. This implies that, ignoring the effect of investor sophistication, the 240-day (i.e., 1-year) period return difference between firms in the highest and lowest deciles of *SUV* is on average 6.31%; however, for shares that are in the highest decile of *INST*, the return difference is reduced by 11.05%*0.5*0.5=2.76%, a reduction of 43.74% in total return difference.

Taken together, tables 8 and 9 provide evidence that consistent with H3 the positive relation between ATV around EAs and future returns is weaker for firms with higher proportion of shares held by sophisticated investors.

6. Robustness and additional analyses

6.1 Industry and time concentration

Trading volume reactions may vary across industries based on the importance of the EA (e.g., EAs might be less informative for R&D-intensive companies). One concern is that ATV is simply identifying a few industries that, ex-post, do unusually well over my sample periods. To see if this is the case, I first compare the composition of my sample of the Fama and French (1997) 48 industries (hereafter "48 industries") to the composition in the two extreme ATV portfolios. Untabulated results show that both extreme portfolios are well distributed across all industries, with the largest deviation from the sample of the 48 industries being in the banking industry. Banks are underweighted (overweighted) in portfolio 10 (1) by 3.44% to 7.16% (7.2% to 14.78%) depending on the sample and the measure of ATV.

To ensure that my results are not driven by this bank effect, I estimate eq. (11) after excluding banks from the sample. Columns (1)-(2) of table 10 present the coefficients from estimating eq. (11) without banks when the dependent variable is abnormal returns measured over the 240-day (i.e., 1-year) period starting two days after an EA.[23] As columns (1)-(2) show the coefficients on d*SUV* and d*TR* are significantly positive and equal to 5.08 and 4.95 compared to 4.96 and 5.14, respectively, as shown in columns (7) and (8) of panel A, table 9. Moreover, all other variables (e.g., $dSUV \times dINST$ and $dTR \times dINST$) are still significant at the 1% level with the predicted sign. Hence, none of my inferences is affected by excluding banks from the full and analyst-forecast samples.

In addition, I estimate eq. (11) after controlling for year and 48 industries fixed effects. As columns (3)-(4) in table 10 show, the coefficients on d*SUV* and d*TR* are significantly positive and on $dSUV \times dINST$ and $dTR \times dINST$ are significantly negative, implying that my inferences remain the same when I use this specification to test my hypotheses.

6.2 Controlling for confounding effects

6.2.1 The accrual anomaly

Prior research finds that investors overestimate the persistence of the accrual component of earnings and, therefore, tend to overprice accruals (e.g., Sloan 1996). Collins and Hribar (2000) and Doyle et al. (2006) provide evidence that this form of mispricing is distinct from the PEAD anomaly. Because this study shows that returns associated with trading volume reactions to EAs are distinct from those associated with earnings surprises, one concern is that this association is subsumed by the accrual anomaly. Specifically, one may argue that firms with higher ATV tend to have lower levels of accruals and thus their EAs are more informative as reflected by higher ATV. I control for the accrual effect by estimating eq. (11) with d*ACCRUAL*, measured as outlined in the appendix.

As is shown in columns (5)-(6) of table 10, the coefficients on d*SUV* and d*TR* are significantly positive and equal to 6.96 and 6.71, respectively. This suggests that, if any, controlling for d*ACCRUAL*, the association between ATV and future abnormal returns is significantly stronger and not weaker or less significant.

[23] For the sake of brevity, in this section I discuss (and present in Table 10) results from estimating eq. (11) for the 240-day (i.e., 1-year) period after the EA only. My inferences from estimating the revised versions of eq. (11) over the 60-day (i.e., 1-quarter) period are the same (untabulated).

6.2.2 Investor sophistication and earnings surprises

Bartov et al. (2000) find that the positive relation between earnings surprises and future returns is weaker for firms with a higher proportion of shares held by sophisticated investors. Bartov et al. (2000) interpret this finding as evidence that the market underreaction to earnings news is weaker when the proportion of firm shares held by institutional investors is higher. One concern is that the significantly negative coefficient on the interaction between d*INST* and d*SUV* or d*TR* documented in table 9 is because eq. (11) is missing an interaction term between d*INST* and d*SUE*.

To address this concern, I estimate eq. (11) with added interaction term between d*INST* and d*SUE*. As columns (7)-(8) of table 10 show the coefficients on d*SUV* and d*TR* are significantly positive and those on d*SUV*×d*INST* and d*TR*×d*INST* are significantly negative. Hence, none of my inferences is affected by controlling for the effect of investor sophistication on the relation between earnings surprises and future returns.

6.3 Alternative specifications

6.3.1 Alternative variable measurement

To ensure that my results are not limited to the proxies for ATV or earnings surprises I use, I conduct all of the reported analyses using alternative proxies.

First, instead of *TR*, I use the turnover difference, i.e. the difference between the numerator and the denominator of *TR*, and market-adjusted turnover difference, i.e. the difference between the numerator and denominator of *TR* after subtracting from each of them the average turnover of firms listed on NYSE, AMEX, or NASDAQ calculated during the same days.[24] My inferences are the same when I use these alternative proxies.

[24] The major shortcoming of these alternative proxies is that their use necessitates correction for problems associated with using volume data from NASDAQ. This is because the volumes on the NASDAQ and NYSE or AMEX markets are not comparable due to differences in their dealership structures. Specifically, as prior literature (e.g., Atkins and Dyl 1997; Anderson and Dyl 2005) finds, the NASDAQ volume is overstated by approximately 70% to

Second, instead of *SUE*, I calculate time-series-based earnings surprises, using the seasonal random walk with trend model (e.g., Bernard and Thomas 1989, 1990; Ball and Bartov 1996), and seasonal random walk model (i.e., the numerator of *SUE*) scaled by price from the last quarter-end. In my main analyses I do not use price as the deflator because, at least in the PEAD context, using price has the logical disadvantage of referring to a market-based measure at the same time that prior literature posits that the market is inefficient.[25]

Doyle et al. (2006) and Livnat and Mendenhall (2006) show that returns associated with earnings surprises based on analyst earnings forecasts are larger and persist for longer horizons (i.e., 720 trading days) than returns associated with time-series-based earnings forecasts (i.e., *SUE*), which are smaller and decrease for horizons longer than 240 trading days. To make sure that my results are not driven by the use of time-series based earnings forecast I compute analyst-forecast-based earnings surprise (*AFE*). For each firm-quarter, I calculate $AFE_{i,q}$ as the actual earnings per share minus the median analyst forecast during the 90-day period before the EA date, scaled by the absolute value of actual earnings per share. As an additional specification, I scale the analyst forecast errors (i.e., the numerator of *AFE*) by price from the last quarter-end (e.g., Livnat and Mendenhall 2006). My inferences are the same when I use these proxies for earnings surprises (which, by construction, limit the sample to firms followed by at least 3 analysts).

6.3.2 Continuous multivariate regressions

As discussed in section 3, to facilitate interpretation of the results and avoid the effect of outliers, all the independent variables used in my multivariate regression analyses are ranked into

100% relative to the NYSE volume. The common approach is to multiply these measures by 0.5 (e.g., Nagel 2005). I also try other parameters such as 0.6, 0.7, and 0.8 and obtain similar results.

[25] The inferences are the same when I calculate the earnings surprises by scaling by the market price per share at the beginning of quarter *q*.

deciles within each calendar quarter. One concern is that results shown in tables 4, 6, and 9 are sensitive to this specification. Hence, I estimate these equations using continuous independent variables. None of my results or inferences is affected by this specification.

In addition, results reported in tables 4, 6, and 9 are based on pooled OLS estimations with t-statistics based on standard errors clustered at the firm and calendar quarter levels. One concern is that the results hold in a pooled regression but not within each calendar quarter. Hence, I also estimate all the equations using Fama and MacBeth (1973) regression procedures with White (1980) standard errors corrected for heteroscedasticity. My inferences remain the same when I use these alternative estimation techniques.

6.3.3 Winsorizing the top and bottom 0.5% of the return variables

The dependent variables in all of the analyses are size-adjusted, buy-and-hold returns. One concern is that extreme high and low returns might drive the results.[26] To mitigate this concern, I winsorize the top and bottom 0.5% of the returns variables within each calendar quarter and reestimate all my analyses. My inferences are the same when I use this specification.

6.4 Time-series properties of abnormal trading volume portfolios

One concern is that sorting firms based on ATV around EAs results in taking, quarter after quarter, long (short) positions in the same firms that, ex-post, do unusually well (badly) over my sample periods. I address this concern by analyzing the time-series properties of firms' tendency to be assigned into same extreme portfolios.

Untabulated results indicate that approximately 87% (80%) of low *SUV* (*TR*) firms change portfolios from quarter to quarter. Similarly, approximately 84% (86%) of high *SUV* (*TR*) firms change portfolios from quarter to quarter. That more than 80% of extreme portfolios turn over each quarter reduces concerns that the *SUV*- and *TR*-return relation is concentrated among same

[26] This concern is not relevant for the independent variables as they are ranked into deciles in the first place.

firms with time-invariant specific characteristics. Analyzing the conditional relative frequencies for membership of *SUV* and *TR* portfolios in 4 consecutive quarters, I find low frequencies in the adjacent quarters and diminishing frequencies in the next quarters across all portfolios. This finding provides support to the observation that quarterly extreme portfolios of ATV do not consist of the same group of firms.

7. Summary and concluding remarks

Earnings announcements (EAs) result in investor reactions on two dimensions: price and trading volume. A growing body of literature asserts that the primary driver of trading volume reactions to public announcements is investor heterogeneity in the form of differential interpretation of the news. Another stream of literature offers a link between the level of investors' differential interpretations of public news and future firm performance. I adopt insights from these streams of literatures and investigate whether firms with higher abnormal trading volume (ATV) around EAs outperform those with lower ATV over the short and long terms following the EA. In addition, entertaining the idea that the proportion of trading volume reactions to EAs that is driven by investors' differential interpretations of the news is lower when the presence of rational investors is higher, I address whether any positive relation between ATV and future firm performance is weaker for firms with a higher proportion of shares held by sophisticated investors−a proxy for investor rationality.

Consistent with theories that attribute ATV around public announcements primarily to differing investor interpretations of the news and that link differential interpretation to future returns, I find that, for several quarters after an EA, firms in the highest decile of ATV significantly outperform those in the lowest decile. Further, I find that ATV and earnings surprises explain future returns incremental to the three Fama and French (1993) and momentum risk-factors. I also document that the level of investor sophistication−a proxy for investor rationality−attenuates the positive relation between ATV and future returns.

Taken together, my study offers contributions along several lines of inquiry. First, I show that trading volume reactions to EAs contain information about future stock returns incremental to that provided by the price reactions and the magnitudes of earnings surprises, the focus of the PEAD literature. Second, I show that the positive relation between ATV and future returns, is prolonged and persistent, which provides evidence that lends support to and links two streams of prior literature: the primary driver of ATV around EAs is investors' differential interpretations of the news, and such differential interpretations are positively related to future stock returns (i.e., there are no reversals in return differential over the 60 days following the EA). Third, by showing that the positive relation between ATV and future returns is weaker for firms with a higher proportion of shares held by sophisticated investors, I highlight the importance of a firm's investor base for the relation between trading volume reactions around EAs and future returns.

Appendix: Variable definitions

- ***SAR***[·, ·] is the size-adjusted, buy-and-hold return of firm *i* measured beginning two days after the earnings announcement for quarter *q* and extending 60 days (i.e., [2, 61]-day window) to 240 days (i.e., [2, 241]-day window) into the future.
- ***SUV*** is the standardized unexplained volume, measured as outlined in chapter 3.1.2.
- ***TR*** is turnover ratio, measured as outlined in chapter 3.1.2.
- ***SUE*** is the standardized unexpected earnings, measured as outlined in chapter 3.1.3.
- ***INST*** is the percentage of firm *i*'s common share institutional ownership at the beginning of calendar quarter *q*. *INST* is calculated as the ratio between the common share holdings for all section 13(f) filers for a given firm and the total number of shares outstanding at the beginning of quarter *q*.
- ***ABR*** is size-adjusted, buy-and-hold return of firm *i* measured beginning 1 day before the earnings announcement for quarter *q* and extending 1 day after the earnings announcement (i.e., [-1, 1]).
- ***SIZE*** is the market value of common equity of firm *i* at the end of fiscal quarter *q*. *SIZE* is calculated as the product of firm *i*'s closing price per share and number of shares outstanding at the end of fiscal quarter *q*.
- ***TA*** is total assets of firm *i* at the end of quarter *q*.
- ***BTM*** is the book-to-market ratio, defined as the ratio of firm *i*'s book value of equity to the market value of equity at the end of fiscal quarter *q*.
- ***MOMEN*** is momentum, calculated as firm *i*'s size-adjusted, buy-and-hold stock return for the six month prior to the earnings announcement, ending one month before the earnings announcement date for quarter *q*.
- ***EVOL*** is earnings volatility, measured following Dichev and Tang (2009) and Cao and Narayanamoorthy (2012) as the variance of the most recent eight quarterly earnings (i.e., net income before extraordinary items), including quarter *q*, of firm *i* scaled by average total assets from the beginning and the end of quarter *q*.
- ***SARVOL*** is size-adjusted return volatility, defined as the standard deviation of firm *i*'s daily abnormal stock return relative to returns for NYSE/AMEX/NASDAQ firms in the same size decile. *SARVOL* is calculated during a 50-day control period [−54, −5] ending 5 days prior to quarter *q*'s earnings announcement date.
- ***SPREAD*** is the relative bid-ask spread, defined as the difference between firm *i*'s closing ask and bid prices divided by the average of the closing ask and bid prices. *SPREAD* calculated as the average relative bid-ask spread during a 50-day control period [−54, −5] ending 5 days prior to quarter *q*'s earnings announcement date.
- ***AMIHUD*** is price impact (a measure of stock *i*'s illiquidity), estimated following Amihud (2002) as a ratio between daily unsigned movement in stock returns divided by dollar trading volume: $|RET_{i,d}|/DVOLUME_{i,d}$. $|RET_{i,d}|$ is the raw return of stock *i* during trading day *d* and $DVOLUME_{i,d}$ is the total amount of dollar trading volume of stock i

during trading day d. *AMIHUD* calculated as the average price impact during a 50-day control period [−54, −5] ending 5 days prior to quarter *q*'s earnings announcement date.

- ***PY_TURN*** is past year turnover, computed as the sum of the ratios between the number of firm *i*'s shares traded in each quarter during the past four quarters (including quarter *q*) and the number of shares outstanding at the end of each quarter.
- ***ACCRUAL*** is the accrual component of firm *i*'s earnings for quarter *q*. *ACCRUAL* is measured as the difference between firm *i*'s net income before extraordinary items and cash flow from operations for quarter *q*, scaled by average total assets from the beginning and the end of quarter *q* (e.g., Collins and Hribar, 2000).

References

Admati, A.R. and P. Pfleiderer. 1988. A Theory of Intraday Patterns: Volume and Price Variability. *Review of Financial Studies* 1: 3-40.

Amihud, Y. 2002. Illiquidity and Stock Returns: Cross-Section and Time-Series Effects. *Journal of Financial Markets*, 5(1): 31-56.

Atkins, A. B. and E. A. Dyl. 1997. Transactions Costs and Holding Periods for Common Stocks. *The Journal of Finance*, 53(1): 309-325.

Aumann, R. J. 1976. Agreeing to Disagree. *The Annals of Statistics*, 4(6): 1236-1239.

Ball, R. and E. Bartov. 1996. How Naïve is the Stock Market's Use of Earnings Information? *Journal of Accounting and Economics*, 21: 319-337.

Bamber, L. S. and Y. S. Cheon. 1995. Differential Price and Volume Reactions to Accounting Earnings Announcements. *The Accounting Review*, 70(3): 417-441.

Bamber, L. S., O. E. Barron, and T. L. Stober. 1997. Trading Volume and Different Aspects of Disagreement Coincident with Earnings Announcements. *The Accounting Review*, 72(4): 575-597.

Bamber, L. S., O. E. Barron, and T. L. Stober. 1999. Differential Interpretations and Trading Volume. *The Journal of Financial and Quantitative Analysis*, 34(3): 369-386.

Bamber, L. S., O. E. Barron, and D. E.Stevens. 2011. Trading Volume Around Earnings Announcements and Other Financial Reports: Theory, Research Design, Empirical Evidence, and Directions for Future Research. *Contemporary Accounting Research*, 28(2): 431-471.

Banerjee, S. 2011. Learning from Prices and the Dispersion in Beliefs. *The Review of Financial* Studies, 24(9): 3025-3068.

Banerjee, S. and I. Kremer. 2010. Disagreement and Learning: Dynamic Patterns of Trade. *The Journal of Finance*, 65(4): 1269-1302.

Bartov, E., S. Radhakrishnan, and I. Krinsky. 2000. Investor Sophistication and Patterns in Stock Returns after Earnings Announcements. *The Accounting Review*, 75(1): 43-63.

Barron, O. E., D. G. Harris, and M. Stanford. 2005. Evidence That Investors Trade on Private Event-Period Information around Earnings Announcements. *The Accounting Review*, 80(2): 403-421.

Beaver, W. 1968. The information Content of Annual Earnings Announcements. *Journal of* Accounting *Research*, 6: 67-92.

Beaver, W., M. McNichols, and R. Price. 2007. Delisting Returns and their Effect on Accounting-Based Market Anomalies. *Journal of Accounting and Economics* 43: 341-368.

Berkman, H., V. Dimitrov, P. Jain, P. Koch, and S. Tice. 2009. Sell on the News: Differences of Opinion, Short-Sale Constraints, and Returns around Earnings Announcements. *Journal of Financial Economics* 92: 376-399.

Bernard, V. L. and J. K. Thomas. 1989. Post-Earnings-Announcement Drift: Delayed Price Response or Risk Premium? *Journal of Accounting Research*, 27: 1-48.

Bernard, V. L. and J. K. Thomas. 1990. Evidence that Stock Prices Do Not Fully Reflect the Implications of Current Earnings for Future Earnings. *Journal of Accounting and Economics*, 13: 305-340.

Blume, L., D. Easly, and M. O'Hara. 1994. Market Statistics and Technical Analysis: The Role of Volume. *The Journal of Finance*, 49(1): 153-181.

Bhushan, R. 1994. An Informational Efficiency Perspective on the Post-Earnings Announcement Drift. *Journal of Accounting and Economics*, 18: 45-65.

Cao, S. S. and G. S. Narayanamoorthy. 2012. Earnings Volatility, Post-Earnings Announcement Drift, and Trading Frictions. *Journal of Accounting Research*, 50(1): 41-74.

Carhart, M. M. 1997. On Persistence in Mutual Fund Performance. *The Journal of Finance* 52(1): 57-82.

Chae, J. 2005. Trading Volume, Information Asymmetry, and Timing Information. *The Journal Finance*, 60(1): 413-442.

Chan, L. K. C., N. Jegadeesh, and J. Lakonishok. 1996. Momentum Strategies. *The Journal of Finance*, 52(5): 1681-1713.

Chen, J., H. Hong, and J. Stein. 2002. Breadth of Ownership and Stock Returns. *Journal of Financial Economics*, 66: 171-205.

Chordia, T. and L. Shivakumar. 2005. Inflation Illusion and Post-Earnings Announcement Drift. *Journal of Accounting and Research*, 43(4): 521-556.

Collins, D. and P. Hribar. 2000. Earnings-Based and Accrual-Based Market Anomalies: One Effect or Two? *Journal of Accounting and Economics* 29: 101-123.

Crawford, S. S., D. T. Roulstone, and E. C. So. 2012. Analyst Initiation of Coverage and Stock Return Synchronicity. *The Accounting Review*, 87(5): 1527-1553.

Diamond, D. and R. Verrecchia. 1987. Constraints on Short-Selling and Asset Price Adjustment to Private Information. *Journal of Financial Economics* 18: 277-311.

Dichev, I. and V. W. Tang. 2009. Earnings Volatility and Earnings Predictability. *Journal of Accounting and Economics* 47: 160-181.

Diether, K., C. Malloy, and A. Scherbina. 2002. Differences of Opinions and the Cross Section of Stock Returns . *Journal of Finance* 57(5): 2113-2141.

Doyle, J. T., R. J. Lundholm, and M. T. Soliman. 2006. The Extreme Future Stock Returns Following I/B/E/S Earnings Surprises. *Journal of Accounting Research*, 44(5): 849-887.

Epstein, L. G. and M. Schneider. 2008. Ambiguity, Information Quality, and Asset Pricing. *The Journal of Finance*, 63(1): 197-228.

Hand, J. R. M. 1990. A Test of the Extended Functional Fixation Hypothesis. *The Accounting Review*, 65(4): 740-763.

Fama, E. F. and K. R. French. 1992. The Cross Section of Expected Stock Returns. *The Journal of Finance*, 47(2): 427-465.

Fama, E. F. and K. R. French. 1993. Common Risk Factors in the Returns on Stocks and Bonds. *Journal of Financial Economics* 33: 3-56.

Fama, E. F. and K. R. French. 1997. Industry Costs of Equity. *Journal of Financial Economics*, 43: 153–193.

Fama, E. F. and J. MacBeth. 1973. Risk, Return and Equilibrium: Empirical Tests. *Journal of Political Economy* 81, 607-636.

Foster, G., C. Olsen, and T. Shevlin. 1984. Earnings Releases, Anomalies, and the Behavior of Security Returns. *The Accounting Review*, 59(4): 574-603.

Garfinkel, J. A., and J. Sokobin. 2006. Volume, Opinion Divergence, and Returns: A Study of Post-Earnings Announcement Drift. *Journal of Accounting Research*, 44(1): 85-112.

Gervais, S., R. Kaniel, and D. H. Mingelgrin. 2001. The High-Volume Return Premium. *The Journal of Finance*, 56(3): 877-919.

Gow, I. D., G. Ormazabal, and D. J. Taylor. 2010. Correcting for Cross Sectional and Time-Series Dependence in Accounting Research. *The Accounting Review*, 85(2): 483 512.

Gould, J. F. and A. W. Kleidon. 1994. Market Maker Activity on Nasdaq: Implications for Trading Volume. *Stanford Journal of Law*, *Business & Finance*, 1: 11-24.

Grabbe, L. and M. A. Post. 1994. The Effect of a Rating Downgrade on Outstanding Commercial Paper. *The Journal of Finance*, 49(1): 39-56.

Grossman, S. J. and J. E. Stiglitz. 1980. On the Impossibility of Informationally Efficient Markets. *The American Economic Review*, 70(3): 393-408.

Grundy, B. D., and M. McNichols. 1989. Trade and the Revelation of Information through Prices and Direct Disclosure. *Review of Financial Studies*, 2(4): 495-526.

Harris, M. and A. Raviv. 1993. Difference of Opinion Make a Horse Race. *Review of Financial Studies* 6: 473-506.

Holthausen, R.W. and R.E. Verrecchia. 1990. The effect of Informedness and Consensus on Price and Volume Behavior. *The Accounting Review* 65, 191-208.

Hong, H. and J. C. Stein. 2003. Differences of Opinion, Short-Sales Constraints, and Market Crashes. *Review of Financial Studies*, 16(2): 487-525.

Hong, H. and J. C. Stein. 2007. Disagreement and the Stock Market. *Journal of Economic Perspectives*, 21(2): 109-128.

Indjejikian, R. J. 1991. The Impact of Costly Information Interpretation on Firm Disclosure Decisions. *Journal of Accounting Research* 29, 277-301.

Johnson, W. and W. C. Schwartz. 2005. Are Investors Misled by Pro Forma Earnings? *Contemporary Accounting Research* 22: 915-963.

Johnson, T. L. and E. C. So. 2012. The Option to Stock Volume Ratio and Future Returns. *Journal of Accounting and Economics*, 106: 262-286.

Kandel, E. and N. D. Pearson. 1995. Differential Interpretation of Public Signals and Trade in Speculative Markets. *Journal of Political Economy* 103(4): 831-872.

Karpoff, J. 1987. The Relation between Price Changes and Trading Volume: A Survey. *Journal of Financial and Quantitative Analysis* 22: 109-126.

Kyle, A. S. 1985. Continuous Auctions and Insider Trading. *Econometrica*, 53(6): 1315-1335.

Kim, O. and R. E. Verrecchia. 1991a. Trading Volume and Price Reactions to Public Announcements. *Journal of Accounting Research*, 29(2): 302-321.

Kim, O. and R. E. Verrecchia. 1991b. Market Reaction to Anticipated Announcements. *Journal of Financial Economics*, 30: 273-309.

Kim, O. and R. E. Verrecchia. 1994. Market Liquidity and Volume around Earnings Announcements. *Journal of Accounting and Economics*, 17:41–67.
Kim, O. and R. E. Verrecchia. 1997. Pre-announcement and Event-period Private Information. *Journal of Accounting and Economics*, 24: 395-419.
Landsman, W. R. and E. L. Maydew. 2002. Has the Information Content of Quarterly Earnings Announcements Declined in the Past Three Decades? *Journal of Accounting Research*, 40(3): 797-808.
Lee, C. M. C. and B. Swaminathan. 2000. Price Momentum and Trading Volume. *The Journal of Finance*, 55(5): 2017-2069.
Liang, I. 2003. Post-Earnings Announcement Drift and Market Participants' Information Processing Biases. *Review of Accounting Studies*, 8(2-3): 321-345.
Livnat, J., and R. R. Mendenhall. 2006. Compering the Post-Earnings Announcement Drift for Surprises Calculated from Analyst and Time Series Forecasts. *Journal of Accounting Research*, 44(1): 177-205.
Milgrom, P. and N. Stokey. 1982. Information, Trade and Common Knowledge. *Journal of Economic Theory*, 26: 17-27.
Miller, E. 1977. Risk, Uncertainty, and Divergence of Opinion. *Journal of Finance* 32(4): 1151-1168.
Nagel, S. 2005. Short Sales, Institutional Investors, and the Cross Section of Stock Returns. *Journal of Financial Economics* 78: 277-309.
Narayanamoorthy, G. 2006. Conservatizm and Cross-Sectional Variation in the Post-Earnings Announcement Drift. *Journal of Accounting Research*, 44(4): 763-789.
Petersen, M. A. 2009. Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches. *Review of Financial Studies*, 22(1): 435-480.
Pfleiderer, P. 1984. The Volume of Trade and the Variability of Prices: A Framework for Analysis in Noisy Rational Expectations Equilibria. *Working Paper* Stanford University.
Piotroski, J. 2000. Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers. *Journal of Accounting Research*, 38(Sup): 1-41.
Qu, S., L. Starks, and H. Yan. 2004. Risk, Dispersion of Analyst Forecasts and Stock Returns. *Working Paper*, University of Texas at Austin.
Ross, S. 1989. Discussion: Intertemporal Asset Pricing. In *Theory of Valuation*, ed. S. Bhattacharya and G. Constantinides, 85-96. Totowa, NJ: Rowman & Littlefield.
Shumway, T. 1997. The Delisting Bias in CRSP Data. *Journal of Finance*, 52(1): 327–340.
Shumway, T. and V. Warther. 1999. The Delisting Bias in CRSP's Nasdaq Data and Its Implications for the Size Effect. *Journal of Finance*, 54 (6): 2361–2389.
Sloan, R. 1996. Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings? *The Accounting Review*, 71(3): 289-316.
Utama, S. and W. M. Cready. 1997. Institutional Ownership, Differential Predisclosure Precision and Trading Volume at Announcement Dates. *Journal of Accounting and Economics,* 24(2): 129-150.

Varian, H. R. 1985. Divergence of Opinion in Complete Markets: A Note. *The Journal of Finance*, 40(1): 309-317.

Varian, H. R. 1989. Differences of Opinion in Financial Markets. In *Financial Risk: Theory, Evidence and Implications: Proceedings of the 11th Annual Economic Policy Conference of the Federal Reserve Bank of St. Louis*, pages 3–37.

Verrecchia, R. E. 1981. On the Relationship between Volume Reaction and Consensus of Investors: Implications for Interpreting Tests of Information Content. *Journal of Accounting Research*, 19(1): 271-283.

Walther, B. 1997. Investor Sophistication and Market Earnings Expectations. *Journal of Accounting Research*, 35(2): 157-179.

White, H. 1980. A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica*, 48(4): 817-838.

Figure 1: Timeline of events

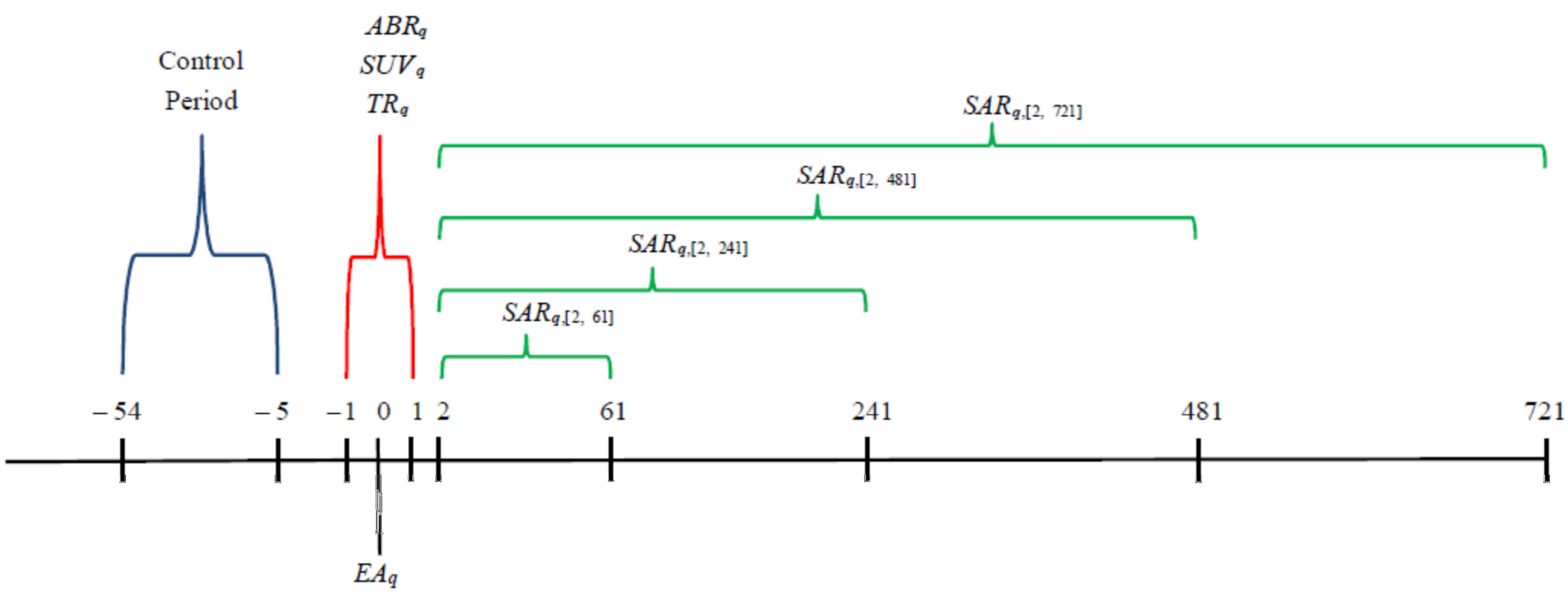

Figure 2: Abnormal trading volume around earnings announcements

Panel A presents means of $SUV_{i,t,q}$ and $TR_{i,t,q}$ during the period from 4 days before to 10 days after earnings announcements (i.e., $t \in [-4, 10]$) of all firm-quarters in the sample (i.e., i = 314,075 for *SUV* and i = 325,842 for *TR*) across all calendar quarters studied in this paper (i.e., $q \in$[1976Q1, 2011Q4]). $SUV_{i,t,q}$ and $TR_{i,t,q}$ denote standardized unexplained volume and turnover ratio, respectively, during day t relative to a quarterly earnings announcement day (i.e., day 0) of firm i in calendar quarter q, measured as outlined in chapter 3.1.2. Panel B presents cross-sectional distribution of $SUV_{i,q}$ and $TR_{i,q}$ for all firm-quarters in the sample (i.e., i = 314,075 for *SUV* and i = 325,842 for *TR*) across all calendar quarters studied in this paper (i.e., $q \in$[1976Q1, 2011Q4]). $SUV_{i,q}$ and $TR_{i,q}$ denote standardized unexplained volume and turnover ratio, respectively, of firm i in calendar quarter q, measured as outlined in chapter 3.1.2.

Panel A: Time-series means of measures of abnormal trading volume around earnings announcements

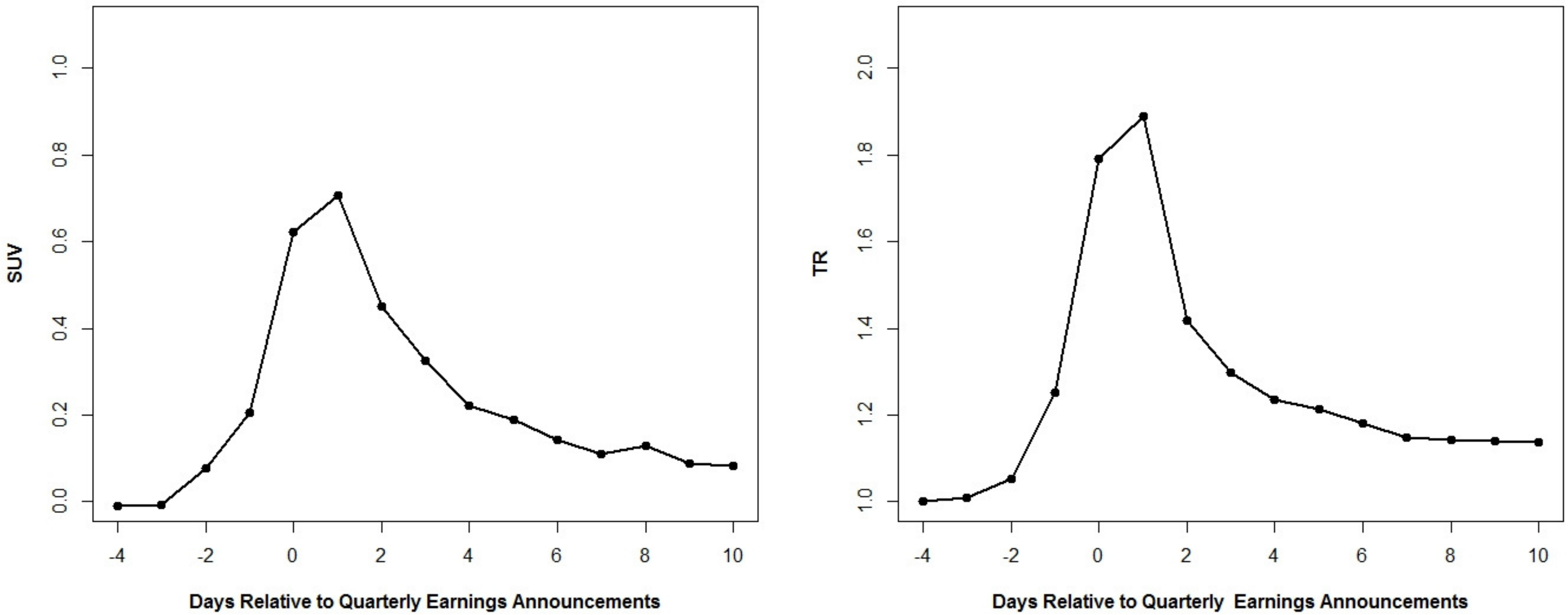

Figure 2 (Cont'd): Abnormal trading volume around earnings announcements

Panel B: Cross-sectional distribution of measures of abnormal trading volume around earnings announcements

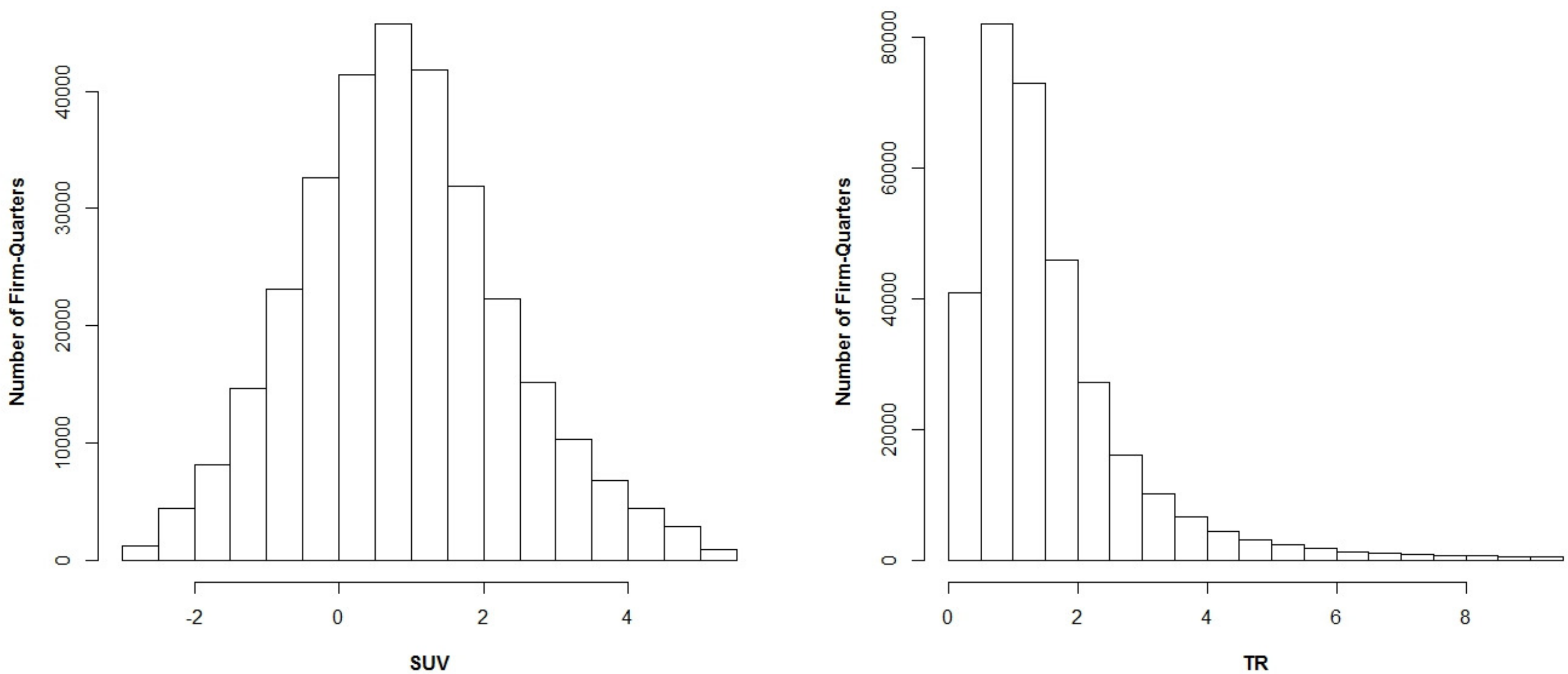

Table 1: Descriptive statistics

Panel A provides sample size information and descriptive statistics of $SUV_{i,q}$ and $TR_{i,q}$ for the full (analyst-forecast) sample of firms, where $SUV_{i,q}$ and $TR_{i,q}$ represent the standardized unexplained volume and the turnover ratio, respectively, of firm *i* in quarter *q* measured as outlined in chapter 3.1.2. Panel A presents descriptive statistics of the main variables used in the analyses. For ease of exposition, the values of *EVOL, SARVOL*, and *AMIHUD* are multiplied by 10^3, 10^3, and 10^5, respectively. Panel B reports the Spearman and Pearson correlation coefficients between the variables. *N* represents the number of firm-quarters across which the descriptives for a given year or variable are calculated. All other variables are defined in the appendix.

Panel A: Variables descriptive statistics

	N	MEAN	STDV	P25	P50	P75
SUV	314,075	0.89	1.61	-0.12	0.81	1.78
TR	325,842	1.74	2.97	0.74	1.23	1.99
SAR[2, 61]	325,842	0.15	22.00	-9.87	-0.48	9.64
SAR[2, 121]	325,842	0.40	35.30	-14.88	-0.74	14.47
SAR[2, 181]	325,842	0.86	47.30	-18.99	-1.07	18.53
SAR[2, 241]	323,346	0.54	60.60	-22.76	-1.34	22.49
SUE	264,231	0.13	1.29	-0.59	0.10	0.79
INST	215,432	0.43	0.27	0.20	0.41	0.65
ABR	325,842	0.46	7.95	-2.92	0.12	3.48
SIZE ($ M)	325,842	2140.00	11434.98	67.24	232.98	916.77
BTM	325,842	0.71	0.58	0.36	0.58	0.89

Panel B: Pearson (Spearman) correlations above (below) diagonal between main variables

	SUV	*TR*	*SUE*	*INST*	*ABR*	*SIZE*	*BTM*
SUV		0.38	0.05	0.19	0.03	0.10	-0.11
TR	0.85		0.04	0.01	0.13	0.06	-0.01
SUE	0.07	0.07		0.04	0.13	0.03	-0.10
INST	0.17	0.10	0.04		0.00	0.12	-0.18
ABR	0.05	0.08	0.17	0.02		-0.01	0.04
SIZE	0.21	0.13	0.04	0.36	0.00		-0.10
BTM	-0.15	-0.10	-0.10	-0.22	0.01	-0.42	

Table 2: Size-adjusted, buy-and-hold returns across deciles of *SUV* and *TR*

This table presents the time-series average equal-weighted size-adjusted, buy-and-hold returns by deciles of $SUV_{i,q}$, and $TR_{i,q}$ (i.e., d*SUV* and d*TR*). $SUV_{i,q}$ and $TR_{i,q}$ represent the standardized unexplained volume and the turnover ratio, respectively, of firm *i* in quarter *q*, measured as outlined in chapter 3.1.2. The number of stocks included in each decile portfolio is reported in brackets below the returns. Decile portfolios are formed within each calendar quarter, ranging from 1 to 10 with the highest (lowest) values located in the 10th (1st) decile. All returns are measured beginning two days after the earnings announcement for quarter *q* and extending 60 days (i.e., [2, 61]-day window, representing a 1-quarter period) to 240 days (i.e., [2, 241]-day window, representing a 1-year period). The sample consists of firm-quarters spanning 1976 through 2011.All returns are shown as percentages. The t-statistics are calculated using the time-series difference in returns between the 10th and 1st deciles. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

	Days relative to quarterly earnings announcement				
	−1 to 1	2 to 61	2 to 121	2 to 181	2 to 241
d*SUV*	Size-adjusted, buy-and-hold returns, %				
1 (Low)	-0.10	-0.32	0.57	1.80	3.22
	(31,478)	(31,478)	(31,478)	(31,478)	(31,229)
5	0.37	1.10	2.23	3.69	5.50
	(31,418)	(31,418)	(31,418)	(31,418)	(31,169)
10 (High)	0.74	2.04	3.49	5.03	6.60
	(31,463)	(31,463)	(31,463)	(31,463)	(31,214)
High−Low	0.84***	2.35***	2.92***	3.23***	3.38***
(t-stat)	(10.40)	(13.40)	(10.50)	(8.94)	(6.90)
Fraction of 240 day return		0.70	0.86	0.96	1.00
d*TR*					
1 (Low)	-0.23	-0.33	0.67	2.04	3.77
	(32,650)	(32,650)	(32,650)	(32,650)	(32,400)
5	0.29	0.91	1.81	2.99	4.32
	(32,605)	(32,605)	(32,605)	(32,605)	(32,356)
10 (High)	1.66	3.45	5.69	8.13	10.45
	(32,639)	(32,639)	(32,639)	(32,639)	(32,389)
High−Low	1.89***	3.78***	5.02***	6.09***	6.68***
(t-stat)	(20.90)	(20.70)	(16.90)	(15.80)	(13.60)
Fraction of 240 day return		0.57	0.75	0.91	1.00

Table 3: Four-risk-factor-adjusted returns by deciles of *SUV* and *TR*

This table presents factor loadings across deciles of $SUV_{i,q}$ obtained by estimating eq. (10) – presented below–where $SUV_{i,q}$ represents the standardized unexplained volume of firm *i* in quarter *q* measured as outlined in chapter 3.1.2. Decile portfolios are formed within each calendar quarter, ranging from 1 to 10 with the highest (lowest) values located in the 10th (1st) decile. Panels A1 and B1 are defined analogously for $TR_{i,q}$, where $TR_{i,q}$ represents the turnover ratio of firm *i* in quarter *q* measured as outlined in chapter 3.1.2. All returns are measured beginning two days after the earnings announcement for quarter *q* and extending 60 days (i.e., [2, 61]-day window, representing 1-quarter period) to 240 days (i.e., [2, 241]-day window, representing 1-year period). The Intercept denotes portfolio alphas and the *BETA*, *HML*, *SMB*, and *UMD* denote window period returns associated with the market return minus risk-free rate, high-minus-low market-to-book, small-minus-big, and momentum strategies, respectively, over the [2, 61]- and [2, 241]-day windows. The sample employed in panels A and B consists of 314,075 (325,842) firm-quarters for returns in the [2, 61]-day window and 311,587 (323,346) for returns in the [2, 241]-day window spanning 1976 through 2011. All returns are shown as percentages, t-statistics are shown in parentheses. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

$$RET^{p}_{q,w} - RET^{f}_{q,w} = \alpha^{p} + \beta^{p}_{1}(RET^{mkt}_{q,w} - RET^{f}_{q,w}) + \beta^{p}_{2} HML_{q,w} + \beta^{p}_{3} SMB_{q,w} + \beta^{p}_{4} UMD_{q,w} + \varepsilon_{w}$$

Panel A: Factor loadings across deciles of *SUV*

	Days relative to quarterly earnings announcement									
	2 to 61					2 to 241				
	Intercept	*BETA*	*HML*	*SMB*	*UMD*	Intercept	*BETA*	*HML*	*SMB*	*UMD*
1(Low)	-0.01	0.94	0.28	0.69	-0.09	2.45	1.01	0.32	0.84	-0.04
	(-0.04)	(26.31)	(5.34)	(13.18)	(-2.59)	(3.48)	(23.34)	(6.02)	(13.18)	(-0.87)
5	1.21	0.97	0.32	0.79	-0.09	3.78	1.12	0.40	0.86	0.00
	(5.37)	(27.10)	(6.27)	(14.78)	(-2.59)	(4.97)	(28.99)	(8.33)	(15.33)	(0.06)
10(High)	2.23	1.09	-0.04	0.78	-0.11	5.41	1.17	0.02	0.87	-0.01
	(8.62)	(26.22)	(-0.73)	(13.02)	(-2.84)	(6.12)	(26.11)	(0.35)	(13.30)	(-0.21)
High–Low	2.24***	0.15***	-0.32***	0.09	-0.02	2.96***	0.17***	-0.30***	0.03	0.03
(t-stat)	(6.55)	(2.69)	(-4.10)	(1.11)	(-0.40)	(3.51)	(2.69)	(-3.93)	(0.37)	(0.45)

Panel B: Factor loadings across deciles of *TR*

	Days relative to quarterly earnings announcement									
	2 to 61					2 to 241				
	Intercept	*BETA*	*HML*	*SMB*	*UMD*	Intercept	*BETA*	*HML*	*SMB*	*UMD*
1(Low)	-0.04	0.84	0.40	0.82	-0.03	3.22	0.95	0.47	0.92	0.02
	(-0.15)	(20.58)	(6.81)	(13.67)	(-0.71)	(3.26)	(18.76)	(7.52)	(12.36)	(0.41)
5	1.02	0.98	0.24	0.76	-0.10	2.90	1.08	0.26	0.80	0.03
	(5.27)	(31.95)	(5.47)	(16.68)	(-3.47)	(4.88)	(35.97)	(7.01)	(18.22)	(0.97)
10(High)	3.60	1.02	0.19	1.02	-0.13	8.46	1.21	0.23	1.21	-0.01
	(11.70)	(20.15)	(2.75)	(13.87)	(-2.79)	(8.31)	(23.09)	(3.63)	(15.87)	(-0.22)
High–Low	3.64***	0.18***	-0.21**	0.20**	-0.11*	5.24***	0.26***	-0.24***	0.29***	-0.03
(t-stat)	(9.16)	(2.79)	(-2.27)	(2.13)	(-1.74)	(3.70)	(3.62)	(-2.64)	(2.71)	(-0.44)

Table 4: Regression tests of the relation between *SUV* or *TR* and future returns

This table presents pooled cross-sectional regression results from estimating several versions of eq. (11), presented below. The results obtained by regressing size-adjusted, buy-and-hold returns measured beginning two days after the earnings announcement for quarter q and extending 60 days (i.e., [2, 61]-day window, representing 1-quarter period) to 240 days (i.e., [2, 241]-day window, representing 1-year period) on deciles of $SUV_{i,q}$ or $TR_{i,q}$. and other control variables. *CONTROLS* represents: $MOMEN_{i,q}$, $EVOL_{i,q}$, $SARVOL_{i,q}$, $SPREAD_{i,q}$, $AMIHUD_{i,q}$, and $PY\_TURN_{i,q.}$ All variables are measured as outlined in the appendix. Decile portfolios are formed within each calendar quarter, ranging from 1 to 10, with the highest (lowest) values located in the 10th (1st) decile, respectively. The sample consists of firm-quarters as indicated in the table spanning 1976 through 2011. The resulting t-statistics, presented in parentheses below the coefficients, are corrected for heteroskedasticity and cross-sectional and time-series correlations using a two-way cluster at the firm and calendar quarter levels. ***, **, and * indicate the coefficient is significant at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

$$SAR_{i,q,w} = \alpha_{0,w} + \beta_{1,w} ATV_{i,q} + \beta_{2,w} ABR_{i,q} + \beta_{3,w} SIZE_{i,q} + \beta_{4,w} BTM_{i,q} + \beta_{k,w} \sum_k CONTROLS_{k,i,q} + \varepsilon_{i,q,w}$$

Multivariate regression tests of H1									
		Days relative to quarterly earnings announcement							
		2 to 61				2 to 241			
	Pred.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
d*SUV*	+	2.79***		2.93***		5.47***		5.23***	
		(7.62)		(9.36)		(5.73)		(6.41)	
d*TR*	+		3.13***		3.20***		6.09***		5.79***
			(9.17)		(10.70)		(6.67)		(7.46)
d*ABR*		2.11***	2.02***	2.23***	2.14***	4.39***	4.25***	3.99***	3.91***
		(10.00)	(9.51)	(8.90)	(8.54)	(6.76)	(6.52)	(5.19)	(5.07)
d*SIZE*		-2.54***	-2.41***	-2.74**	-2.40**	-12.12***	-11.85***	-9.48***	-9.14***
		(-7.89)	(-7.55)	(-2.44)	(-2.10)	(-11.61)	(-11.62)	(-2.88)	(-2.80)
d*BTM*		0.96	0.99	2.07***	2.11***	3.59*	3.70*	8.32***	8.42***
		(1.29)	(1.33)	(3.13)	(3.22)	(1.65)	(1.71)	(4.37)	(4.43)
CONTROLS		NO		YES		NO		YES	
Adj.R^2 (%)		0.41	0.46	0.59	0.63	0.62	0.64	1.00	1.02
N		314,075	325,842	229,880	237,345	311,587	323,346	227,429	234,886

Table 5: Size-adjusted, buy-and-hold returns by quintiles of *SUV* or *TR* and deciles of *SUE*

Panel A presents the time-series average equal weighted size-adjusted, buy-and-hold returns by deciles of $SUE_{i,q}$ (i.e., d*SUE*). Panel B presents the time-series average equal weighted size-adjusted, buy-and-hold returns by quintiles of $SUV_{i,q}$ or $TR_{i,q}$ (i.e., q*SUV* or q*TR*, respectively) and deciles of $SUE_{i,q}$. All variables are measured as outlined in the appendix. The number of stocks included in each decile portfolio is reported in brackets below the returns. Quintile and decile portfolios are formed independently within each calendar quarter, ranging from 1 to 5 and from 1 to 10, respectively, with the highest (lowest) values located in the 5th (1st) and 10th (1st) quintile and decile, respectively. All returns are measured beginning two days after the earnings announcement for quarter *q* and extending 60 days (i.e., [2, 61]-day window, representing a 1-quarter period) to 240 days (i.e., [2, 241]-day window, representing a 1-year period). The sample consists of firm-quarters spanning 1976 through 2011. All returns are shown as percentages. The t-statistics are calculated using the time-series difference in returns between the 10th and 1st deciles. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

Panel A: Size-adjusted, buy-and-hold returns across deciles of *SUE*					
		ays Relative to Quarterly Earnings Announceme			
	−1 to 1	2 to 61	2 to 121	2 to 181	2 to 241
d*SUE*	Size-adjusted, buy-and-hold returns, %				
1 (Bad)	-1.35	0.13	0.70	1.61	2.59
	(26,489)	(26,489)	(26,489)	(26,489)	(26,242)
5	0.15	0.90	2.00	3.42	5.25
	(26,035)	(26,035)	(26,035)	(26,035)	(25,855)
10 (Good)	2.21	3.10	4.97	6.61	8.11
	(26,475)	(26,475)	(26,475)	(26,475)	(26,228)
Good−Bad	3.55***	2.98***	4.27***	5.00***	5.52***
(t-stat)	(51.90)	(15.30)	(14.80)	(12.70)	(11.30)
Fraction of 240 day return		0.54	0.77	0.91	1.00

Table 5 (Cont'd): Size-adjusted, buy-and-hold returns by quintiles of *SUV* or *TR* and deciles of *SUE*

Panel B: Size-adjusted, buy-and-hold returns across quintiles of *SUV* or *TR* and deciles of *SUE*						
		Days relative to quarterly earnings announcement				
		−1 to 1	2 to 61	2 to 121	2 to 181	2 to 241
q*SUV*	d*SUE*	Size-adjusted, buy-and-hold returns, %				
1 (Low)	1 (Bad)	-1.04	-1.10	-0.98	0.02	0.87
		(5,486)	(5,486)	(5,486)	(5,486)	(5,433)
1 (Low)	10 (Good)	1.04	1.71	3.47	5.14	6.63
		(4,000)	(4,000)	(4,000)	(4,000)	(3,970)
1 (Low)	Good−Bad	2.08	2.81	4.45	5.12	5.76
5 (High)	1 (Bad)	0.17	0.96	1.58	2.48	3.07
		(4,957)	(4,957)	(4,957)	(4,957)	(4,915)
5 (High)	10 (Good)	3.51	4.07	5.78	7.09	9.04
		(6,513)	(6,513)	(6,513)	(6,513)	(6,444)
5 (High)	Good−Bad	3.34	3.11	4.21	4.61	5.97
High,Good−Low,Bad		4.55***	5.17***	6.77***	7.07***	8.17***
(t-stat)		(29.60)	(13.30)	(11.40)	(8.81)	(8.16)
Fraction of 240 day return			0.63	0.83	0.87	1.00
q*TR*	d*SUE*					
1 (Low)	1 (Bad)	-0.84	-1.37	-1.14	-0.30	0.17
		(5,569)	(5,569)	(5,569)	(5,569)	(5,514)
1 (Low)	10 (Good)	0.45	1.74	3.09	4.77	6.35
		(3,831)	(3,831)	(3,831)	(3,831)	(3,805)
1 (Low)	Good−Bad	1.29	3.12	4.23	5.06	6.18
5 (High)	1 (Bad)	-3.15	1.24	2.56	3.39	4.56
		(4,985)	(4,985)	(4,985)	(4,985)	(4,934)
5 (High)	10 (Good)	5.00	5.19	8.00	10.02	12.27
		(6,480)	(6,480)	(6,480)	(6,480)	(6,415)
5 (High)	Good−Bad	8.14	3.95	5.44	6.64	7.71
High,Good−Low,Bad		5.84***	6.56***	9.14***	10.32***	12.10***
(t-stat)		(34.90)	(15.80)	(14.10)	(11.90)	(11.10)
Fraction of 240 day return			0.54	0.76	0.85	1.00

Table 6: Four-risk-factor-adjusted returns by quintiles of *SUV* or *TR* and deciles of *SUE*

This table presents estimated factor loadings across quintiles of $SUV_{i,q}$ and deciles of $SUE_{i,q}$ (i.e., q*SUV*,d*SUE*), where $SUV_{i,q}$ and $SUE_{i,q}$ represent the standardized unexplained volume and standardized unexpected earnings of firm i in quarter q measured as outlined in chapters 3.1.2 and 3.1.3. Quintile and decile portfolios are formed independently within each calendar quarter, ranging from 1 to 5 and from 1 to 10, respectively, with the highest (lowest) values located in the 5th (1st) and 10th (1st) quantile and decile, respectively. All returns are measured beginning two days after the earnings announcement for quarter q and extending 60 days (i.e., [2, 61]-day window) to 240 days (i.e., [2, 241]-day window) into the future. The Intercept denotes portfolio alphas, and the *BETA*, *HML*, *SMB*, and *UMD* denote window period returns associated with the market return minus risk-free rate, high-minus-low market-to-book, small-minus-big, and momentum strategies, respectively, over the [2, 61] and [2, 241] days windows. The sample employed in this table consists of 255,470 firm-quarters for returns in the [2, 61]-day window and 253,015 for returns in the [2, 241]-day window. The firm-quarters included in the sample span 1976 through 2011. All returns are shown as percentages, t-statistics are shown in parentheses. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

Factor loadings across quantiles of *SUV* or *TR* and deciles of *SUE*										
	Days relative to quarterly earnings announcement									
	2 to 61					2 to 241				
	Intercept	*BETA*	*HML*	*SMB*	*UMD*	Intercept	*BETA*	*HML*	*SMB*	*UMD*
q*SUV* ,*dSUE*										
q1,d1(Low,Bad)	-0.03	0.86	0.32	0.91	-0.43	0.81	1.10	0.39	0.84	-0.16
	(-0.06)	(12.67)	(3.29)	(8.97)	(-7.01)	(0.59)	(15.80)	(4.45)	(8.15)	(-2.28)
q5,d10(High,Good)	4.06	1.01	0.10	0.59	0.17	8.80	1.04	0.18	0.61	0.12
	(10.71)	(16.00)	(1.17)	(6.54)	(2.95)	(7.41)	(16.89)	(2.40)	(6.97)	(1.97)
High,Good – Low,Bad	4.09***	0.14	-0.22*	-0.32**	0.6***	7.99***	-0.06	-0.21*	-0.22	0.27***
(t-stat)	(7.21)	(1.56)	(-1.70)	(-2.37)	(7.15)	(4.41)	(-0.68)	(-1.83)	(-1.64)	(3.02)
q*SUV* ,d*AFE*										
q1,d1(Low,Bad)	-0.39	1.00	0.36	1.05	-0.39	3.13	1.12	0.33	1.17	-0.11
	(-0.66)	(10.30)	(2.71)	(7.42)	(-4.52)	(2.06)	(13.91)	(3.37)	(8.93)	(-1.45)
q5,d10(High,Good)	6.28	1.14	0.07	0.98	0.04	21.37	1.39	-0.32	1.47	0.33
	(10.62)	(11.95)	(0.53)	(6.78)	(0.47)	(7.99)	(9.98)	(-1.89)	(6.62)	(2.52)
High,Good – Low,Bad	6.67***	0.14	-0.29	-0.07	0.43***	18.24***	0.27*	-0.65***	0.30	0.44***
(t-stat)	(7.98)	(1.04)	(-1.58)	(-0.33)	(3.46)	(5.94)	(1.70)	(-3.34)	(1.17)	(2.91)

Table 7: Regression tests of the relation between *SUV* or *TR* and *SUE* and future returns

This table presents pooled cross-sectional regression results from estimating several versions of eq. (11), presented below. The results were obtained by regressing size-adjusted, buy-and-hold returns measured beginning two days after the earnings announcement for quarter q and extending 60 days (i.e., [2, 61]-day window, representing a 1-quarter period) to 240 days (i.e., [2, 241]-day window, representing a 1-year period) on deciles of $SUV_{i,q}$ or $TR_{i,q}$, deciles of $SUE_{i,q}$ and other control variables. $CONTROLS_{i,q}$ represents: $MOMEN_{i,q}$, $EVOL_{i,q}$, $SARVOL_{i,q}$, $SPREAD_{i,q}$, $AMIHUD_{i,q}$, and $PY\_TURN_{i,q}$. All variables are measured as outlined in the appendix. Decile portfolios are formed within each calendar quarter, ranging from 1 to 10, with the highest (lowest) values located in the 10th (1st) decile, respectively. The sample consists of firm-quarters as indicated in the table spanning 1976 through 2011. The resulting *t*-statistics, presented in parentheses below the coefficients, are corrected for heteroskedasticity and cross-sectional and time-series correlations using a two-way cluster at the firm and calendar quarter levels. ***, **, and * indicate the coefficient is significant at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

$$SAR_{i,q,w} = \alpha_{0,w} + \beta_{1,w} ATV_{i,q} + \beta_{2,w} SUE_{i,q} + \beta_{3,w} ABR_{i,q} + \beta_{4,w} SIZE_{i,q} + \beta_{5,w} BTM_{i,q} + \beta_{k,w} \sum_k CONTROLS_{k,i,q} + \varepsilon_{i,q,w}$$

Multivariate regression tests of H2

		Days relative to quarterly earnings announcement							
		2 to 61				2 to 241			
	Pred.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
d*SUV*	+	2.50***		2.58***		5.30***		4.60***	
		(6.71)		(8.01)		(5.48)		(6.02)	
d*TR*	+		2.89***		2.95***		6.11***		5.56***
			(7.95)		(9.33)		(6.27)		(7.12)
d*SUE*	+	2.93***	2.94***	3.21***	3.21***	5.78***	5.79***	6.50***	6.55***
		(8.89)	(8.92)	(10.29)	(10.31)	(7.56)	(7.53)	(7.04)	(7.27)
d*ABR*		1.51***	1.40***	1.67***	1.58***	2.76***	2.53***	2.59***	2.38***
		(7.04)	(6.62)	(6.25)	(6.04)	(3.92)	(3.59)	(2.84)	(2.63)
d*SIZE*		-2.25***	-2.14***	-1.77	-1.43	-11.16***	-10.83***	-5.58	-5.10
		(-6.24)	(-5.95)	(-1.49)	(-1.18)	(-9.58)	(-9.51)	(-1.56)	(-1.42)
d*BTM*		1.31*	1.34**	2.35***	2.37***	4.27**	4.46**	8.56***	8.74***
		(1.93)	(1.99)	(3.44)	(3.53)	(2.03)	(2.14)	(4.14)	(4.24)
CONTROLS		NO		YES		NO		YES	
Adj.R^2 (%)		0.57	0.63	0.81	0.86	0.68	0.71	1.19	1.23
N		255,470	264,242	193,338	199,547	253,015	261,779	190,920	197,121

Table 8: Size-adjusted, buy-and-hold returns by quintiles of *INST* and deciles of *SUV* or *TR*

This table presents the time-series average equal-weighted size-adjusted, buy-and-hold returns by quintiles of $INST_{i,q}$ and deciles of $SUV_{i,q}$, or $TR_{i,q}$ (i.e., q*INST* and d*SUV* or d*TR*, respectively). All variables are measured as outlined in the appendix. The number of stocks included in each quintile and decile portfolio is reported in brackets below the returns. Quintile and decile portfolios are formed independently within each calendar quarter, ranging from 1 to 5 and from 1 to 10, respectively, with the highest (lowest) values located in the 5th (1st) and 10th (1st) quintile and decile, respectively. All returns are measured beginning two days after the earnings announcement for quarter *q* and extending 60 days (i.e., [2, 61]-day window) to 240 days (i.e., [2, 241]-day window) into the future. The sample consists of firm-quarters spanning 1980 through 2011. All returns are shown as percentages. The t-statistics are calculated using the time-series difference in returns between the 10th and 1st deciles. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

		Days relative to quarterly earnings announcement				
		−1 to 1	2 to 61	2 to 121	2 to 181	2 to 241
q*INST*	d*SUV*	Size-adjusted, buy-and-hold Returns, %				
1 (Low)	1 (Low)	-0.05	-1.05	-0.19	1.03	3.51
		(5,935)	(5,935)	(5,935)	(5,935)	(5,862)
1 (Low)	10 (High)	5.01	5.61	9.80	13.71	16.56
		(1,847)	(1,847)	(1,847)	(1,847)	(1,840)
1 (Low)	High–Low	5.06***	6.66***	9.98***	12.68***	13.05***
(t-stat)		(11.55)	(8.37)	(7.49)	(7.82)	(5.94)
3	1 (Low)	-0.10	0.13	2.14	4.05	5.73
		(3,961)	(3,961)	(3,961)	(3,961)	(3,927)
3	10 (High)	0.69	3.03	4.87	7.06	9.82
		(4,129)	(4,129)	(4,129)	(4,129)	(4,082)
3	High–Low	0.79***	2.90***	2.73***	3.01***	4.10***
(t-stat)		(3.47)	(5.64)	(3.41)	(2.74)	(2.85)
5 (High)	1 (Low)	0.05	-0.62	0.12	0.43	1.59
		(2,677)	(2,677)	(2,677)	(2,677)	(2,656)
5 (High)	10 (High)	-0.43	0.72	1.71	2.73	3.36
		(6,594)	(6,594)	(6,594)	(6,594)	(6,530)
5 (High)	High–Low	-0.49***	1.34***	1.59***	2.31***	1.77*
(t-stat)		(-2.73)	(3.37)	(2.58)	(2.93)	(1.84)

q*INST*	d*TR*					
1 (Low)	1 (Low)	-0.16	-0.87	-0.12	0.92	2.72
		(8,595)	(8,595)	(8,595)	(8,595)	(8,477)
1 (Low)	10 (High)	5.17	5.56	9.15	13.02	15.63
		(5,089)	(5,089)	(5,089)	(5,089)	(5,031)
1 (Low)	High–Low	5.33***	6.43***	9.27***	12.10***	12.91***
(t-stat)		(21.85)	(13.84)	(12.61)	(12.35)	(10.47)
3	1 (Low)	-0.26	-0.20	0.82	2.33	3.97
		(3,478)	(3,478)	(3,478)	(3,478)	(3,455)
3	10 (High)	1.20	4.09	6.79	10.16	13.60
		(4,143)	(4,143)	(4,143)	(4,143)	(4,114)
3	High–Low	1.46***	4.29***	5.97***	7.83***	9.63***
(t-stat)		(5.57)	(8.29)	(7.06)	(6.89)	(6.35)
5 (High)	1 (Low)	-0.09	-0.97	0.48	1.42	2.31
		(1,428)	(1,428)	(1,428)	(1,428)	(1,418)
5 (High)	10 (High)	-2.17	1.56	2.45	3.85	4.64
		(4,036)	(4,036)	(4,036)	(4,036)	(3,994)
5 (High)	High–Low	-2.08***	2.52***	1.97**	2.43**	2.33*
(t-stat)		(-7.85)	(4.45)	(2.23)	(2.08)	(1.69)

Table 9: Multivariate regression tests of the effect of investor sophistication on the relation between *SUV* or *TR* and future returns

This table presents pooled cross-sectional regression results from estimating several versions of eq. (11), presented below. The results obtained by regressing size-adjusted, buy-and-hold returns measured beginning two days after the earnings announcement for quarter *q* and extending 60 days (i.e., [2, 61]-day window, representing a 1-quarter period) to 240 days (i.e., [2, 241]-day window, representing a 1-year period) on deciles of $SUV_{i,q}$ or $TR_{i,q}$, their interaction with deciles of $INST_{i,q}$, deciles of $SUE_{i,q}$, and other control variables. *CONTROLS* represents: $MOMEN_{i,q}$, $EVOL_{i,q}$, $SARVOL_{i,q}$, $SPREAD_{i,q}$, $AMIHUD_{i,q}$, and $PY\_TURN_{i,q}$. All variables are measured as outlined in the appendix. Decile portfolios are formed within each calendar quarter, ranging from 1 to 10, with the highest (lowest) values located in the 10th (1st) decile, respectively. The sample consists of firm-quarters as indicated in the table spanning 1980 through 2011. The resulting *t*-statistics, presented in parentheses below the coefficients, are corrected for heteroskedasticity and cross-sectional and time-series correlations using a two-way cluster at the firm and calendar quarter levels. ***, **, and * indicate the coefficient is significant at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

$$SAR_{i,q,w} = \alpha_{0,w} + \beta_{1,w}ATV_{i,q} + \beta_{2,w}SUE_{i,q} + \beta_{3,w}INST_{i,q} + \beta_{4,w}INST_{i,q} \times ATV_{i,q} + \beta_{6,w}ABR_{i,q} + \beta_{7,w}SIZE_{i,q} + \beta_{8,w}BTM_{i,q} + \beta_{k,w}\sum_k CONTROLS_{k,i,q} + \varepsilon_{i,q,w}$$

Multivariate regression tests of H3									
		Days relative to quarterly earnings announcement							
		2 to 61				2 to 241			
	Pred.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
d*SUV*	+	3.13***		2.76***		6.31***		4.96***	
		(8.15)		(8.14)		(6.03)		(5.67)	
d*TR*	+		3.20***		2.83***		6.29***		5.14***
			(9.20)		(9.10)		(6.56)		(6.31)
d*SUE*	+			3.32***	3.33***			7.26***	7.33***
				(9.44)	(9.59)			(6.43)	(6.65)
d*INST*		0.23	0.25	-0.85	-0.83	0.80	0.86	-2.61	-2.69
		(0.43)	(0.46)	(-1.21)	(-1.18)	(0.51)	(0.53)	(-1.17)	(-1.15)
d*SUV* ×d*INST*	–	-5.03***		-4.50***		-11.05***		-8.76***	
		(-6.69)		(-4.95)		(-4.91)		(-3.40)	
d*TR* ×d*INST*	–		-3.90***		-3.09***		-8.37***		-6.48***
			(-5.31)		(-3.59)		(-4.06)		(-2.61)
d*ABR*		2.25***	2.17***	1.67***	1.62***	4.02***	3.87***	2.46**	2.25**
		(9.08)	(8.69)	(5.55)	(5.42)	(5.15)	(4.84)	(2.36)	(2.18)
d*SIZE*		-2.96***	-2.74***	-1.45	-1.06	-13.46***	-13.14***	-4.91	-4.31
		(-6.96)	(-6.66)	(-1.24)	(-0.89)	(-8.87)	(-8.74)	(-1.36)	(-1.20)
d*BTM*		1.08	1.11	2.50***	2.54***	4.55*	4.68*	9.54***	9.76***
		(1.33)	(1.38)	(3.74)	(3.83)	(1.87)	(1.94)	(4.60)	(4.73)
CONTROLS		NO		YES		NO		YES	
Adj.R^2 (%)		0.53	0.56	0.90	0.94	0.70	0.71	1.24	1.27
N		208,490	215,432	145,300	149,934	206,408	213,342	143,232	147,858

Table 10: Robustness tests

This table presents pooled cross-sectional regression results from estimating several versions of eq. (11). The results obtained by regressing size-adjusted, buy-and-hold returns measured beginning two days after the earnings announcement for quarter *q* and extending 240 days (i.e., [2, 241]-day window, representing a 1-year period) on deciles of $SUV_{i,q}$ or $TR_{i,q}$, their interaction with deciles of $INST_{i,q}$, deciles of $SUE_{i,q}$, and other control variables. Columns (1)-(2) exclude banks (as defined by Fama-French 48 industries classification) from the regressions. Columns (3)-(4) include year and Fama-French 48 industries fixed effects as additional control variables. Columns (5)-(6) include deciles of $ACCRUAL_{i,q}$ as additional control variables. Columns (7)-(8) include interactions between deciles of $INST_{i,q}$, and deciles of $SUE_{i,q}$ as additional control variables. All variables are measured as outlined in the appendix. Decile portfolios are formed within each calendar quarter, ranging from 1 to 10, with the highest (lowest) values located in the 10th (1st) decile, respectively. The resulting *t*-statistics, presented in parentheses below the coefficients, are corrected for heteroskedasticity and cross-sectional and time-series correlations using a two-way cluster at the firm and calendar quarter levels. ***, **, and * indicate the coefficient is significant at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

		No banks		Fixed effects		d*ACCRUAL*		d*INST* ×d*SUE*	
	Pred.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
d*SUV*	+	5.03***		5.01***		6.96***		6.17***	
		(5.01)		(6.21)		(5.50)		(5.70)	
d*TR*	+		4.95***		5.17***		6.71***		6.19***
			(5.63)		(6.92)		(5.88)		(6.18)
d*SUE*	+	4.71***	4.69***	5.96***	5.95***	4.94***	4.91***	6.29***	6.26***
		(4.76)	(4.71)	(6.85)	(6.87)	(4.79)	(4.77)	(6.84)	(6.86)
d*INST*		-2.67**	-2.68**	-1.98	-1.92	1.01	1.06	2.09	2.18
		(-2.16)	(-2.12)	(-1.41)	(-1.31)	(0.56)	(0.55)	(1.26)	(1.24)
d*SUV* ×d*INST*	–	-5.98***		-6.78***		-12.18***		-10.34***	
		(-2.78)		(-3.38)		(-4.25)		(-4.45)	
d*TR* ×d*INST*	–		-6.14**		-5.30***		-8.84***		-7.46***
			(-1.98)		(-2.62)		(-3.19)		(-3.34)
d*ABR*		2.87***	2.71***	2.66***	2.50***	2.43**	2.24**	2.43***	2.23***
		(3.04)	(2.92)	(3.11)	(2.94)	(2.44)	(2.24)	(2.80)	(2.56)
d*SIZE*		-13.41***	-13.00***	-9.74***	-9.41***	-14.77***	-14.21***	-13.31***	-12.87***
		(-8.51)	(-8.47)	(-7.86)	(-7.72)	(-8.23)	(-8.14)	(-7.84)	(-7.79)
d*BTM*		5.26**	5.42**	9.07***	9.29***	4.09	4.24	4.86**	5.05**
		(2.04)	(2.11)	(4.27)	(4.37)	(1.43)	(1.49)	(1.99)	(2.08)
d*ACCRUAL*						-6.12***	-6.22***		
						(-4.86)	(-4.83)		
d*SUE* ×d*INST*								-15.03***	-15.35***
								(-5.93)	(-6.02)
YEAR_FE				YES	YES				
INDST_FE				YES	YES				
Adj.R^2 (%)		0.85	0.86	1.66	1.69	0.75	0.76	0.81	0.83
N		151,045	155,789	171,588	177,314	137,371	141,473	171,588	177,314