Is Information Risk Priced? Evidence from Abnormal Idiosyncratic Volatility

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ABSTRACT

We propose a new, price-based measure of information risk called abnormal idiosyncratic volatility (AIV) that captures information asymmetry faced by uninformed investors. AIV is the idiosyncratic volatility prior to information events in excess of normal levels. Using earnings announcements as information events, we show that AIV is positively associated with abnormal insider trading, short selling, and institutional trading during pre-earnings-announcement periods. We find that stocks with high AIV earn economically and statistically larger future returns than stocks with low AIV. Taken together, our findings support the notion that information risk is priced.

Keywords: Information Risk, Idiosyncratic Volatility, Earnings Announcement, Expected Returns

JEL Classification Number: G00, G12, G14

1. Introduction

Standard asset pricing theory posits that expected asset returns are related to their covariances with systematic factors under the assumption that information is homogeneous for all investors. When information is asymmetric across investors, the question of how asset prices and expected returns are determined is theoretically challenging. Different model assumptions lead to different predictions, and technical difficulties hinder a complete analysis.[1] Empirically, the question of whether the risk of information asymmetry is priced in asset returns is far from settled, although many studies have investigated this topic. The primary difficulty is related to the lack of proper measures of information risk. Thus, in this paper, we explore the pricing of information risk by constructing a price-based measure of information risk.

In the previous literature, the most prominent measures of information risk are based on trading quantities.[2] Easley et al. (1996) and Easley, Hvidkjaer, and O'Hara (2002; hereafter EHO) develop a microstructure model and use order flow to estimate the probability of informed trading (PIN). Due to difficulties in computing PIN under high-frequency trading, Easley, Lopez de Prado, and O'Hara (2012) develop a new procedure to overcome flow toxicity, the volume-synchronized probability of informed trading. Instead of using all transactions, Hwang and Qian (2011) construct an information risk measure based on large trades. More recently, Choi, Jin, and Yan (2014) use prior weekly institutional ownership volatility to proxy for information risk. Although these quantity-based measures are shown to be positively related to expected future stock returns, the pricing evidence is also challenged

[1] Wang (1993) notes that the role of information asymmetry in the risk premium is indeterminate because the amount of information impounded in an asset price changes with changes in information asymmetry. Easley and O'Hara (2004) demonstrate that information risk is priced because uninformed investors are always on the wrong side of the trade, whereas Hughes, Liu, and Liu (2007) show that the pricing impact of asset-specific private information goes to zero as the number of assets increases. See also Garleanu and Pedersen (2004) and Lambert, Leuz, and Verrecchia (2007) for conditions under which information asymmetry affects asset pricing.

[2] There are also alternative measures of information risk based on firm characteristics such as firm size, earnings quality, and analyst coverage. In addition, there is an interesting study by Kelly and Ljungqvist (2012) that uses three natural experiments to test the pricing of information risk.

in the literature (Duarte and Young, 2009; hereafter DY; Lai, Ng, and Zhang, 2014; Chung and Huh, 2014).

We begin with the assumption that information risk is multifaceted; as such, it is unlikely that quantity-based measures can capture information risk in all its aspects. In principle, an informed trading equilibrium incorporates both quantity and price. We construct an information risk measure called abnormal idiosyncratic volatility (AIV), which is the idiosyncratic volatility before an information-intensive event in excess of the idiosyncratic volatility of the normal period. The literature has long recognized that information flow is reflected in idiosyncratic volatility (e.g., Roll, 1988; Morck, Yeung, and Yu, 2000; Durnev, Morck, and Yeung, 2004; Ferreira and Laux, 2007; Dang, Moshirian, and Zhang, 2015). However, idiosyncratic volatility may reflect other features of firms such as fundamental risk and investors' overreaction to firm-specific information (e.g., Wei and Zhang, 2006; Teoh, Yang, and Zhang, 2007; Hou, Peng, and Xiong, 2013). Therefore, AIV is employed to tease out unusual price variations caused by trading activities related to information-intensive events.

To estimate AIV, we calculate differences in idiosyncratic volatility between pre-earnings-announcement periods and non-earnings-announcement periods. Earnings announcements are selected in this study as the information-intensive event for several reasons. First, earnings announcements are the most value-relevant information events that firms use to reveal their past profitability and to help investors project their future performance (Beyer et al., 2010). Second, informed trading is pervasive prior to earnings announcements (Krinsky and Lee, 1996; Kim and Verrecchia, 1997; Vega, 2006; Bamber, Barron, and Stevens, 2011; Back, Crotty, and Li, 2014). Third, beginning in 1970, the Securities and Exchange Commission has mandated quarterly reporting for all exchange-listed firms in the US. Therefore, estimating AIV is feasible for all stocks over the sample period.[3]

[3] The disadvantage of focusing solely on earnings announcements is that many other corporate events also contain information about firm value, and excluding these corporate events makes the information risk measure noisier because many of these events are conducted during non-earnings-announcement periods. We view the work documented in this paper as the first step in eventually achieving a full-blown measure of information risk. In spite of this disadvantage, we also note that the results presented in this paper are strong enough to demonstrate that a price-based information risk measure adds value to quantity-based measures

Using both annual and quarterly earnings announcements, we estimate AIV for stocks listed on the NYSE, Amex, and Nasdaq over the 40-year period from 1972 to 2012. We perform the following analyses. First, because it is well documented in the literature that corporate insiders, short sellers, and institutional traders are informed traders, we link AIV to their trading activities to determine whether it captures informed trading. Indeed, we find positive relationships between AIV and abnormal insider trading, abnormal short selling, and abnormal institutional trading during the pre-earnings-announcement periods. However, we show that AIV is only weakly related to the existing information risk measures, which suggests that AIV captures a distinct aspect of information risk that other measures do not.

Second, we explore whether the information risk captured by AIV is priced. Using a portfolio analysis, we find that high-AIV firms tend to have high future stock returns. Moreover, the pricing of AIV is more pronounced for but not limited to small stocks. A trading strategy combining a long position in a high-AIV quintile portfolio with a short position in a low-AIV quintile portfolio generates a 2.89% risk-adjusted return. The spread return increases to 5.52% if the long-short strategy is applied to the smallest size quintile. The pricing of AIV is also evidenced in the regression method of Fama and MacBeth (1973), with other well-known pricing factors controlled for. The pricing of AIV is robust to the inclusion of alternative information risk measures, subperiods, the exclusion of inactive or penny stocks, and other specifications. In addition, the AIV effect on returns is not particularly sensitive to the window that defines the pre-earnings-announcement period.

Finally, we provide additional evidence to illuminate the understanding of the pricing impact of AIV. Because AIV is calculated as the difference in idiosyncratic volatility between pre-earnings-announcement and non-earnings-announcement periods, it is tempting to relate the pricing of AIV to the idiosyncratic volatility anomaly documented by Ang et al. (2006, 2009; hereafter AHXZ). However, our results show that the pricing of AIV is distinct from the idiosyncratic volatility anomaly. The idiosyncratic volatility in both pre-

of information risk.

and non-earnings-announcement periods contributes to the pricing of AIV. We also exploit the time variation in AIV to show that there is a contemporaneous negative relationship between the stock return and the change in AIV. This relationship is consistent with the notion that AIV captures risk instead of mispricing.

The contribution of this paper can be understood as follows. First, because theoretical studies regarding whether information risk is priced yield opposite predictions that are derived from their different assumptions, our results provide a specific case in which the risk in information related to earnings announcements is priced, supporting the prediction that information risk is priced in general. Second, the price-based measure we construct is simple yet powerful to capture contemporary, information-related activities and risk premiums for future returns. We acknowledge that the measure we construct may not reflect all aspects of information risk and all information events. We also note that the ideas developed in this paper to construct measures of asymmetric information related to earnings announcements might also be applied to other information events, such as merges and acquisitions.

The remainder of this paper is organized as follows. Section 2 provides a more in-depth discussion of how our information risk measure, AIV, is motivated and describes the construction and summary statistics of the measure. Section 3 shows that the information risk measure, AIV is contemporaneously related to various informed trading activities, but it is only weakly related to other information risk measures in the literature. Section 4 presents formal asset pricing tests and shows that the information risk captured by AIV is priced. Section 5 further examines whether the pricing of AIV derives from information risk. The last section concludes.

2. Measuring information risk

2.1. Quantity- and Price-based information risk measures

Quantity-based information risk measures have their pros and cons, and although PIN has been widely used in the literature, critics of this measure have also emerged. DY argue that PIN is priced not based on its information risk component but on its illiquidity component. Furthermore, Mohanram and Rajgopal (2009) and Lai, Ng, and Zhang (2014) challenge the robustness of the return predictability of PIN in extended samples. In addition, it is also becoming increasingly difficult to estimate PIN because of the ever-growing number of trades and high-frequency algorithmic trading. Non-pricing evidence regarding other quantity-based information risk measures is also documented in the literature. For the U.S. market, Chung and Huh (2014) show that the pricing effect of the adverse-selection costs of trading by Glosten and Harris (1988) and Foster and Viswanathan (1993) is subsumed by the corresponding non-information costs of trading. For the international markets, Lai, Ng, and Zhang (2014) show that the relative trade informativeness measure of Hasbrouck (1991), the percentage price impact measure of Huang and Stoll (1996), the adverse selection component of Huang and Stoll (1997), and the asymmetric information parameter of Madhavan, Richardson, and Roomans (1997) exhibit no strongly significant pricing effects.

Although informed trading can be discerned from unusual trading quantities, it can also be identified from prices because informed trading is more likely to cause prices to change. In our study, we construct a price-based information risk measure, AIV, to be used in the empirical part of the paper. The measure is based on idiosyncratic volatility rather than on the order flow or trading size that characterizes quantity-based information risk measures. It has been recognized in the literature that idiosyncratic volatility is related to firm-specific information impounded in stock prices by informed traders. In an influential paper, Morck, Yeung, and Yu (2000) find that the market model R^2 tends to be higher for emerging countries than for developed countries. The intuitive explanation that these authors provide is that more firm-specific information is available to the market in developed countries, whereas the lack of firm-specific information in emerging countries forces investors to infer information for one firm from the price changes of other firms, thereby causing synchronized price changes across firms.

There have been many follow-up studies in the literature (e.g., Durnev, Morck, and Yeung, 2004; Ferreira and Laux, 2007) that mostly confirm the Morck, Yeung and Yu (2000) findings, particularly in cross-country studies (e.g., Jin and Myers, 2006; Fernandes and Ferreira, 2008, 2009; Dang, Moshirian, and Zhang, 2015). At the firm level, the issue is much more complicated because, for one, idiosyncratic volatility also includes a firm's business and financial risks (e.g., Wei and Zhang, 2006) and risks caused by informed trading. In the empirical part of this paper, we use the difference in idiosyncratic volatilities between a period with a substantial amount of informed trading and a period with no or little informed trading to mitigate the impact of business and financial risks on idiosyncratic volatility.

In the empirical study below, we use the earnings announcement as the event of information release. We calculate the difference in idiosyncratic volatilities between pre-earnings-announcement and non-earnings-announcement periods as a firm's abnormal idiosyncratic volatility, AIV. We show that the cross-sectional variation in AIV corresponds to much of the information-related trading activities and average return differences.

2.2. An empirical measure of information risk

To capture informed trading activity, we use the idiosyncratic volatility of a stock during a period with a high probability of informed trading, and we compare it with idiosyncratic volatility during a normal period. A period prior to an earnings announcement is a natural choice for a period with a high probability of informed trading because private information gathering is more profitable during such a period.[4] There is an abundance of both theo-

[4]According to Kim and Verrecchia (1991), informed investors acquire private information prior to earnings announcement and trade both before and after the earnings are made public. In other words, an anticipated earnings announcement stimulates more private information gathering because the value of private informa-

retical and empirical evidence showing that informed trading is pervasive prior to earnings announcements (Krinsky and Lee, 1996; Kim and Verrecchia, 1997; Vega, 2006; Bamber, Barron, and Stevens, 2011; Back, Crotty, and Li, 2014).

We measure idiosyncratic volatility relative to the Fama and French (1993) three-factor model (FF-3) using the following regression:

$$R_i = \alpha_i + \beta_i MKT + s_i SMB + h_i HML + \varepsilon_i, \tag{1}$$

where R_i is the daily excess return of stock i, MKT is the value-weighted market portfolio excess return over the risk-free rate, SMB is the size premium, and HML is the value premium. The regression is run for each stock and each month using daily returns over the past year.

Specifically, we obtain the daily residual, ε_i, for each firm by running regression (1) using daily data over the past year. Then, we classify a stock's past one-year trading days into pre-earnings-announcement days (PEAs) and non-earnings-announcement days (NEAs). Pre-earnings-announcement days are days on $t-5$ to $t-1$, where day t is the annual or quarterly earnings announcement date. Non-earnings-announcement days are all other trading days excluding the 11 days around annual or quarterly earnings announcement dates (i.e., excluding $t-5$ to $t+5$). We compute the idiosyncratic volatility of a stock for pre-earnings-announcement days (IV_{PEA}) and for non-earnings-announcement days (IV_{NEA}) as the log of the standard deviations of the residual obtained from (1). We express the idiosyncratic volatility in annualized percentage units, assuming that there are 252 trading days in a year, and we define

$$IV_{PEA} = \ln\sqrt{\frac{252 \times \sum\limits_{j \in PEA} \varepsilon_j^2}{n_{PEA} - 1}}, \qquad IV_{NEA} = \ln\sqrt{\frac{252 \times \sum\limits_{j \in NEA} \varepsilon_j^2}{n_{NEA} - 1}}, \tag{2}$$

where n_{PEA} and n_{NEA} are the number of days in the pre- and non-earnings announcement periods, respectively.

tion can be realized immediately after the earnings are announced. Thus, we expect more informed trading to occur in the pre-earnings-announcement period.

To tease out the idiosyncratic volatility component that is related to information risk surrounding earnings announcements, we use the difference between pre- and non-earnings-announcement periods. We coin the difference in idiosyncratic volatility as the abnormal idiosyncratic volatility (AIV).

$$AIV = IV_{PEA} - IV_{NEA} \tag{3}$$

AIV is obtained for each firm in every month using the daily data from the past year. All firm and time subscripts have been omitted for convenience. AIV is the measure constructed to capture information risk related to earnings announcements.

2.3. Data sample and summary statistics

We construct the main dataset used in our analysis from CRSP and Compustat. We obtain stock and market returns data from CRSP and firm fundamentals and earnings announcement data from Compustat. Our final sample includes all common stocks listed on the NYSE, Amex, and Nasdaq that are covered in the CRSP and Compustat data. We begin our data with 1972 because Compustat began recording earnings announcement dates in that year. We exclude stocks with prices below one dollar. To accurately calculate the idiosyncratic volatility in the pre-earnings-announcement period, we adjust the earnings announcement date to the next trading day if an earnings announcement is made after 4:00 pm. We obtain earnings announcement times from the IBES and Ravenpack News Analytics database.[5] We winsorize all continuous variables at the 1st and 99th percentiles to mitigate the influence of outliers. Our final sample consists of 1,443,493 firm-month observations spanning from July 1972 to June 2012.

Panel A of Table 1 reports the descriptive statistics for variables used in the subsequent analysis. AIV is our key price-based measure of information risk. R is the monthly stock

[5] We adjust the earnings announcement dates for the sample after 2000. We use the date reported in Compustat as the earnings announcement date if the earnings announcement time is not available. The results are unaffected by the earnings announcement date adjustment.

excess return over one-month T-Bill rate. β_{Mkt} is the market beta of the stock with respect to the CRSP value-weighted index estimated following Fama and French (1992). *Size* is the log of the market capitalization at the end of last June. *BM* is the log of the book-to-market ratio. Following AHXZ, IV_{AHXZ} is the annualized standard deviation of daily residuals based on the FF-3 model during the previous month. *Illiquidity* is Amihud's (2002) illiquidity. We also follow Brennan et al. (2012) and include three separate past stock returns ($R_{[-3,-2]}, R_{[-6,-4]}, R_{[-12,-7]}$) in our asset pricing analysis.

Table 1 here

Panel B reports the descriptive statistics for the information environment variables drawn from the previous literature. We use these information environment variables for direct comparison with *AIV* or as control variables in the pricing model. We use EHO's probability of informed trading (PIN_{EHO}) and DY's probability of informed trading and of symmetric order-flow shocks (PIN_{DY}, $PSOS_{DY}$) that was downloaded from the authors' websites. We measure earnings surprise using standardized unexpected earnings (*SUE*) following Livnat and Mendenhall (2006). Accruals (*Accrual*) and accrual quality (*AQuality*) are two proxies of earnings management based on Sloan (1996) and Francis et al. (2005), respectively. We also include analyst-based information asymmetry measures (*Analyst*, *FErr*, and *FDisp*) in our analysis. The data sources and the construction of all the variables are summarized in Appendix.

2.4. Distribution of *AIV*

We observe a wide variation of *AIV* in Panel A of Table 1 that has a mean value of 0.007 and a standard deviation of 0.332. This large variation is necessary and important to capture the distinct feature of information risk across firms and over time. In Panel C, we present the distribution of *AIV* that is sorted by market capitalization. Stocks are sorted into size quintiles by their market capitalization. The average *AIV* demonstrates a linear increasing trend with size quintile. In other words, the information risk measured by AIV is positively associated with size, which is unlike most of the other information risk measures that are negatively correlated with firm size. We discuss the positive association between AIV and firm size further in Section 3.4.

Figure 1 plots the average abnormal absolute residual return from the FF-3 model around earnings announcement days for stocks in the full sample. The bell-shaped pattern reveals a large surprise in stock returns surrounding the announcements. The substantial variation in stock returns indicates information leakage prior to earnings announcements and that the leaked information is incorporated into stock prices through informed trading (e.g., Vega, 2006; Bamber, Barron, and Stevens, 2011; Back, Crotty, and Li, 2014). The large variations in post-earnings announcements are consistent with earnings drift (Kothari, 2001) and investor disagreement (Kondor, 2012), which are well-documented phenomena in the literature.

Figure 1 here

3. AIV and information risk

In this section, we examine whether AIV is related to information risk. We preform two seperate tests to evaluate the information risk content of AIV. First, we examine the association of AIV with abnormal insider trading, short selling, and institutional trading activities during pre-earnings-announcement periods. Second, we explore the relations between AIV and other firm characteristics including alternative measures of information risk.

3.1. Insider trading

The most important and difficult task that must be undertaken to show the information risk nature of AIV is to identify informed traders. Among all types of possible informed traders, corporate insiders have the most direct access to firm-specific information. Although corporate insiders are prohibited by law from trading using material nonpublic information by law,[6] corporate insiders nonetheless earn huge trading profits with their private information (e.g., Aboody and Lev, 2000; Piotroski and Roulstone, 2005; Huddart, Ke, and Shi, 2007; Ravina and Sapienza, 2010; Cohen, Malloy, and Pomorski, 2012). Therefore, evidence that stocks characterized by high abnormal insider trading during earnings-announcement periods also have large AIV supports our hypothesis that AIV is related to information risk.

We obtain insider trading data from the SEC Official Summary of Security Transactions and Holdings in the Thomson Reuters insider filings database. We examine open market purchases and sales by insiders. We only consider directors and officers of a firm as insiders because Seyhun (1998) indicates that trades by other insiders (such as large shareholders, members of advisory boards, retired officers, and officers of subsidiaries) do not convey substantial information. We aggregate purchases and sales by all directors and officers of the same firm on the same trading day. For a given stock at the end of each calendar year, we calculate the pre-earnings-announcement insider trading activity (IT_{PEA}) as the annualized daily average proportion of shares traded by directors and officers in the period from five days to one day prior to the past earnings announcements in that calendar year. Similarly, we compute non-earnings-announcement insider trading activity (IT_{NEA}) as the annualized daily average proportion of shares traded by insiders on all days of the past year, excluding the period from five days before to five days after an earnings announcement. The abnormal insider trading activity (AIT) is therefore the difference in insider trading between pre- and non-earnings-announcement periods ($IT_{PEA} - IT_{NEA}$).

Next, Table 2 reports the AIV of stock portfolios sorted by AIT. Panel A of Table 2

[6] Insiders in the U.S. must report specific details for each of their trades. This requirement dates back to the Securities and Exchange Act of 1934 under which the Securities and Exchange Commission (SEC) promulgated Rule 10b-5. This regulation requires that certain persons that have material nonpublic information about a firm should disclose that information or abstain from trading. The U.S. Supreme Court clarified that the rule applies to the firm's insiders, namely, its officers and directors, as well as controlling shareholders. With the promulgation of the Sarbanes-Oxley Act of 2002, the SEC adopted new rules and shortened the window for most SEC filings involving insider trading information to two business days after the buy or sell transaction. Prior to this change, the reporting period typically lasted until the 10th day of the month following the insiders' trades.

shows the AIV of single-sorted quintile portfolios formed annually sorted by abnormal insider trading (AIT). Panel B shows the AIV of five-by-five double-sorted portfolios sorted first by market capitalization ($Size$) and then by abnormal insider trading (AIT). We calculate the time-series average of AIV for each stock portfolio.

Panel A shows that the average AIV increases with AIT. The difference between the AIV of the highest and lowest AIT quintiles is positive and significant. In Panel B, the positive relationship between AIV and AIT is only significant in the smaller size quintile portfolios, which might be due to two reasons. First, small firms are normally associated with poorer internal and external corporate governance, and as a result, insiders are more likely to trade based on material nonpublic information in pre-earnings-announcement periods. Second, although insiders in large firms, to some extent, may also trade based on material nonpublic information, the price impact of insiders' transactions is not substantial enough to move the stock price very much.

Table 2 here

Figure 2 plots the average abnormal absolute residual return from the FF-3 model around earnings announcement days for stocks with large and small quintile stock portfolios sorted by AIT separately. Consistent with Table 2, stocks in the highest AIT quintile have a larger return variation prior to earnings announcements, which leads to a smaller announcement-day surprise relative to stocks in the lowest AIT quintile.

Figure 2 here

3.2. Short selling

Following the previous literature, short sellers are also selected as prominent representatives of informed traders. Using a proprietary NYSE order dataset covering the 2000 to 2004 period, Boehmer, Jones, and Zhang (2008) show that short sellers contribute to more than

10% of daily trading volume and are extremely informed. International evidence also shows that short selling is associated with an increase in the speed with which information is incorporated into prices (e.g., Bris, Goetzmann, and Zhu, 2007; Beber and Pagano, 2013; Saffi and Sturgessz, 2011; Massa, Zhang, and Zhang, 2015).

We obtain the information on short sales from the NYSE TAQ Regulation SHO database. The Regulation SHO database covers the January 3, 2005 through July 6, 2007 period, and contains data for all short sales reported to the NYSE for NYSE-listed and traded securities. For each stock at the end of each calendar year, we calculate the pre-earnings-announcement short selling activity (SS_{PEA}) as the annualized average daily proportion of shares sold short during the period from five days before to one day before earnings announcements during the calendar year. The non-earnings-announcement short selling activity (SS_{NEA}) is the annualized daily average proportion of shares sold short in all days in the same calendar year, excluding the period from five days before to five days after an earnings announcement. Abnormal short selling activity (ASS) is therefore the difference in short sales between pre- and non-earnings-announcement periods ($SS_{PEA} - SS_{NEA}$).

Table 3 reports the AIV of stock portfolios sorted by ASS. Panel A shows the AIV of single-sorted quintile portfolios formed annually sorted by abnormal short selling (ASS), and Panel B shows the AIV of five-by-five portfolios sorted first by market capitalization ($Size$) and then by abnormal short selling (ASS). We calculate the time-series average of AIV for each stock portfolio. Panel A shows a monotonically positive relationship between ASS and AIV. The difference in AIVs between High-ASS and Low-ASS portfolios is significantly positive. Similar to Panel A, Panel B depicts a larger AIV for High-ASS portfolios than for Low-ASS portfolios across all size categories. Our overall findings present a positive relationship between short selling and AIV.

Table 3 here

Figure 3 plots the average abnormal absolute residual return from the FF-3 model around earnings announcement days for stocks with large and small quintile stock portfolios sorted separately by ASS . Stocks with a larger ASS appear to have a larger return variation before earnings announcements.

Figure 3 here

3.3. Institutional trading

Our next inquiry invovles the relationship between AIV and institutional trading. Institutional investors are more sophisticated and better informed than individual investors. They are resourceful with respect to collecting information, skillful in analyzing the collected information, and powerful in mobilizing their funds. Puckett and Yan (2011) find that institutional investors earn significant abnormal returns in their trading. Hendershott, Livdan, and Schurhoff (2015) find that institutional trading volume predicts both the occurrence and sentiment of news announcements. More specifically, Campbell, Ramadorai, and Schwartz (2009) show that institutional trades are highly informed regarding near-future earnings announcements. Therefore, institutional trading activity may increase idiosyncratic volatility before earnings announcements.

We obtain daily institutional trading information from the ANcerno dataset. The ANcerno company provides consulting services to help institutional investors monitor their trading costs. The dataset covers all the equity transaction histories of its institutional clients for each equity trade over the January 1999 to December 2010 period. The ANcerno dataset has been widely used in studying institutional trading activity. A more detailed description of the data can be found in Puckett and Yan (2011) and Jame (2014).

For each stock at the end of each calendar year, we calculate the pre-earnings-announcement institutional trading activity (IN_{PEA}), which is the annualized daily average proportion of shares traded by institutions in the five days [-5,-1] prior to quarterly and annual earnings announcements over the calendar year. The non-earnings-announcement institutional trading activity (IN_{NEA}) is the annualized daily average proportion of shares traded by institutions in the same calendar year, excluding trading days from five days before to five days after the earnings announcement. Abnormal institutional trading activity (AIN) is therefore the difference in institutional trading between pre-earnings-announcement and non-earnings-announcement periods ($IN_{PEA} - IN_{NEA}$).

Table 4 reports the AIV of quintile portfolios sorted by AIN. Panel A shows the AIV of single-sorted portfolios formed annually sorted by (AIN), and Panel B shows the AIV of portfolios sorted first by market capitalization ($Size$) and then by (AIV). We calculate the time-series average of AIV for each stock portfolio. Panel A reports a monotonically positive relationship between AIN and AIV. The difference in AIVs between High AIN and Low AIN portfolios is positive and significant. Panel B indicates that there are monotonically increasing relationships between average AIV and average ASS across all size categories.

Table 4 here

Figure 4 plots the average abnormal absolute residual return from the FF-3 model around earnings announcement days for stocks with large and small quintile stock portfolios sorted separately by AIN . As above, stocks with a larger AIN have a larger return variation before earnings announcements.

Figure 4 here

Overall, the portfolio results provide direct evidence that AIV is related to information risk induced by informed traders such as corporate insiders, short sellers and institutional investors prior to earnings announcement periods. In the subsequent section, we extend the analysis to its relations with other firm characteristics.

3.4. Relations with other firm characteristics

We investigate the relations between AIV and firm characteristics for two reasons. First, we examine whether information risk proxied by AIV is highly correlated with conventional pricing factors. If AIV is highly correlated with commonly used pricing variables, then the cross-sectional evidence on AIV and expected stock returns might be driven by alternative pricing channels such as liquidity and market capitalization. Second, we investigate whether AIV is strongly associated with other measures of information risk. If the AIV proposed in this study is highly correlated with existing measures of information risk, then AIV may simply be a proxy for a similar type of information risk, and the incremental contribution of AIV as a new information risk proxy would be diminished.

The commonly used pricing variables we have identified include market beta (β_{Mkt}), market capitalization ($Size$), book-to-market ratio (BM), AHXZ's idiosyncratic volatility (IV_{AHXZ}), and Amihud's (2002) illiquidity ($Illiquidity$). We also examine the relationship of AIV with other measures of information risk such as EHO's probability of informed trading (PIN_{EHO}), DY's probability of informed trading (PIN_{DY}), DY's probability of symmetric order-flow shocks ($PSOS$), earnings surprises (SUE), accruals ($Accruals$), accrual quality ($AQuality$), the number of analysts following ($Analyst$), analyst forecast errors ($FErr$), and analyst dispersion ($FDisp$). Panel A of Table 5 presents both Fama-MacBeth (1973) and panel regressions of AIV on asset pricing variables. In the panel regressions, we include models with and without year fixed effects. In Panel B, a similar set of analyses is conducted on the known information risk variables. All Fama-Macbath (1973) t-statistics reported in parentheses are based on Newey-West standard errors, and all t-statistics reported in panel regressions are based on robust standard errors adjusted for heteroskedasticity and clustered at both the firm and year levels.

Table 5 here

Several notable observations emerge from Table 5. Panel A shows that AIV is positively associated with $Size$ and negatively correlated with IV_{AHXZ} and *Illiquidity*. Thus, the results suggest that stocks with high AIV have larger market capitalization, lower idiosyncratic volatility, and higher liquidity, which is consistent with general intuition. For example, large firms have more shares available to be lent to short sellers who contribute to high abnormal idiosyncratic volatility during earnings announcements (Saffi and Sturgessz, 2011; Massa, Zhang, and Zhang, 2015). Although conventional wisdom suggests that small firms might be characterized by higher information asymmetry between insiders and outsiders, the information asymmetry among outside investors may be lower in these firms. The rationale is that outside speculators may not be incentivized to collect private information and trade on small firms, which often feature poor corporate governance that discourages informed trading (e.g., Morck, Yeung, and Yu, 2000; Durnev, Morck, and Yeung, 2004; Ferreira and Laux, 2007).

Informed traders avoid stocks with high arbitrage risk, as proxied by idiosyncratic volatility (Shleifer and Vishny, 1997), and stocks with high transaction costs (Admati and Pfleiderer, 1988).[7] Although the estimated coefficients of $Size$, IV_{AHXZ}, and *Illiquidity* are all statistically significant at conventional levels, the highest adjusted R^2 among these variables is 2.2% (IV_{AHXZ}), which corresponds to a correlation coefficient value that is lower than 15%. The results also show no consistently significant relationship between AIV and β_{Mkt} or BM. The overall findings suggest no strong association between AIV and common pricing variables.

The relation between AIV and other information risk measures presented in Panel B of Table 5 shows that AIV is positively associated with earnings surprises, total accruals, earnings quality, number of analysts following, and the quality of analyst forecasts. However, AIV is not significantly related to PIN_{EHO}, PIN_{DY}, or $PSOS$. The highest adjusted R^2 of these models is 1.1%, which supports the notion that AIV can serve as a new measure for information risk, in addition to existing measures.

[7] However, empirically, it may not be surprising to find a negative correlation between AIV and IV_{AHXZ}, because $AIV = IV_{PEA} - IV_{NEA}$, and IV_{NEA} is positively correlated with IV_{AHXZ}.

The overall results suggest that AIV is a concrete measure of information risk for each stock. More importantly, AIV is a new measure of information risk that is not closely correlated with commonly used pricing factors or alternate measures of information risk. Our next task is to examine the cross-sectional pricing of AIV.

4. Is the earnings-announcement-related information risk priced?

In this section, we employ several steps to test the pricing of AIV. First, we look at the distribution of stock returns across portfolios of stocks single-sorted by AIV and double-sorted by market capitalization and then by AIV. Second, we test whether AIV affects cross-sectional expected stock returns using Fama and French's (1992) asset pricing framework. Finally, we conduct a variety of robustness tests on the pricing of AIV.

4.1. Portfolio approach

As the first step in evaluating our hypothesis that price-based information risk proxied by AIV is related to future stock returns, we construct monthly equally weighted portfolios sorted by AIV. Panel A of Table 6 reports average monthly returns in excess of the one-month T-Bill rate (R) and Fama-French three-factor risk-adjusted returns (R_{Adj}) of single-sorted quintile portfolios formed monthly sorted by AIV. Panel B shows the R_{Adj} of double-sorted quintile portfolios sorted monthly first by prior-year $Size$ and then by prior-year AIV. All t-statistics reported in parentheses are based on Newey-West standard errors. The sample period runs from July 1972 to June 2012.

Table 6 here

The results of Panel A show a positive relationship between AIV and future stock returns. The differences in excess and risk-adjusted returns between the High and Low AIV quintile portfolios are both positive and significant at the 1% level. Most importantly, the return spreads between the High and Low AIV quintile portfolios are significant economically. A trading strategy combining a long position in a High AIV quintile portfolio with a short position in a Low AIV quintile portfolio generates a 2.72% annualized excess return and a 2.89% annualized risk-adjusted return.

There might be a concern that the positive risk premium for AIV is simply a manifestation of return effects related to firm size. To address this potential concern, we employ double-sorted portfolio returns in Panel B to provide robust evidence that the positive relationship between AIV and future stock returns is not driven by market capitalization. The difference in risk-adjusted returns between High and Low AIV quintile portfolios is statistically significant in four of the five $Size$ quintiles. Furthermore, the return differential is more pronounced in the small $Size$ quintile portfolio. The long High-AIV and short Low-AIV trading strategy applied in the smallest $Size$ quintile portfolio yields 5.52% annualized excess returns. In an unreported analysis, we further conduct a double-sorted portfolio analysis with the book-to-market ratio or Amihud's illiquidity and AIV. The positive relationship between AIV and future stock returns is robust for controlling these firm characteristics.

Overall, the portfolio results provide evidence that price-based information risk proxied by AIV positively affects future stock returns. In the next step, we conduct cross-sectional regression analyses to examine the pricing ability of AIV in Fama-MacBeth's (1973) framework.

4.2. Fama-MacBeth approach

In this subsection, we follow Fama and French's (1992) method with cross-sectional return determinants, including market beta, market capitalization, and the book-to-market ratio as control. In addition, following Brennan et al. (2012) and AHXZ, we include idiosyncratic volatility, illiquidity, and past stock returns in our analysis of asset pricing returns. For each month, we run cross-sectional regressions of monthly stock excess returns on return determinants as follows.

$$R_{it+1} = a + b_1 AIV_{it} + b_2 \beta_{Mkt,it} + b_3 Size_{it} + b_4 BM_{it} + b_5 IV_{AHXZ,it} + b_6 Illiquidity_{it} + b_7 R_{[-3,-2],it} + b_8 R_{[-6,-4],it} + b_9 R_{[-12,-7],it} + \varepsilon_{it+1},$$

where $R_{i,t+1}$ is the monthly excess stock return for firm i at time $t+1$, AIV is abnormal idiosyncratic volatility, β_{Mkt} is market beta, $Size$ is market capitalization, BM is the book-to-market ratio, IV_{AHXZ} is AHXZ's idiosyncratic volatility, $Illiquidity$ is Amihud's (2002) illiquidity, $R_{[-3,-2]}$ is the past two-month stock returns, $R_{[-6,-4]}$ is the past three-month stock returns, and $R_{[-12,-7]}$ is the past six-month stock returns. Time-series averages of the estimates are reported in Table 7. All t-statistics reported in parentheses are based on Newey-West standard errors. M1-M2 examine the full sample period from July 1972 to June 2012, M3-M4 examine the period from July 1972 to June 1992, and M5-M6 examine the period from July 1992 to June 2012.

Table 7 here

The table reveals several notable findings. First, our hypothesis is that uninformed investors demand a risk premium for trading stocks with informed investors prior to earnings announcements, and hence stocks with high information risk measured by AIV should compensate for uninformed investors' potential trading losses. We thus expect a positive and significant time-series average coefficient of AIV. The results support our hypothesis. The average coefficient of AIV is 0.258 with t-statistics varying from 4.01 in M4 to 7.25 in M1.

Second, AIV is significantly priced not only in the full sample but also across two subperiods. In the full sample, the time-series average coefficient of AIV is 0.271 in M1 ($t = 7.25$) and 0.246 in M2 ($t = 6.44$). It is notable that the t-statistics are above the newly required significance criteria of three because Harvey, Liu, and Liu (2013) argue that a discovered factor must clear a higher hurdle as a result of the extensive data mining that is currently underway. Furthermore, we examine whether the pricing of AIV is robust across subperiods for two purposes. First, we want to assess whether the basic result that AIV is priced is true during subperiods within the period analyzed. Second, we aim to examine whether the pricing of AIV is more or less pronounced during the recent subperiod. The results show that AIV is significantly priced in both the tested subperiods: 1997-1992 and 1992-2002. Notably, the pricing of AIV is more pronounced during the second subperiod, which is consistent with the astonishing growth in short selling and institutional trading in recent years.

Third, we find consistent signs and significance levels for the coefficients of other conventional pricing factors. For example, MB, $Illiquidity$, and $R_{[-12,-7]}$ have positive and significant coefficients in all the models. IV_{AHXZ} is negatively and significantly associated with monthly excess stock returns, with an average t-statistics of -8.15. β_{Mkt} and $Size$ are insignificantly related to the cross-section of expected stock returns.

4.3. Robustness

In this subsection, we perform further tests to ensure that the pricing of AIV is robust to various specifications. It might be argued that our results are likely driven by the omission of other measures of information risk. For example, Easley, Hvidkjaer, and O'Hara (2002) show that PIN_{EHO} reflects information risk systematically priced by investors but we do not include PIN_{EHO} in our main analysis. To exclude this alternative interpretation, Panel A of Table 8 includes PIN_{EHO} and other measures of information risk such as SUE, PIN_{DY}, and $PSOS$, as additional control variables.

The results show that AIV is significantly priced across all the models from M1 to M10 after controlling for alternative measures of information risk.[8] Moreover, the t-statistics of AIV are all above three in these models. Consistent with Easley, Hvidkjaer, and O'Hara (2002) and Duarte and Young (2009), PIN_{EHO} and PIN_{DY} are positively related to monthly

[8] PIN_{EHO} is available from 1984-1998, and PIN_{DY} and $PSOS$ are available from 1984-2005. Also, PIN_{EHO}, PIN_{DY}, and $PSOS$ are only available for NYSE stocks.

excess stock returns, and the coefficients are insignificant in the full specification with the inclusion of IV_{AHXZ}, *Illiquidity*, $R_{[-3,-2]}$, $R_{[-6,-4]}$, and $R_{[-12,-7]}$.

Table 8 here

Because the risk premium of AIV is more significant in the Small $Size$ quintile portfolio shown in Table 6, it is natural to inquire whether the relationship between AIV and the cross-section of stock returns is driven by inactive or penny stocks. To address this concern in the sample selection, we provide the results for a subsample of large and actively traded stocks by replicating the Fama-MacBeth regressions of M1 and M2 from Table 7 and report the results in Panel B of Table 8. M1-M2 include only stocks with an average price greater than $5; M3-M4 test stocks listed on the NYSE and Amex because larger firms are listed and traded on the NYSE/Amex and have high trading volumes; and M5-M6 examine stocks with at least 100 shares traded on each trading day over the past one year. The results confirm our findings regarding the positive risk premium of information risk proxied by AIV.

We define the pre-earnings-announcement window as a five-day period before the earnings announcement in the main tests. We verify below that the results are robust to alternative definitions of pre-earnings-announcement windows. In Panel C of Table 8, we provide results for alternative measurement windows for the pre-earnings-announcement period of AIV. Here, [-10,-1] ([-3,-1], [-10,-1] [2,10], and [-5,-1] [2,5]) refer to the alternative measures of AIV ($IV_{PEA} - IV_{NEA}$), where IV_{PEA} is calculated as the log annualized standard deviation of daily residuals based on the FF-3 model in days [-10,-1] ([-3,-1], [-10,-1] [2,10], and [-5,-1] [2,5]) prior to quarterly and annual earnings announcements over the preceding year, and IV_{NEA} is defined as the log annualized standard deviation of daily residuals based on the FF-3 model excluding days around announcements [-10,10]([-3,3], [-10,10], and [-5,5]) over the preceding year. The results show that our findings are robust to alternative measurement windows.

Finally, to avoid the bid-ask bounce and lagged reaction effects found in Jegadeesh and

Titman (1993), we skip one month to test the relationship between AIV and future stock returns. M1-M2 of Panel D skip one month between AIV and R_{it+1}, and we find that AIV remains still significantly priced. Theoretically, idiosyncratic risk can also be measured by the market model. Therefore, we show the results for an alternative measure of AIV that is calculated based on the market model instead of the FF-3 model in M3-M4. In M5-M6, we construct an alternative measure of AIV that is calculated based on earnings-announcement dates without adjusting for the time of earnings announcements. Raw AIV is calculated without taking the logarithm transformation of idiosyncratic volatility in M7-M8. The results show that our findings are robust to these alternative specifications of AIV

5. Further analyses of AIV as an information risk measure

Our AIV measure is the idiosyncratic volatility in pre-earnings-announcement periods minus the idiosyncratic volatility in non-earnings-announcement periods, and AIV is found to be positively related to future stock returns. A natural question is whether this result is driven by the same unknown factor that drives the idiosyncratic volatility puzzle documented by AHXZ. In addition, the return predictive power of AIV might be driven by a behavioral explanation in which a high idiosyncratic volatility in the pre-earnings-announcement period signals that a firm has good future prospects; investors overreact in response, and hence, future stock prices continue to rise. We examine these possible alternative explanations in this section.

5.1. Is it due to the idiosyncratic volatility anomaly?

The positive relationship between AIV and future stock returns is robust after controlling for many firm characteristics, including the previous month's idiosyncratic volatility, IV_{AHXZ}, used by AHXZ, as shown in Tables 7 and 8. Because AIV is the difference in the log of idiosyncratic volatility (of the past year) between pre- and non-earnings-announcement periods, the concern that the AIV effect on future returns might reflect the IV_{AHXZ} anomaly remains valid. After all, the idiosyncratic volatility in the non-earnings-announcement period of the past year is cross-sectionally and positively correlated with idiosyncratic volatility in the past month, and AIV is significantly and negatively associated with IV_{AHXZ}, as shown in Table 5, although the goodness-of-fit is poor. To quell such concerns, we provide additional evidence below that shows that the AIV effect can be distinguished from the IV_{AHXZ} anomaly.

Panel A of Table 9 reports the average Fama-French risk-adjusted future returns, R_{Adj}, on five-by-five portfolios sorted first by IV_{AHXZ} and then by AIV. The results show that in each of the IV_{AHXZ} quintiles, average future returns increase with AIV, although not monotonically. The difference in average R_{Adj} between the High and Low AIV portfolios is significantly positive for four out of five IV_{AHXZ} quintiles.

Table 9 here

Panel B of Table 9 reports the average Fama-French risk-adjusted future returns, R_{Adj}, on five-by-five portfolios sorted first by IV_{NEA} and then by IV_{PEA}. The average future returns increase with IV_{PEA} in all but the highest IV_{NEA} quintiles and again not monotonically. The difference in average R_{Adj} between the High and Low AIV portfolios is positive for the second and third IV_{NEA} quintiles. The results provide preliminary evidence that the pricing of AIV is not driven by the IV_{AHXZ} anomaly, and, to a certain extent, that IV_{PEA} contributes to the pricing of AIV.

Table 10 reports Fama-MacBeth regressions of future returns on IV_{PEA} and IV_{NEA} separately with other control variables, including IV_{AHXZ}. The results in M1-M2 show that IV_{PEA} has a positive effect on future returns, whereas IV_{NEA} has a negative effect on future returns, but neither is significant when used alone. These results show that the difference between IV_{PEA} and IV_{NEA} matters most in predicting future stock returns. The subperiod results in M4-M9 basically reconfirm the full sample results.

Table 10 here

Overall, the results from Tables 9 and 10 indicate that the AIV effect on future stock returns is distinct from the IV_{AHXZ} anomaly.

5.2. Contemporaneous change in AIV

Unlike some variables, such as $Size$ and BM, that have large cross-sectional but small time-series variations, AIV has substantial cross-sectional and time-series variations. Therefore, we may explore the effect of its change over time on contemporaneous returns. If AIV represents information risk, an increase in AIV over one month indicates the increase in information risk and, therefore, should be accompanied by a lower contemporaneous return. We examine this implication below.

Table 11 reports the average contemporaneous returns on portfolios sorted by the monthly change in AIV, denoted ΔAIV_{Con}. Panel A reports the average excess returns and Fama-French risk-adjusted returns on quintile portfolios sorted by ΔAIV_{Con}, which reveals a very strong negative relation, although the relation is not completely monotonic across ΔAIV_{Con} portfolios. Panel B presents the average contemporaneous risk-adjusted returns for five by five portfolios first sorted by size and then by ΔAIV_{Con}. The results demonstrate that the negative relation between contemporaneous risk-adjusted returns and the change in AIV is more prominent in small firms and absent in the largest size quintile.

Table 11 here

Table 12 reports Fama-MacBeth regressions of monthly excess stock returns on the contemporaneous change in AIV with other control variables in the full sample and in the two subperiods. In all three regressions, the contemporaneous change in AIV is significantly negatively associated with the returns, reconfirming the portfolio results.

Table 12 here

Combined with the predictive regression results from Tables 6 to 8, the results from Tables 11 and 12 show a convincing pattern of stock prices regarding the information risk related to earnings announcements that are perceived by uninformed investors. An increase in the abnormal idiosyncratic volatility signals an increase in the risk of trading with more informed investors, so the stock price drops (or increases less), resulting in higher expected future returns. Likewise, a decrease in AIV signals a reduction in the risk of trading with informed investors, and the stock price increases, which results in lower expected future returns.

6. Conclusion

In this paper, we examine whether the risk due to information asymmetry is compensated for in expected stock returns. We note that the theoretical models in the literature result in opposite predictions based on their different assumptions and that the previous empirical studies encounter issues related to robustness and computational difficulties. We also take the position that information risk is multifaceted and cannot be represented with a single measure.

We develop a price-based information risk measure based on a firm's idiosyncratic volatility differential between pre- and non-earnings-announcement periods. The price-based information risk measure we construct, AIV, has variations both across firms and over time. AIV is related to insider trading, short selling, and institutional trading activities. The higher AIV firm-years are associated with higher abnormal insider trading, short selling, and institutional trading activities prior to earnings announcements. Moreover, AIV is virtually unrelated to alternative information risk measures used in the literature.

The information risk captured by AIV is positively associated with expected stock returns. We also exploit the time variation in AIV to demonstrate that the contemporaneous negative relationship between the stock return and the AIV change is consistent with the interpretation that AIV captures the information risk. Furthermore, the AIV effect is distinct from and not a reflection of the idiosyncratic volatility anomaly. Overall, these results support the general notion that information risk is priced. In future research, we will extend our methodology to other information events such as mergers and acquisitions, dividend revisions, and other important corporate events, to further and deepen our understanding of the pricing of information risk.

Appendix
Variable Definition

Variable	Acronym	Description	Source
Panel A: Information Risk Measures			
Abnormal idiosyncratic volatility	AIV	$IV_{PEA} - IV_{NEA}$, difference in idiosyncratic volatility between pre-earnings-announcement and non-earnings-announcement periods	CRSP & Compustat
Pre-earnings-announcement idiosyncratic volatility	IV_{PEA}	Log of annualized standard deviation of daily residuals based on the Fama-French three-factor model in five days [-5,-1] prior quarter and annual earnings announcements over the preceding one year	CRSP & Compustat
Non-earnings-announcement idiosyncratic volatility	IV_{NEA}	Log of annualized standard deviation of daily residuals based on the Fama-French three-factor model excluding days prior announcement [-5,-1] and earnings announcement days [0,1] over the preceding one year	CRSP & Compustat
Contemporaneous change in abnormal idiosyncratic volatility	ΔAIV_{Con}	Contemporaneous change in AIV	CRSP & Compustat
Panel B: Asset Pricing Test Variables			
Monthly excess returns	R	Monthly stock returns in excess of risk-free rate (in percentage)	CRSP
Monthly risk-adjusted returns	R_{Adj}	Monthly risk-adjusted returns based on the Fama-French three-factor model	CRSP
Market beta	β_{Mkt}	Market beta of the stock with respect to the CRSP value-weighted index estimated following Fama and French (1992)	CRSP
Market capitalization	$Size$	Log of the market capitalization of firm in million dollars	CRSP
Book-to-market ratio	BM	Log of the book-to-market equity ratio	CRSP & Compustat
AHXZ's idiosyncratic volatility	IV_{AHXZ}	Annulized standard deviation of daily residuals based on the Fama-French three-factor model following AHXZ during previous month (in percentage)	CRSP
Amihud's (2002) illiquidity	$Illiquidity$	Annual mean of the daily absolute stock returns divided by dollar trading volume following Amihud (2002), this estimate is multiple by 10^6	CRSP
Past two-month stock returns	$R_{[-3,-2]}$	Cumulative stock returns over two months ending at the beginning of the previous month (in percentage)	CRSP
Past three-month stock returns	$R_{[-6,-4]}$	Cumulative stock returns over three months ending three months previously (in percentage)	CRSP
Past six-month stock returns	$R_{[-12,-7]}$	Cumulative stock returns over six months ending six months previously (in percentage)	CRSP

Appendix
Variable Definition-Continued

Variable	Acronym	Description	Source
Panel C: Information Environment Variables			
EHO's PIN	PIN_{EHO}	Probability of informed trading estimated using Easley, Hvidkjaer, and O'Hara's (2002) method	Hvidkjaer's website
DY's PIN	PIN_{DY}	Probability of informed trading estimated using Duarte and Young's (2009) method	Duarte's website
DY's PSOS	$PSOS$	Probability of symmetric order-flow shocks estimated using Duarte and Young's (2009) method	Duarte's website
Earnings surprises	SUE	Standardized unexpected earnings calculated as most recent announced earnings less earnings one year before scaled by stock price following Livnat and Mendenhall (2006)	IBES
Accruals	$Accruals$	Total accruals defined as changes in current assets minus changes in current liabilities minus changes in cash plus changes in current debt in current liabilities minus depreciation and amortization expense scaled by total assets following Sloan (1996)	Compustat
Accruals quality	$AQuality$	Standard deviation of prior five-year residual accruals obtained by regressing total accruals on past, current, and future cash flows, and revenue growth for each year and industry group scaled by average total assets, following Francis et al.'s (2005) model	CRSP & Compustat
Number of analysts following	$Analyst$	Number of financial analysts following a firm	IBES
Analyst forecast errors	$FErr$	Absolute value of the difference between announced earnings and mean of forecast earnings scaled by mean of analyst forecasts	IBES
Analyst dispersion	$FDisp$	Standard deviation of analyst forecasts scaled by mean of analyst forecasts	IBES
Panel D:Short Selling, Insider Trading, and Institutional Trading Variables			
Abnormal short selling	ASS	$SS_{PEA} - SS_{NEA}$, difference in short selling between pre-earnings-announcement and non-earnings-announcement periods	Reg SHO
Pre-earnings-announcement short selling	SS_{PEA}	Annulized daily proportion of shares short sold in five days [-5,-1] prior quarter and annual earnings announcements over the preceding one year (in percentage)	Reg SHO
Non-earnings-announcement short selling	SS_{NEA}	Annulized daily proportion of shares short sold excluding days around earnings announcements [-5, 5] over the preceding one year (in percentage)	Reg SHO
Abnormal insider trading	AIT	$IT_{PEA} - IT_{NEA}$, difference in insider trading between pre-earnings-announcement and non-earnings-announcement periods	Thomson Insider
Pre-earnings-announcement insider trading	IT_{PEA}	Annulized daily proportion of shares traded by directors and officers in five days [-5,-1] prior quarter and annual earnings announcements over the preceding one year (in percentage)	Thomson Insider
Non-earnings-announcement insider trading	IT_{NEA}	Annulized daily proportion of shares traded by directors and officers excluding days around earnings announcement [-5, 5] over the preceding one year (in percentage)	Thomson Insider
Abnormal institutional trading	AIN	$IN_{PEA} - IN_{NEA}$, difference in institutional trading between pre-earnings-announcement and non-earnings-announcement periods	ANcerno
Pre-earnings-announcement institutional trading	IN_{PEA}	Annulized daily proportion of shares traded by institutional investors in five days [-5,-1] prior quarter and annual earnings announcements over the preceding one year (in percentage)	ANcerno
Non-earnings-announcement institutional trading	IN_{NEA}	Annulized daily proportion of shares traded by institutional investors excluding days around earnings announcements [-5, 5] over the preceding one year (in percentage)	ANcerno

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Table 1
Summary Statistics

This table presents the summary statistics of main variables used in this study. Panel A reports the asset pricing test variables that include abnormal idiosyncratic volatility (AIV), pre-earnings-announcement idiosyncratic volatility (IV_{PEA}), non-earnings-announcement idiosyncratic volatility (IV_{NEA}), monthly excess returns (R), market beta (β_{Mkt}), market capitalization ($Size$), book-to-market ratio (BM), AHXZ's idiosyncratic volatility (IV_{AHXZ}), Amihud's (2002) illiquidity ($Illiquidity$), past two-month stock returns ($R_{[-3,-2]}$), past three-month stock returns ($R_{[-6,-4]}$), and past six-month stock returns ($R_{[-12,-7]}$). Panel B reports the information environment variables that include EHO's PIN (PIN_{EHO}), DY's PIN (PIN_{DY}), DY's PSOS ($PSOS$), earnings surprises (SUE), accruals ($Accruals$), accruals quality ($AQuality$), number of analysts following ($Analyst$), analyst forecast errors ($FErr$), and analyst dispersion ($FDisp$). Panel C presents the AIV statistics of stock portfolios sorted on $Size$. All the variables are defined in Appendix. The summary statistics includes the number of observations (NObs), mean, median, standard deviation (STD), the percentiles (5% and 95%), and quartiles (25% and 75%) distribution of the variables. The sample period is from July 1972 to June 2012.

Panel A: Asset Pricing Test Variables at the Monthly Frequency

Variable	NObs	Mean	STD	5%	25%	Median	75%	95%
AIV	1,443,493	0.007	0.332	-0.521	-0.190	0.009	0.208	0.533
IV_{PEA}	1,443,493	-0.909	0.573	-1.847	-1.313	-0.911	-0.517	0.054
IV_{NEA}	1,443,493	-0.916	0.514	-1.751	-1.292	-0.920	-0.558	-0.046
R	1,443,493	0.674	12.431	-18.180	-6.443	-0.167	6.604	22.542
β_{Mkt}	1,443,493	1.324	0.332	0.720	1.094	1.309	1.567	1.889
$Size$	1,443,493	4.932	1.902	2.043	3.497	4.782	6.239	8.308
BM	1,443,493	-0.377	0.789	-1.817	-0.841	-0.299	0.151	0.809
IV_{AHXZ}	1,443,403	42.363	28.146	12.959	22.798	34.755	53.226	99.363
$Illiquidity$	1,410,206	5.454	15.737	0.004	0.044	0.357	2.674	29.842
$R_{[-3,-2]}$	1,429,616	2.259	17.410	-23.645	-8.155	0.866	10.657	33.229
$R_{[-6,-4]}$	1,422,677	3.420	21.445	-27.787	-9.637	1.409	13.588	41.928
$R_{[-12,-7]}$	1,405,026	7.552	32.299	-36.142	-12.381	3.375	21.375	66.541

Panel B: Information Environment Variables at the Annual Frequency

Variable	NObs	Mean	STD	5%	25%	Median	75%	95%
PIN_{EHO}	23,908	0.210	0.074	0.115	0.159	0.199	0.246	0.347
PIN_{DY}	34,441	0.185	0.088	0.087	0.128	0.163	0.220	0.362
$PSOS$	34,441	0.290	0.163	0.115	0.176	0.236	0.362	0.638
SUE	112,809	-0.001	0.090	-0.107	-0.009	0.002	0.011	0.092
$Accruals$	100,240	-0.037	0.087	-0.182	-0.078	-0.036	0.005	0.103
$AQuality$	85,739	0.051	0.039	0.010	0.024	0.040	0.065	0.131
$Analyst$	70,334	8.718	8.528	1.000	2.452	5.806	12.258	26.435
$FErr$	66,443	0.786	2.135	0.007	0.051	0.174	0.548	3.417
$FDisp$	64,144	0.593	1.349	0.021	0.072	0.161	0.350	2.504

Panel C: The *AIV* Statistics of Portfolios Sorted by *Size*

Portfolios	NObs	Mean	STD	5%	25%	Median	75%	95%
AIV for Small $Size$	288,887	-0.024	0.391	-0.672	-0.245	-0.011	0.213	0.585
AIV for 2	288,701	0.004	0.344	-0.552	-0.205	0.005	0.216	0.559
AIV for 3	288,700	0.010	0.322	-0.505	-0.191	0.008	0.209	0.533
AIV for 4	288,701	0.013	0.303	-0.472	-0.178	0.011	0.201	0.500
AIV for Large $Size$	288,504	0.033	0.276	-0.403	-0.143	0.028	0.202	0.479

Table 2
Insider Trading and *AIV*

This table reports the abnormal idiosyncratic volatility (*AIV*) of stock portfolios sorted on abnormal insider trading (*AIT*). The left panel shows *AIV* of single-sorted portfolios formed annually on abnormal insider trading (*AIT*). The right panel shows *AIV* of portfolios sorted first by market capitalization (*Size*) and then by abnormal insider trading (*AIT*). The differences in *AIV* between the high and the low portfolios are also reported, along with *t*-statistics in parentheses. The *t*-statistics reported in parentheses are based on Newey-West standard errors. The sample period is from January 1996 to December 2011.

	Panel A: Single-Sorted Portfolios	**Panel B: Double-Sorted Portfolios Sort by *Size*, then *AIT***				
Portfolios	*AIV*	Small *Size*	2	3	4	Large *Size*
Low *AIT*	-0.013	-0.062	-0.048	-0.001	0.029	0.033
2	0.020	-0.007	-0.018	0.014	0.007	0.044
3	0.009	-0.001	-0.028	-0.025	0.004	0.017
4	0.009	0.028	-0.004	0.002	0.013	0.033
High *AIT*	0.026	0.014	0.051	0.013	0.016	0.058
High-Low	**0.039**	**0.076**	**0.099**	**0.014**	**-0.013**	**0.024**
	(3.73)	**(1.95)**	**(2.28)**	**(0.49)**	**(-0.40)**	**(1.37)**

Table 3
Short Selling and *AIV*

This table reports the abnormal idiosyncratic volatility (*AIV*) of stock portfolios sorted on abnormal short selling (*ASS*). The left panel shows *AIV* of single-sorted portfolios formed annually on abnormal short selling (*ASS*). The right panel shows *AIV* of portfolios sorted first by market capitalization (*Size*) and then by abnormal short selling (*ASS*). The differences in *AIV* between the high and the low portfolios are also reported, along with *t*-statistics in parentheses.The *t*-statistics reported in parentheses are based on Newey-West standard errors. The sample period is from January 2005 to July 2007.

	Panel A: Single-Sorted Portfolios	**Panel B: Double-Sorted Portfolios Sort by *Size*, then *ASS***				
Portfolios	*AIV*	Small *Size*	2	3	4	Large *Size*
Low *ASS*	-0.130	-0.092	-0.120	-0.149	-0.124	-0.108
2	-0.056	-0.057	-0.126	-0.074	-0.085	-0.027
3	0.005	-0.106	-0.081	-0.017	0.003	0.028
4	0.060	-0.027	-0.011	0.048	0.045	0.077
High *ASS*	0.132	0.151	0.030	0.149	0.159	0.125
High-Low	**0.262**	**0.243**	**0.150**	**0.298**	**0.283**	**0.233**
	(5.04)	**(1.50)**	**(1.03)**	**(10.13)**	**(4.65)**	**(5.54)**

Table 4
Institutional Trading and *AIV*

This table reports the abnormal idiosyncratic volatility (*AIV*) of stock portfolios sorted on abnormal institutional trading (*AIN*). The left panel shows *AIV* of single-sorted portfolios formed annually on abnormal institutional trading (*AIN*). The right panel shows *AIV* of double-sorted portfolios sorted first by market capitalization (*Size*) and then by abnormal institutional trading (*AIN*). The differences in *AIV* between the high and the low portfolios are also reported, along with t-statistics in parentheses. The t-statistics reported in parentheses are based on Newey-West standard errors. The sample period is from January 1999 to December 2010.

	Panel A: Single-Sorted Portfolios	**Panel B: Double-Sorted Portfolios Sort by *Size*, then *AIN***				
Portfolios	*AIV*	Small *Size*	2	3	4	Large *Size*
Low *AIN*	-0.063	-0.070	-0.072	-0.071	-0.072	-0.061
2	-0.031	-0.070	-0.063	-0.039	-0.028	-0.003
3	-0.035	-0.060	-0.061	-0.032	-0.015	0.031
4	0.006	-0.032	-0.031	-0.008	0.039	0.063
High *AIN*	0.078	-0.023	0.022	0.056	0.083	0.131
High-Low	**0.140**	**0.047**	**0.093**	**0.127**	**0.155**	**0.191**
	(20.20)	**(1.98)**	**(7.18)**	**(11.50)**	**(17.74)**	**(17.20)**

Table 5
Relations with Other Firm Characteristics

This table presents Fama-MacBeth cross-sectional regression and panel regression of the abnormal idiosyncratic volatility (AIV) on asset pricing test variables in Panel A and information environment variables in Panel B with or without year-fixed effects (Y) as control.

$$Fama-MacBeth : AIV = a + bV + \varepsilon,$$
$$Panel : AIV = a + bV(+cY) + \varepsilon,$$

where V refers to market beta (β_{Mkt}), market capitalization ($Size$), book-to-market ratio (BM), AHXZ's idiosyncratic volatility (IV_{AHXZ}), Amihud's (2002) illiquidity ($Illiquidity$), EHO's PIN (PIN_{EHO}), DY's PIN (PIN_{DY}), DY's PSOS ($PSOS$), earnings surprises (SUE) , accruals ($Accruals$), accruals quality ($AQuality$), number of analysts following ($Analyst$), analyst forecast errors ($FErr$), and analyst dispersion ($FDisp$). The t-statistics reported in parentheses are based on Newey-West standard errors for Fama-MacBeth (1973) cross-sectional regression and based on robust standard errors adjsuted for heteroskedasticity and clustered at both the firm and year level for panel regression. $\bar{R}^2$ is adjusted R^2. The sample period varies according to the availability of asset pricing test and information environment variables.

Panel A: Asset Pricing Test Variables

	Fama-MacBeth Regression		Panel Regression		Panel Regression	
	$AIV = a + bV + \varepsilon$		$AIV = a + bV + \varepsilon$		$AIV = a + bV + cY + \varepsilon$	
Variable	b	$\bar{R}^2$	b	$\bar{R}^2$	b	$\bar{R}^2$
β_{Mkt}	-0.003	0.1%	-0.014	0.0%	-0.008	0.9%
	(-0.31)		(-2.18)		(-1.33)	
$Size$	0.010	0.7%	0.008	0.2%	0.012	1.3%
	(3.52)		(4.77)		(8.62)	
BM	-0.001	0.1%	0.004	0.0%	-0.004	0.9%
	(-0.31)		(1.21)		(-1.79)	
IV_{AHXZ}	-0.111	1.4%	-0.108	1.6%	-0.110	2.2%
	(-8.08)		(-22.51)		(-18.72)	
$Illiquidity$	-1.330	0.3%	-0.674	0.2%	-0.693	1.0%
	(-3.64)		(-3.81)		(-3.88)	

Table 5
Relations with Other Firm Characteristics-Continued

Panel B: Information Environment Variables						
	Fama-MacBeth Regression		Panel Regression		Panel Regression	
	$AIV = a + bV + \varepsilon$		$AIV = a + bV + \varepsilon$		$AIV = a + bV + cY + \varepsilon$	
Variable	b	$\bar{R}^2$	b	$\bar{R}^2$	b	$\bar{R}^2$
PIN_{EHO}	-0.050	0.1%	-0.042	0.0%	-0.051	0.4%
	(-1.06)		(-0.90)		(-1.06)	
PIN_{DY}	-0.124	0.4%	-0.049	0.0%	-0.099	1.0%
	(-1.41)		(-1.10)		(-2.07)	
$PSOS$	-0.067	0.3%	-0.045	0.1%	-0.049	1.0%
	(-1.79)		(-2.15)		(-2.35)	
SUE	0.022	0.0%	0.003	0.0%	0.004	1.0%
	(2.20)		(1.12)		(1.39)	
$Accruals$	0.062	0.1%	0.081	0.1%	0.064	0.9%
	(4.65)		(5.09)		(4.84)	
$AQuality$	-0.142	0.2%	-0.254	0.2%	-0.205	1.0%
	(-2.07)		(-5.55)		(-5.29)	
$Analyst$	0.002	0.3%	0.002	0.2%	0.002	1.1%
	(5.69)		(5.00)		(5.11)	
$FErr$	-0.001	-0.3%	-0.000	0.0%	-0.000	0.9%
	(-2.95)		(-3.20)		(-2.91)	
$FDisp$	-0.003	-0.2%	-0.001	0.0%	-0.001	0.9%
	(-4.78)		(-2.83)		(-2.73)	

Table 6
Monthly Excess Returns and Risk-Adjusted Returns of AIV Portfolios

This table reports equally weighted average monthly excess returns (R) and risk-adjusted returns (R_{Adj}) of stock portfolios sorted on the abnormal idiosyncratic volatility (AIV). Panel A shows R and R_{Adj} of single-sorted portfolios formed monthly on prior-year AIV. Panel B shows R_{Adj} of double-sorted portfolios sorted monthly first by prior-year market capitalization ($Size$) and then by prior-year AIV. The differences in R and R_{Adj} between the high and the low portfolios are also reported, along with t-statistics in parentheses. The t-statistics reported in parentheses are based on Newey-West standard errors. The sample period is from July 1972 to June 2012.

	Panel A: Single-Sorted Portfolios		**Panel B: Double-Sorted Portfolios Sort by $Size$, then AIV**				
Portfolios	R	R_{Adj}	Small $Size$	2	3	4	Large $Size$
Low AIV	0.955	-0.230	-0.363	-0.347	-0.330	-0.151	-0.025
2	1.108	-0.071	-0.022	-0.124	-0.181	-0.023	0.034
3	1.145	-0.027	0.084	-0.034	-0.143	-0.045	0.055
4	1.174	0.002	0.025	-0.149	0.041	0.005	0.037
High AIV	1.180	0.008	0.086	0.012	-0.060	0.036	-0.002
High-Low	**0.224**	**0.238**	**0.449**	**0.358**	**0.270**	**0.186**	**0.023**
	(4.40)	**(4.38)**	**(4.63)**	**(4.30)**	**(3.19)**	**(2.56)**	**(0.34)**

Table 7
The Effect of AIV on Cross-Sectional Expected Stock Returns

This table shows Fama-MacBeth cross-sectional regression results for the following model.

$$R_{it+1} = a + b_1 AIV_{it} + b_2 \beta_{Mkt,it} + b_3 Size_{it} + b_4 BM_{it} + b_5 IV_{AHXZ,it} + b_6 Illiquidity_{it} + b_7 R_{[-3,-2],it} + b_8 R_{[-6,-4],it} + b_9 R_{[-12,-7],it} + \varepsilon_{it+1},$$

where $R_{i,t+1}$ is the monthly stock excess return of firm i at time $t+1$, AIV is abnormal idiosyncratic volatility, β_{Mkt} is market beta, $Size$ is market capitalization, BM is book-to-market ratio, IV_{AHXZ} is AHXZ's idiosyncratic volatility, $Illiquidity$ is Amihud's (2002) illiquidity, $R_{[-3,-2]}$ is past two-month stock returns, $R_{[-6,-4]}$ is past three-month stock returns, and $R_{[-12,-7]}$ is past six-month stock returns. The t-statistics reported in parentheses are based on Newey-West standard errors. M1-M2 examine a sample period from July 1972 to June 2012, M3-M4 examine a sample period from July 1972 to June 1992, and M5-M6 examine a sample period from July 1992 to June 2012. The table presents time series averages of the estimated slope coefficients from the above regression. $\bar{R}^2$ is the time-series average of adjusted R^2 in the cross-sectional regression, and Firms denotes the time-series average of the number of firms in the cross-sectional regression.

	Full Sample		1972-1992		1992-2012	
Variable	M1	M2	M3	M4	M5	M6
AIV	**0.271**	**0.246**	**0.236**	**0.208**	**0.305**	**0.284**
	(7.25)	**(6.44)**	**(5.09)**	**(4.01)**	**(5.23)**	**(5.08)**
β_{Mkt}	-0.026	0.174	-0.384	-0.063	0.332	0.411
	(-0.09)	(0.80)	(-1.15)	(-0.23)	(0.74)	(1.23)
$Size$	0.008	-0.065	-0.018	-0.077	0.034	-0.053
	(0.22)	(-2.12)	(-0.34)	(-1.76)	(0.65)	(-1.24)
BM	0.327	0.276	0.372	0.348	0.281	0.204
	(4.62)	(4.45)	(3.87)	(3.86)	(2.72)	(2.42)
IV_{AHXZ}		-1.850		-2.127		-1.573
		(-9.79)		(-9.38)		(-5.27)
$Illiquidity$		0.018		0.019		0.017
		(4.74)		(3.02)		(4.00)
$R_{[-3,-2]}$		0.408		0.420		0.397
		(1.64)		(1.32)		(1.03)
$R_{[-6,-4]}$		0.478		0.670		0.286
		(1.80)		(1.84)		(0.74)
$R_{[-12,-7]}$		0.864		1.294		0.434
		(5.02)		(5.68)		(1.77)
Intercept	0.750	1.210	1.177	1.472	0.324	0.948
	(2.52)	(4.26)	(3.33)	(4.70)	(0.68)	(2.01)
$\bar{R}^2$	3.7%	5.8%	4.1%	6.2%	3.3%	5.3%
Firms	3,007	2,810	2,461	2,180	3,554	3,439

Table 8
Robustness

This table repeats Fama-MacBeth regressions of M1-M2 of Table 8 with robustness tests in the following model.

$$R_{it+1} = a + b_1 AIV_{it} + b_2 \beta_{Mkt,it} + b_3 Size_{it} + b_4 BM_{it} + b_5 IV_{AHXZ,it} + b_6 Illiquidity_{it} + b_7 R_{[-3,-2],it} + b_8 R_{[-6,-4],it} + b_9 R_{[-12,-7],it} + \varepsilon_{it+1},$$

where $R_{i,t+1}$ is the monthly stock excess return of firm i at time $t+1$, AIV is abnormal idiosyncratic volatility, β_{Mkt} is market beta, $Size$ is market capitalization, BM is book-to-market ratio, IV_{AHXZ} is AHXZ's idiosyncratic volatility, $Illiquidity$ is Amihud's (2002) illiquidity, $R_{[-3,-2]}$ is past two-month stock returns, $R_{[-6,-4]}$ is past three-month stock returns, and $R_{[-12,-7]}$ is past six-month stock returns. Panel A provides results with additional control variables that include earnings surprises (SUE), EHO's PIN (PIN_{EHO}), DY's PIN (PIN_{DY}), and DY's PSOS ($PSOS$). Panel B provides results for large and active stocks. Price>$5 signifies stocks with price greater than 5 at the end of last June. NYSE/AMEX signifies stocks traded on the New York Stock Exchange or American Stock Exchange. Active Stocks refer to stocks with at least 100 shares traded in every trading day in the past one year. Panel C provides results for alternative measurement windows for the pre-earnings-announcement period of AIV. [-10,-1] ([-3,-1], [-10,-1] [2,10], and [-5,-1] [2,5]) refers to the alternative measure of AIV ($IV_{PEA} - IV_{NEA}$), where IV_{PEA} is calculated as the log of the annualized standard deviation of daily residuals based on the Fama-French three-factor model in ten days [-10,-1] ([-3,-1], [-10,-1] [2,10], and [-5,-1] [2,5]) prior quarter and annual earnings announcements over the preceding one year and IV_{NEA} is defined as the log of the annualized standard deviation of daily residuals based on the Fama-French three-factor model excluding days around earnings announcements [-10,10]([-3,3], [-10,10], and [-5,5]) over the preceding one year. Panel D provides results for other robustness tests. Skip One Month refers to a one-month gap between AIV and R_{it+1}. Market Model refers to the alternative measure of AIV that is calculated based on the market model instead of the Fama-French three-factor model. Announcement Time refers to the alternative measure of AIV that is calculated based on earnings-announcement windows not adjusted by earnings-announcement time. Raw AIV is calculated without taking the logarithm transformation of idiosyncratic volatility. The table presents time series averages of the estimated slope coefficients from the above regression. The t-statistics reported in parentheses are based on Newey-West standard errors. The sample period is from July 1972 to June 2012 except for Panel A where sample period is limited by the availability of additional information environment variables. $\bar{R}^2$ is the time-series average of adjusted R^2 in the cross-sectional regression, and Firms denotes the time-series average of the number of firms in the cross-sectional regression.

Panel A: Additional Control Variables										
Variable	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
AIV	**0.275**	**0.243**	**0.335**	**0.250**	**0.324**	**0.271**	**0.331**	**0.275**	**0.320**	**0.274**
	(6.40)	**(5.54)**	**(5.21)**	**(4.09)**	**(5.55)**	**(5.01)**	**(5.63)**	**(5.04)**	**(5.43)**	**(4.83)**
SUE	2.192	1.743							1.366	1.048
	(3.74)	(3.20)							(4.61)	(3.98)
PIN_{EHO}			1.657	-0.036						
			(3.17)	(-0.08)						
PIN_{DY}					1.388	0.587			1.222	0.475
					(3.00)	(1.61)			(2.70)	(1.36)
$PSOS$							0.262	-0.021	0.251	0.035
							(1.12)	(-0.10)	(1.10)	(0.16)
β_{Mkt}	0.018	0.191	-0.319	-0.181	-0.069	-0.010	-0.086	-0.007	-0.048	-0.004
	(0.06)	(0.87)	(-0.92)	(-0.62)	(-0.22)	(-0.04)	(-0.27)	(-0.03)	(-0.15)	(-0.02)
$Size$	0.001	-0.073	0.162	0.023	0.111	0.013	0.094	0.001	0.118	0.012
	(0.03)	(-2.40)	(3.35)	(0.58)	(2.46)	(0.35)	(2.14)	(0.01)	(2.49)	(0.31)
BM	0.306	0.259	0.247	0.213	0.245	0.211	0.245	0.208	0.237	0.207
	(4.37)	(4.14)	(2.85)	(2.68)	(3.22)	(3.00)	(3.27)	(2.99)	(3.20)	(3.00)
IV_{AHXZ}		-1.727		-1.941		-1.486		-1.533		-1.465
		(-9.04)		(-6.06)		(-4.99)		(-5.05)		(-4.79)
Illiquidity		0.017		0.019		0.021		0.022		0.021
		(4.07)		(2.01)		(2.19)		(2.29)		(2.08)
$R_{[-3,-2]}$		0.403		0.472		0.493		0.480		0.413
		(1.59)		(1.26)		(1.51)		(1.46)		(1.28)
$R_{[-6,-4]}$		0.428		0.607		0.775		0.777		0.750
		(1.60)		(1.49)		(2.47)		(2.49)		(2.41)
$R_{[-12,-7]}$		0.826		1.230		0.895		0.911		0.849
		(4.82)		(6.00)		(4.32)		(4.40)		(4.19)
Intercept	0.718	1.197	-0.212	1.024	-0.014	0.771	0.298	0.976	-0.107	0.797
	(2.38)	(4.09)	(-0.52)	(2.76)	(-0.04)	(2.05)	(0.71)	(2.43)	(-0.24)	(1.91)
$\bar{R}^2$	3.8%	5.9%	3.2%	5.4%	3.4%	5.9%	3.4%	5.9%	3.8%	6.1%
Firms	2,905	2,725	1,575	1,489	1,546	1,475	1,546	1,475	1,519	1,449

Table 8
Robustness-Continued

Panel B: Large and Active Stocks

	Price>$5		NYSE		Active Stocks	
Variable	M1	M2	M3	M4	M5	M6
AIV	**0.206**	**0.179**	**0.140**	**0.123**	**0.194**	**0.158**
	(5.14)	**(4.48)**	**(2.48)**	**(2.51)**	**(3.56)**	**(3.14)**
β_{Mkt}	-0.023	0.078	-0.051	-0.030	-0.130	0.080
	(-0.08)	(0.37)	(-0.19)	(-0.14)	(-0.46)	(0.37)
$Size$	-0.002	-0.072	-0.038	-0.094	-0.106	-0.188
	(-0.07)	(-2.43)	(-1.08)	(-3.08)	(-2.36)	(-5.00)
BM	0.270	0.218	0.154	0.147	0.274	0.214
	(3.69)	(3.37)	(2.30)	(2.30)	(3.45)	(3.06)
IV_{AHXZ}		-1.936		-1.907		-2.551
		(-9.99)		(-7.71)		(-10.26)
$Illiquidity$		0.009		0.057		0.234
		(1.03)		(1.06)		(6.25)
$R_{[-3,-2]}$		0.529		0.432		0.526
		(1.92)		(1.42)		(1.83)
$R_{[-6,-4]}$		0.600		0.329		0.404
		(2.08)		(0.96)		(1.35)
$R_{[-12,-7]}$		0.903		0.906		0.899
		(5.02)		(4.16)		(4.37)
Intercept	0.786	1.315	1.004	1.481	1.630	2.294
	(2.47)	(4.34)	(3.26)	(5.18)	(4.60)	(6.82)
$\bar{R}^2$	3.8%	6.1%	4.5%	7.6%	4.9%	7.8%
Firms	2,391	2,221	1,171	1,105	1,787	1,722

Table 8
Robustness-Continued

Panel C: Alternative Measurement Window								
	[-10,-1]		[-3,-1]		[-10,-1] [2,10]		[-5,-1] [2,5]	
Variable	M1	M2	M3	M4	M5	M6	M7	M8
AIV	**0.308**	**0.297**	**0.217**	**0.192**	**0.272**	**0.271**	**0.276**	**0.247**
	(6.50)	**(6.24)**	**(6.51)**	**(5.73)**	**(4.94)**	**(4.61)**	**(5.88)**	**(5.05)**
β_{Mkt}	-0.022	0.175	-0.041	0.159	-0.016	0.182	-0.019	0.180
	(-0.08)	(0.81)	(-0.15)	(0.73)	(-0.06)	(0.84)	(-0.07)	(0.83)
$Size$	0.008	-0.065	0.006	-0.068	0.011	-0.063	0.010	-0.064
	(0.22)	(-2.11)	(0.16)	(-2.20)	(0.29)	(-2.06)	(0.27)	(-2.08)
BM	0.328	0.277	0.320	0.270	0.328	0.277	0.327	0.277
	(4.64)	(4.47)	(4.54)	(4.36)	(4.64)	(4.47)	(4.64)	(4.46)
IV_{AHXZ}		-1.841		-1.851		-1.850		-1.852
		(-9.72)		(-9.71)		(-9.75)		(-9.78)
$Illiquidity$		0.018		0.018		0.018		0.018
		(4.71)		(4.82)		(4.70)		(4.73)
$R_{[-3,-2]}$		0.406		0.448		0.405		0.408
		(1.63)		(1.79)		(1.62)		(1.64)
$R_{[-6,-4]}$		0.481		0.479		0.481		0.478
		(1.81)		(1.81)		(1.81)		(1.80)
$R_{[-12,-7]}$		0.867		0.868		0.869		0.868
		(5.04)		(5.02)		(5.05)		(5.04)
Intercept	0.746	1.206	0.784	1.246	0.724	1.191	0.728	1.194
	(2.50)	(4.24)	(2.62)	(4.36)	(2.43)	(4.19)	(2.44)	(4.20)
$\bar{R}^2$	3.7%	5.8%	3.7%	5.8%	3.7%	5.8%	3.7%	5.8%
Firms	3,007	2,810	2,959	2,772	3,007	2,810	3,007	2,810

Table 8
Robustness-Continued

Panel D: Others

	Skip One Month		Market Model		Announcement Time		Raw AIV	
Variable	M1	M2	M3	M4	M5	M6	M7	M8
AIV	**0.217**	**0.173**	**0.274**	**0.252**	**0.266**	**0.243**	**0.447**	**0.408**
	(5.73)	**(4.57)**	**(7.20)**	**(6.64)**	**(6.90)**	**(6.34)**	**(5.61)**	**(5.17)**
β_{Mkt}	-0.024	0.175	-0.026	0.173	-0.025	0.174	-0.022	0.177
	(-0.09)	(0.81)	(-0.09)	(0.80)	(-0.09)	(0.80)	(-0.08)	(0.81)
$Size$	0.009	-0.066	0.008	-0.066	0.008	-0.065	0.011	-0.063
	(0.25)	(-2.14)	(0.21)	(-2.14)	(0.22)	(-2.12)	(0.30)	(-2.04)
BM	0.327	0.275	0.327	0.276	0.327	0.276	0.328	0.277
	(4.63)	(4.43)	(4.62)	(4.45)	(4.62)	(4.45)	(4.64)	(4.47)
IV_{AHXZ}		-1.862		-1.850		-1.850		-1.849
		(-9.89)		(-9.79)		(-9.79)		(-9.81)
$Illiquidity$		0.018		0.018		0.018		0.018
		(4.71)		(4.73)		(4.73)		(4.72)
$R_{[-3,-2]}$		0.415		0.408		0.408		0.407
		(1.67)		(1.64)		(1.64)		(1.64)
$R_{[-6,-4]}$		0.481		0.478		0.478		0.480
		(1.82)		(1.80)		(1.80)		(1.81)
$R_{[-12,-7]}$		0.868		0.864		0.864		0.865
		(5.04)		(5.02)		(5.02)		(5.02)
Intercept	0.744	1.217	0.754	1.213	0.750	1.210	0.728	1.190
	(2.49)	(4.29)	(2.53)	(4.27)	(2.52)	(4.26)	(2.44)	(4.18)
$\bar{R}^2$	3.7%	5.8%	3.7%	5.8%	3.7%	5.8%	3.7%	5.8%
Firms	3,001	2,806	3,007	2,810	3,007	2,810	3,007	2,810

Table 9
Risk-Adjusted Returns of AIV Portfolios and Idiosyncratic Volatility Anomaly

This table reports equally weighted average risk-adjusted returns (R_{Adj}) of stock portfolios sorted on the abnormal idiosyncratic volatility (AIV). Panel A shows R_{Adj} of double-sorted portfolios sorted monthly first by prior-month AHXZ's idiosyncratic volatility (IV_{AHXZ}) and then by prior-year AIV. Panel B shows R_{Adj} of double-sorted portfolios sorted monthly first by prior-year non-earnings-announcement idiosyncratic volatility (IV_{NEA}) and then by prior-year pre-earnings-announcement idiosyncratic volatility (IV_{PEA}). The differences in R_{Adj} between the High and the Low portfolios are also reported, along with t-statistics in parentheses. The t-statistics reported in parentheses are based on Newey-West standard errors. The sample period is from July 1972 to June 2012.

Panel A: Double-Sorted Portfolios, Sort by IV_{AHXZ}, then AIV

Portfolios	Low IV_{AHXZ}	2	3	4	High IV_{AHXZ}
Low AIV	0.017	0.003	0.018	-0.148	-1.081
2	0.065	0.109	0.150	-0.020	-0.666
3	0.073	0.117	0.128	0.127	-0.585
4	0.137	0.263	0.265	0.044	-0.711
High AIV	0.098	0.203	0.308	0.067	-0.553
High-Low	**0.081**	**0.200**	**0.290**	**0.215**	**0.528**
	(1.47)	**(3.21)**	**(3.83)**	**(2.23)**	**(4.38)**

Panel B: Double-Sorted Portfolios, Sort by IV_{NEA}, then IV_{PEA}

Portfolios	Low IV_{NEA}	2	3	4	High IV_{NEA}
Low IV_{PEA}	0.126	0.014	-0.087	-0.184	-0.569
2	0.177	0.083	0.027	0.019	-0.576
3	0.141	0.070	0.090	-0.037	-0.460
4	0.117	0.163	0.180	-0.077	-0.608
High IV_{PEA}	0.138	0.226	0.104	-0.040	-0.623
High-Low	**0.012**	**0.212**	**0.191**	**0.144**	**-0.055**
	(0.19)	**(3.52)**	**(2.65)**	**(1.49)**	**(-0.35)**

Table 10
The Effects of IV_{PEA} and IV_{NEA} on Cross-Sectional Expected Stock Returns

This table shows Fama-MacBeth cross-sectional regression results for the following model.

$$\begin{aligned} R_{it+1} &= a + b_1 IV_{PEA,it} + b_2 IV_{NEA,it} + b_3 \beta_{Mkt,it} + b_4 Size_{it} + b_5 BM_{it} + b_6 IV_{AHXZ,it} \\ &\quad + b_7 Illiquidity_{it} + b_8 R_{[-3,-2],it} + b_9 R_{[-6,-4],it} + b_{10} R_{[-12,-7],it} + \varepsilon_{it+1}, \end{aligned}$$

where $R_{i,t+1}$ is the monthly stock excess return of firm i at time $t+1$, IV_{PEA} is pre-earnings-announcement idiosyncratic volatility, IV_{NEA} is non-earnings-announcement idiosyncratic volatility, β_{Mkt} is market beta, $Size$ is market capitalization, BM is book-to-market ratio, IV_{AHXZ} is AHXZ's idiosyncratic volatility, $Illiquidity$ is Amihud's (2002) illiquidity, $R_{[-3,-2]}$ is past two-month stock returns, $R_{[-6,-4]}$ is past three-month stock returns, and $R_{[-12,-7]}$ is past six-month stock returns. The t-statistics reported in parentheses are based on Newey-West standard errors. M1-M3 examine a sample period from July 1972 to June 2012, M4-M6 examine a sample period from July 1972 to June 1992, and M7-M9 examine a sample period from July 1992 to June 2012. The table presents time series averages of the estimated slope coefficients from the above regression. $\bar{R}^2$ is the time-series average of adjusted R^2 in the cross-sectional regression, and Firms denotes the time-series average of the number of firms in the cross-sectional regression.

	Full Sample			1972-1992			1992-2012		
Variable	M1	M2	M3	M4	M5	M6	M7	M8	M9
IV_{PEA}	**0.106**		**0.224**	**0.096**		**0.197**	**0.117**		**0.251**
	(1.11)		**(4.45)**	**(0.89)**		**(2.98)**	**(0.74)**		**(3.29)**
IV_{NEA}		**-0.148**	**-0.331**		**-0.179**	**-0.334**		**-0.117**	**-0.328**
		(-0.80)	**(-2.01)**		**(-0.80)**	**(-1.67)**		**(-0.39)**	**(-1.25)**
β_{Mkt}	0.153	0.249	0.229	-0.073	0.046	0.024	0.378	0.452	0.434
	(0.80)	(1.44)	(1.35)	(-0.29)	(0.20)	(0.11)	(1.31)	(1.76)	(1.71)
$Size$	-0.055	-0.075	-0.073	-0.068	-0.084	-0.082	-0.042	-0.066	-0.064
	(-1.80)	(-2.46)	(-2.38)	(-1.58)	(-2.10)	(-2.04)	(-0.97)	(-1.44)	(-1.38)
BM	0.281	0.264	0.265	0.353	0.338	0.337	0.209	0.191	0.194
	(4.64)	(4.47)	(4.48)	(3.93)	(3.77)	(3.76)	(2.60)	(2.50)	(2.54)
IV_{AHXZ}	-1.895	-1.657	-1.676	-2.166	-1.887	-1.918	-1.624	-1.427	-1.434
	(-12.47)	(-12.26)	(-12.26)	(-11.19)	(-9.45)	(-9.36)	(-7.08)	(-8.05)	(-8.17)
$Illiquidity$	0.409	0.435	0.020	0.414	0.441	0.022	0.405	0.429	0.018
	(1.65)	(1.76)	(5.09)	(1.31)	(1.38)	(3.65)	(1.06)	(1.14)	(3.56)
$R_{[-3,-2]}$	0.513	0.571	0.432	0.699	0.750	0.441	0.327	0.392	0.422
	(1.98)	(2.25)	(1.75)	(1.94)	(2.15)	(1.39)	(0.88)	(1.07)	(1.12)
$R_{[-6,-4]}$	0.870	0.888	0.570	1.298	1.307	0.747	0.441	0.469	0.393
	(5.24)	(5.56)	(2.24)	(5.76)	(5.87)	(2.13)	(1.91)	(2.17)	(1.07)
$R_{[-12,-7]}$	0.018	0.020	0.885	0.019	0.022	1.305	0.017	0.018	0.466
	(4.62)	(5.14)	(5.55)	(3.02)	(3.66)	(5.85)	(3.67)	(3.65)	(2.17)
Intercept	1.303	0.941	1.001	1.570	1.114	1.186	1.036	0.768	0.816
	(4.58)	(2.80)	(2.93)	(4.29)	(2.27)	(2.37)	(2.39)	(1.68)	(1.76)
$\bar{R}^2$	6.0%	6.1%	6.2%	6.4%	6.6%	6.6%	5.5%	5.7%	5.7%
Firms	2,810	2,810	2,810	2,180	2,180	2,180	3,439	3,439	3,439

Table 11
Monthly Excess Returns and Risk-Adjusted Returns of ΔAIV_{Con} Portfolios

This table reports equally weighted average monthly excess returns (R) and risk-adjusted returns (R_{Adj}) of stock portfolios sorted on the contemporaneous change in abnormal idiosyncratic volatility (ΔAIV_{Con}), where ΔAIV_{Con} is calculated as the difference in AIV from t to $t+1$. Panel A shows R and R_{Adj} of single-sorted portfolios formed monthly on ΔAIV_{Con}. Panel B shows R_{Adj} of double-sorted portfolios sorted monthly first by prior-year market capitalization ($Size$) and then by current ΔAIV_{Con}. The differences in R and R_{Adj} between the High and the Low portfolios are also reported, along with t-statistics in parentheses. The t-statistics reported in parentheses are based on Newey-West standard errors. The sample period is from July 1972 to May 2012.

	Panel A: Single-Sorted Portfolios		**Panel B: Double-Sorted Portfolios Sort by $Size$, then ΔAIV_{Con}**				
Portfolios	R	R_{Adj}	Small $Size$	2	3	4	Large $Size$
Low ΔAIV_{Con}	2.167	0.917	2.120	1.400	0.762	0.329	0.062
2	1.227	0.051	-0.041	-0.076	0.101	0.112	0.088
3	0.509	-0.616	-1.113	-0.963	-0.708	-0.299	-0.114
4	0.556	-0.558	-1.070	-0.879	-0.695	-0.300	0.005
High ΔAIV_{Con}	1.127	-0.049	0.290	-0.065	-0.186	-0.070	0.050
High-Low	**-1.040**	**-0.967**	**-1.830**	**-1.465**	**-0.948**	**-0.399**	**-0.012**
	(-8.47)	**(-8.60)**	**(-9.98)**	**(-8.20)**	**(-7.19)**	**(-3.47)**	**(-0.12)**

Table 12
The Effects of ΔAIV_{Con} on Cross-Sectional Expected Stock Returns

This table shows Fama-MacBeth cross-sectional regression results for the following model.

$$R_{it+1} = a + b_1\Delta AIV_{Con,it+1} + b_2\beta_{Mkt,it} + b_3 Size_{it} + b_4 BM_{it} + b_5 IV_{AHXZ,it} + b_6 Illiquidity_{it} + b_7 R_{[-3,-2],it} + b_8 R_{[-6,-4],it} + b_9 R_{[-12,-7],it} + \varepsilon_{it+1},$$

where $R_{i,t+1}$ is the monthly stock excess return of firm i at time $t+1$, ΔAIV_{Con} is contemporaneous change in abnormal idiosyncratic volatility, β_{Mkt} is market beta, $Size$ is market capitalization, BM is book-to-market ratio, IV_{AHXZ} is AHXZ's idiosyncratic volatility, $Illiquidity$ is Amihud's (2002) illiquidity, $R_{[-3,-2]}$ is past two-month stock returns, $R_{[-6,-4]}$ is past three-month stock returns, and $R_{[-12,-7]}$ is past six-month stock returns. The t-statistics reported in parentheses are based on Newey-West standard errors. M1 examines a sample period from July 1972 to May 2012, M2 examines a sample period from July 1972 to June 1992, and M3 examines a sample period from July 1992 to May 2012. The table presents time series averages of the estimated slope coefficients from the above regression. $\bar{R}^2$ is the time-series average of adjusted R^2 in the cross-sectional regression, and Firms denotes the time-series average of the number of firms in the cross-sectional regression.

	Full Sample	1972-1992	1992-2012
Variable	M1	M2	M3
ΔAIV_{Con}	**-1.463**	**-1.462**	**-1.465**
	(-6.06)	**(-5.23)**	**(-3.71)**
β_{Mkt}	0.190	-0.042	0.423
	(0.87)	(-0.15)	(1.25)
$Size$	-0.061	-0.076	-0.046
	(-1.99)	(-1.74)	(-1.08)
BM	0.277	0.342	0.212
	(4.43)	(3.75)	(2.49)
IV_{AHXZ}	-1.798	-2.156	-1.439
	(-9.39)	(-9.43)	(-4.78)
$Illiquidity$	0.020	0.022	0.019
	(5.14)	(3.29)	(4.33)
$R_{[-3,-2]}$	0.354	0.376	0.331
	(1.42)	(1.18)	(0.86)
$R_{[-6,-4]}$	0.461	0.668	0.253
	(1.73)	(1.84)	(0.65)
$R_{[-12,-7]}$	0.869	1.310	0.427
	(5.09)	(5.79)	(1.76)
Intercept	1.139	1.440	0.837
	(3.98)	(4.57)	(1.76)
$\bar{R}^2$	5.9%	6.4%	5.4%
Firms	2,782	2,161	3,405

Figure 1
Price Variation Around Earnings Announcements

This figure displays average abnormal absolute residual return (a_t) for day $t \in [-10, 10]$ around earnings announcements, calculated as the average of daily absolute FF-3 model residuals of day t, minus the average of daily absolute FF-3 model residuals during non-earnings-announcement periods. The sample period is from July 1972 to June 2012.

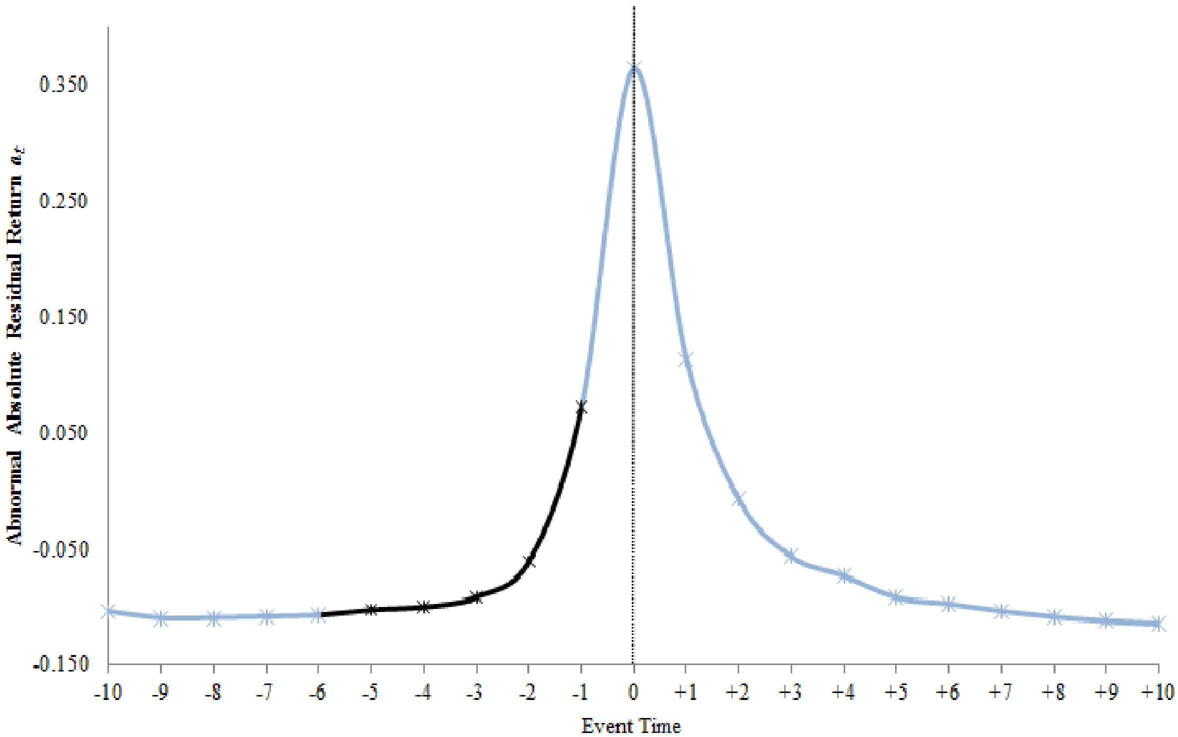

Figure 2
Large and Small AIT Stocks

This figure displays average abnormal absolute residual return (a_t) for day $t \in [-10, 10]$ around earnings announcements, calculated as the average of daily absolute FF-3 model residuals of day t, minus the average of daily absolute FF-3 model residuals during non-earnings-announcement periods, for the large and small quintile stock portfolios sorted by abnormal insider trading (AIT). The sample period is from January 1996 to December 2011.

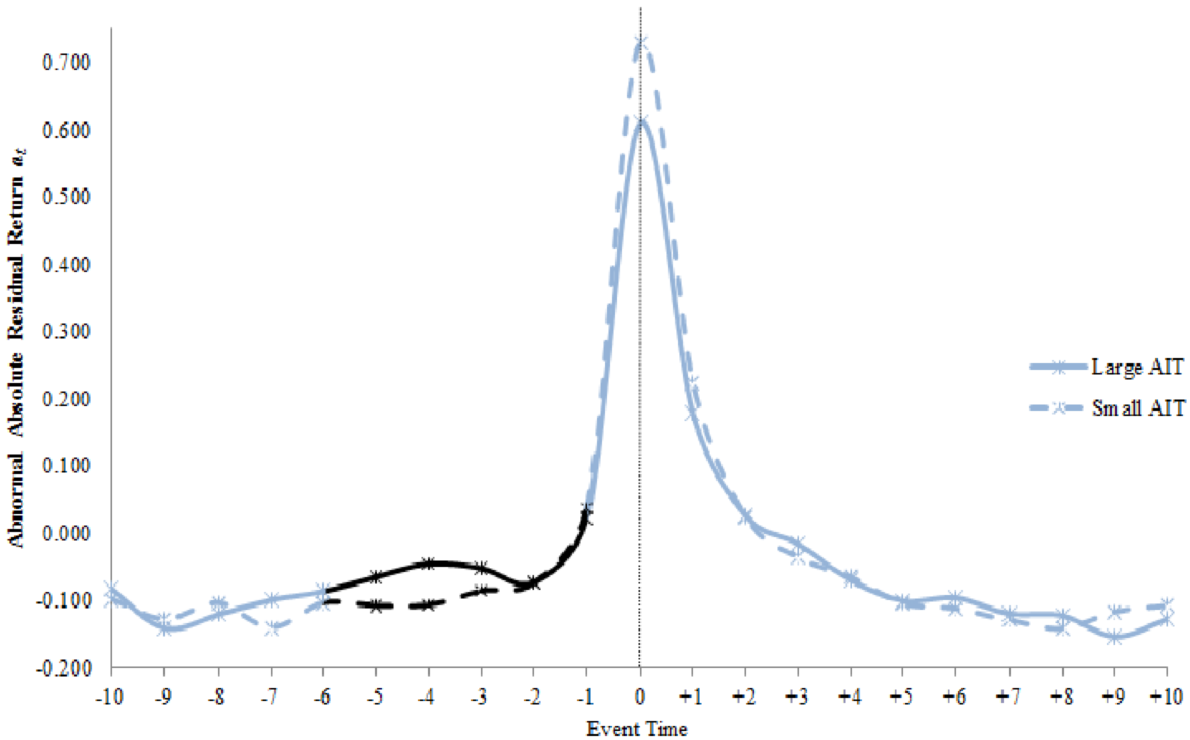

Figure 3
Large and Small ASS Stocks

This figure displays average abnormal absolute residual return (a_t) for day $t \in [-10, 10]$ around earnings announcements, calculated as the average of daily absolute FF-3 model residuals of day t, minus the average of daily absolute FF-3 model residuals during non-earnings-announcement periods, for the large and small quintile stock portfolios sorted by abnormal short selling (ASS). The sample period is from January 1996 to December 2011.

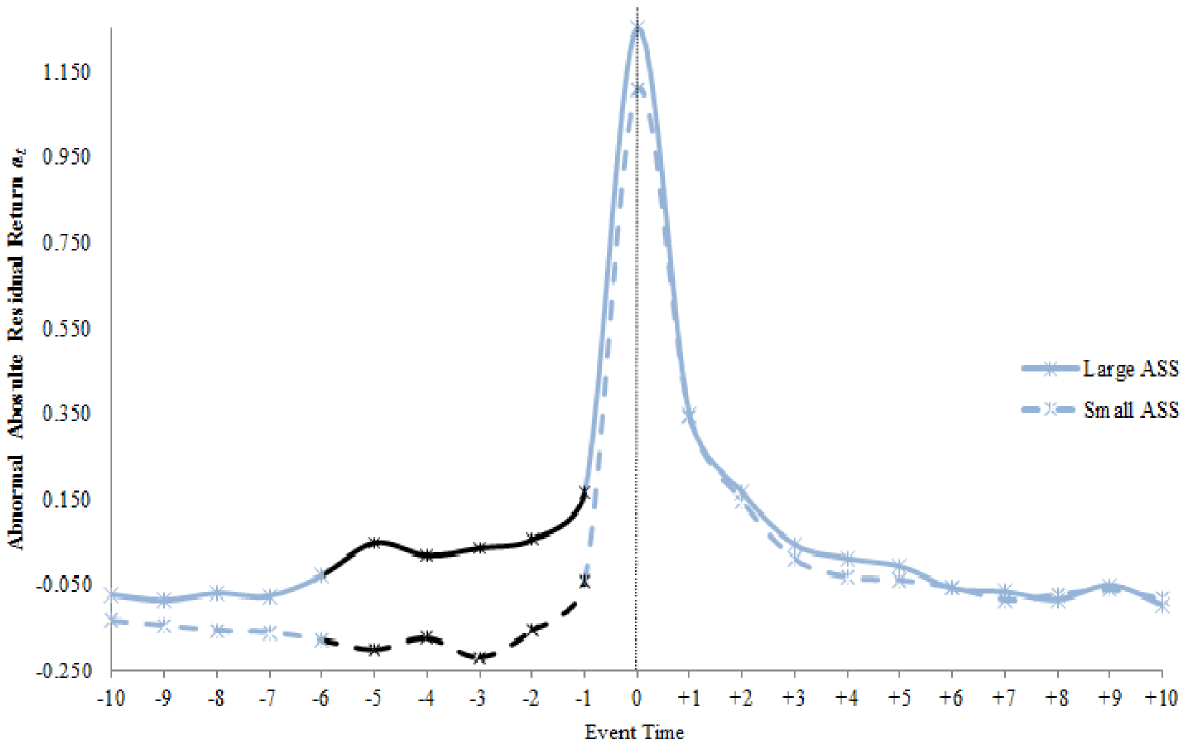

Figure 4
Large and Small AIN Stocks

This figure displays average abnormal absolute residual return (a_t) for day $t \in [-10, 10]$ around earnings announcements, calculated as the average of daily absolute FF-3 model residuals of day t, minus the average of daily absolute FF-3 model residuals during non-earnings-announcement periods, for the large and small quintile stock portfolios sorted by abnormal institutional trading (AIN). The sample period is from January 1996 to December 2011.