Abnormal Accrual, Informed Trader, and Long-Term Stock Return: Evidence from Japan*

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Abstract: This study examines the association among abnormal accruals, long-term stock returns, and probability of informed trading. Some analytical and empirical research for post-earnings announcement drift provide evidence that a high arrival rate of informed traders helps stock prices become more efficient. We focus on the abnormal accrual anomaly, and investigate these studies' implications using data from the Tokyo Stock Exchange in Japan. Consistent with these studies, we show that stocks with a high probability of informed trading exhibit less abnormal accrual mispricing relative to stocks with a low probability of informed trading.

JEL Classification: G15; M41

Keywords: Abnormal accruals, Market microstructure, High-frequency data, Informed trader.

Data Availability: All data are available from public sources.

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1 Introduction

This study examines the relationship among abnormal accruals, long-term stock return, and informed trading activity. Sloan (1996) finds that market participants overweigh (underweigh) future earnings implications of current accruals (cash flows), and therefore, stocks with relatively high (low) accruals tend to have negative (positive) future abnormal returns. Using the Mishkin test to examine whether the market participants have a rational expectation, he concludes that the result is consistent with naïve investor hypothesis, that market participants "fixate" on earnings and fail to distinguish between the persistency of accrual and cash flow components of current earnings.

Xie (2001) follows up Sloan (1996) by distinguishing between abnormal and normal components of total accruals. He contends that market participants particularly overestimate the abnormal portion of accruals stemming from managerial discretion, and concludes that the mispricing of total accruals that Sloan (1996) documents is due largely to abnormal accruals.

These studies raise one research question in our mind: do all market participants fail to distinguish the accrual and cash flow components (abnormal accruals and normal accruals) of current earnings?

It is a rational assumption that at least two types of traders are in the stock market: uninformed traders and informed traders. The former trade stocks using only public information (e.g., earnings announcements) and are not good at analyzing the information. The latter trade stocks using not only public information, they also access private information sources and are skillful at analyzing the information. Because of the private information and analyzing skill, informed traders are likely to be more sophisticated than uninformed traders at estimate the intrinsic value of stocks.

In particular, it is difficult for uninformed traders who access only public information sources and have limited analytical ability to distinguish between accruals and cash flow or to derive the abnormal component from total accruals. In contrast, informed traders easily distinguish between abnormal and normal components of total accruals, and correctly understand the future earnings implications of these accruals using public and private information and their high analytical skills. Therefore, it is expected that with actively informed trading, the price of stocks is unlikely to diverge from intrinsic value, correctly reflecting properties of abnormal accruals over stocks with inactively informed trading.

Consistent with this prediction, some analytical research shows that more informed trading helps market efficiency. For example, Callen *et al.* (2000) present the proposition that reducing uninformed trading curbs deviations of market prices form an efficient price. In addition, even if a deviation exists, Easley and O'Hara (1992a) demonstrate that increasing the fraction of trades from informed traders accelerates the convergence of stock price to an efficient price, because the trading activity reveals the information about the true value to the other market participants.

Furthermore, in keeping with these theoretical predictions, Vega (2006) focuses on an anomaly related to accounting, post-earnings announcement drift, and investigates whether these theoretical predictions are valid. She finds that stocks with a high arrival rate of informed traders experience low or insignificant drift.

These previous studies suggest that the more actively informed traders trade a stock, the more quickly the stock price converges on an efficient price; hence, this leads to the disappearance of the anomalies. We focus not on total accruals but on abnormal accruals that are more undetectable information for uninformed traders, and test whether informed trading activity affects the abnormal accrual mispricing. It is likely that more undetectable information for uninformed traders leads to raise the power of our test, which verifies the validity of the aforementioned theoretical research.

Following Vega (2006), we use probability of informed trading (PIN) developed by Easley *et al.* (1996) and Easley *et al.* (2002) in market microstructure research to capture the trading activity of informed traders. We find that the average size-BE/ME adjusted abnormal returns from abnormal accrual based trading strategy for low PIN stocks is significantly positive, 6.35 percent over 12 months, while those for high PIN is insignificant, 0.59 percent. This negative relation between abnormal accrual mispricing and PIN is robust even after controlling for other factors known to influence the accrual anomaly, namely arbitrage risk and transaction costs (e.g., Mashruwala *et al.* 2006). We conclude that it is consistent with naïve investor hypothesis, that is, abnormal accrual mispricing is related negatively to traders' ability to understand earnings information properly.

Many researchers have been interested in the accrual anomaly, and still continue to debate about the source. What drives the observe accrual anomaly? Prior research suggests that two explanations exist on why the accruals-based trading strategy earns an abnormal return. First, investors fail to understand accurately the persistence of accruals (Sloan 1996) or the component of accruals (Xie 2001). This is called the mispricing explanation. In contrast, some researchers explain that the accrual anomaly is due to risk factors. For example, Khan (2007) shows that a considerable portion of the abnormal returns to the accrual-based trading strategy is explained by risk in using extended Intertemporal Capital Asset Pricing Model (ICAPM). This is called the risk explanation.

The accrual anomaly is observed in many countries (e.g., Pincus *et al.* 2007), so ascertaining its cause is an important research issue throughout the world. Our results are consistent with the mispricing explanation because if the risk explanation is true, then the accrual anomaly should be observed regardless of informed trading activity. Our results can be interpreted as showing that the trading from informed traders helps keep the price efficient; thereby, stock prices reflect recondite information such as abnormal accrual stemming from managerial discretion. Thus, the anomaly for the stocks with actively informed trading, is likely to disappear quickly.

This paper is related most closely to two studies, Collins *et al.* (2003) and Balsam *et al.* (2002). These studies show that the proportion of sophisticated investors' participation, as proxied by the percentage of common stock owned by institutions, is negatively associated with market mispricing. Collins *et al.* (2003) find that stocks with high institutional ownership exhibit less accrual mispricing relative to stocks with low institutional ownership. This research is consistent with investor sophistication mitigating the accrual mispricing phenomenon.

Furthermore, Balsam *et al.* (2002) investigate how investors react to the abnormal accrual components before and after the release of the full set of financial statements in Form 10-Q, which provides market participants with the data necessary to estimate the abnormal portion of total accruals. They find that negative association between abnormal accruals and abnormal returns prior to the release of Form 10-Q varies systematically with investor sophistication; i.e., for stocks with low institutional ownership, they do not observe negative correlation between abnormal accruals and abnormal returns prior to the release of Form 10-Q, while they observe such correlationship for stocks with high institutional ownership. Balsam *et al.* (2002) interpret that sophisticated investors recognize accruals management and understand that abnormal accruals for future earnings precede the 10-Q filing date, because they are able to access other, more private sources of information. Therefore, they conclude that high investor sophistication quickly impounds abnormal portions of accruals into stock prices.

In sum, consistent with this paper, these researches suggest that sophisticated investors who have more information (i.e., informed traders) than uninformed traders react correctly to the components of earnings, even before disclosure of the data necessary to compute the normal and abnormal components of accruals. Moreover, even if traders' reactions with regard to abnormal accruals are insufficient to impound into stock prices, informed traders should arbitrage the abnormal accruals quickly mispricing away.

Our study differs in two respects from these prior researches that examine the association between informed trading and the mispricing of accruals. First, we use PIN to capture the trading activity of informed traders. Prior research (e.g., Collins *et al.* 2003; Balsam *et al.* 2002; Ali *et al.* 2000) uses the percentage of outstanding common shares held by institutional owners. This is an indirect noisy measure of informed trading activity because some institutional investors trade the stocks actively, but others just hold them: more holding of stocks by sophisticated investors might not mean more actively informed trading[1]. On the other hand, PIN is a direct measure of informed trading activity because PIN is estimated by using high-frequency data based on direct individual trading. Therefore, prior research may have bias against the informed trading measure; therefore, it was unlikely to examine whether informed trading affects the accrual anomaly in direct way.

Second, we examine whether informed trading affects the relationship between abnormal accrual and long-term stock returns. Contrary to Balsam *et al.* (2002), who focus on short-term stock returns, we focus on long-window ones because the exact date when investors are provided the data necessary to estimate the abnormal portion of total accruals cannot be specified in the case of the Japanese stock market. More importantly, the purpose of this study is to reveal which explanation, market mispricing or risk, is a more plausible cause of the accrual anomaly by examining the association between informed trading and the accrual anomaly. This research design using long-window returns enables us to distinguish the source of the accrual anomaly. Our result that informed trading negatively affects the association between abnormal

[1] Ali *et al.* (2000) use the participation of all institutional investors for the stocks as proxy for investor sophisticated, while Collins *et al.* (2003) use the percentage of common shares held by *transient* institutions to eliminate the institutions that are unlikely to trade on information utilizing Bushee (1998) three categories of institutions classified by trading behavior. The measurement of Collins *et al.* (2003) decreases the measurement error relative to that of Ali *et al.* (2000). However, the measurement error is not fully eliminated even by the procedure of Collins *et al.* (2003), because some transient institutions trades on information but others do not.

accruals and long-term stock returns, even after controlling for risk factors or other factors (e.g., arbitrage risk and transaction costs) known to affect the long-term stock returns, suggests that the mispricing explanation is supported.

The paper proceeds as follows. Section 2 reviews prior research and develops our hypothesis. In Section 3, we present data description and definitions of variables, and Section 4 reports empirical tests for our hypothesis, using data from the Japanese stock market. Finally, Section 5 presents the summary and conclusions.

2 Prior Research and Hypothesis Development

Market microstructure research examining the interaction of information and stock prices has become increasingly conspicuous. Most research in this area assumes a realistic portrayal that there are uninformed traders and informed traders in the stock markets. Because of private information, informed traders have an information advantage over uninformed traders about intrinsic values of stocks. Some market microstructure research demonstrates that this information asymmetry affects the deviation of stock prices from efficient value and the speed of price adjustments to converge to an efficient price or full information value.

For example, Callen *et al.* (2000) show that the probability that stock prices deviate from their efficient price increases as noise trading by uninformed traders increases, because the noise trading prevents market participants from estimating precisely the efficient price, so convergence may not obtain over the long term. Moreover, they demonstrate that when the prices go way up or down from the intrinsic value, convergence to a stable equilibrium price is exponentially fast as noise trading by uninformed traders is eliminated.

In keeping with Callen *et al.* (2000), Easley and O'Hara (1992b) present the proposition that increasing the fraction of trades from informed traders hastens the adjustment process, because their trading activity reveals information about the true value to the market participants. Consequently, they claim that informed trading helps to accelerate the rate at which prices reflect full information.

Furthermore, Easley and O'Hara (1992a) illustrate that price adjustment properties in various markets differ only in the number of composition of traders by developing a simulation of their theoretical model. Because not all trades arise from informed traders but also from uninformed traders, prices frequently move in the wrong direction. Informed traders profit from trading if prices are not at full information levels, and they continue to trade until prices become efficient (e.g., O'Hara 1995). Easley and O'Hara (1992a) find that repeated trading by informed traders eventually reveals those traders' information, and prices eventually adjust to full information levels theoretically. In addition, they show that the speed of adjustment depends on the composition of traders; markets with more informed traders have a higher rate of price convergence.

In sum, the result of these theoretical researches suggests that more activity of informed (uninformed) trading leads to the probability that the stock prices will deviate from efficient value decreases (increases), and that informed (uninformed) trading causes prices to converge faster (slower) even if stock prices are mispriced temporarily.

These theoretical predictions have implication for anomalies research. They imply that stocks with more informed traders are not observed anomalies, or that the anomalies disappear over a short term. Vega (2006) focuses on a well-known accounting anomaly; post-earnings announcement drift (PEAD), and tests whether this argument is valid. Consistent with this argument, she finds that stocks with a high arrival rate of informed traders experiences low or insignificant PEAD. Vega (2006) concludes that the more information (both private and public) traders have about the true value of a stock, and the more they agree and trade on this information, the smaller the abnormal return drift. In contrast, we focus on another accounting anomaly, abnormal accrual anomaly, and examine whether a high arrival rate of informed traders is negatively associated with the abnormal accrual mispricing.

Sloan (1996) finds that market participants overweigh (underweigh) future earnings implications of current accruals (cash flows); therefore, stocks with relatively high (low) accruals tend to have negative (positive) future abnormal returns. This phenomenon is referred to as accrual anomaly. He concludes that market participants are not exactly rational for accrual information and stock prices act "as if" they fail to correctly anticipate future implications of current accrual. Bradshaw *et al.* (2001) show that even professional information intermediaries—financial analysts or auditors—do not understand the future consequences associated with current accrual. Their evidence reinforces the interpretation of Sloan (1996) that market participants do not anticipate fully the future implications of current accrual. These researches suggest that market participants, even professional information intermediaries, misunderstand the persistence of accrual and that the stock price diverges from the intrinsic value of reflected accrual information;

therefore, the current accruals predict the future return in the process of converging to that intrinsic value.

Xie (2001) reexamines the accrual anomaly to explore the cause, and finds that market participants overestimate the persistence of abnormal components of the accrual estimated by the Jones (1991) model. He concludes that market participants overprice the portion of abnormal accruals stemming from managerial discretion. This research can be interpreted as indicating that accrual anomaly is due to misunderstanding the abnormal accruals component by naïve market participants. Therefore, Xie (2001) brings one research question to mind: is the market mispricing with respect to abnormal accruals homogeneous among the stocks?

The composition of traders that are informed versus uninformed should differ from one stock to another, thus leading to differences in the percentage of naïve uninformed traders. Informed traders always are more sophisticated than uninformed traders about the true value of the stock. Further, as Vega (2006) mentioned, informed traders are skillful at analyzing public information. Therefore, informed traders are expected to understand the accrual implication, the part of public information, for future earnings by utilizing not only superior analyzing skill but also their private information. Informed traders are likely to detect accrual management through managerial discretion even if earnings are inflated or deflated by using accruals; therefore, they will unscramble the accrual implication properly. As a result, when informed trading behavior is more active, stock prices will reflect more information processed by informed traders and become efficient. In addition, the uninformed traders can infer accurately the true value of the stocks from the price reflecting informed traders' beliefs.

Consequently, more active informed trading leads to less accrual mispricing due to managerial discretion, since the traders have high ability to analyze the accrual information and their private information. Alternatively, even if the accrual mispricing is temporary, informed traders trade the stock until the mispricing disappears. Therefore, more active informed trading leads to quicker disappearance of the mispricing. In the context of the long-window abnormal accrual mispricing demonstrated by Xie (2001), the degree of mispricing differs among the stocks; stocks with higher informed trading have less abnormal accrual mispricing over the long term. So, the ability of abnormal accrual to predict long-term stock returns is expected to negatively relate to the activity of informed trading. These arguments suggest the following hypothesis:

H: Stocks with high activity of informed trading exhibit less long-term abnormal accrual mispricing relative to stocks with low activity of informed trading.

If our hypothesis is accepted, long-term returns for stocks with high informed trading activity should be less sensitive to abnormal accruals information. There are two reasons for this prediction: First, these stocks are unlikely to diverge from efficient value impounding current abnormal accruals for future earnings implications. Second, as a result of informed trading arbitrage, stock prices become efficient in the short-term even if stock prices are mispriced temporarily.

3 Data Description and Definition of Variables

We start by explaining the Japanese reporting system. Figure 1 describes the timeline of Japanese financial reporting and an overview of the measurement in our analysis. As firms having March fiscal year end account for around 75% of listed firms, then we explain fiscal year end of March as an example.

Japanese firms are required by stock exchanges to announce an overview of some of their financials (i.e., summary report), such as sales, earnings, dividends, and management earnings forecasts of these items for the following year within 45 days after the end of the fiscal year. However, this simple overview does not include information to estimate the abnormal portion of total accruals, so traders, especially uninformed traders who are unable to access private information sources, cannot precisely estimate abnormal accrual at that point in time. After announcing this summary report, firms also have to report audited financial statements, such as balance sheet, income statement, and cash flow statement within three months of the fiscal year's end. Investors can access these statements on firms' web sites or on the Electronic Disclosure for Investors' NETwork (EDINET) system, which is like the Electronic Data-Gathering, Analysis, and Retrieval (EDGAR) system in the U.S. All traders eventually can estimate abnormal accruals precisely, using reported audited financial statements.

We constrain our sample to fiscal year end of March, because the fiscal year end of most Japanese firms is March. Further, in view of the Japanese financial reporting system, buy-and-hold return calculations begin at the end of June, three months after the fiscal year end. This lag ensures to enable all traders to estimate the abnormal portion of total accruals based on public information.

3.1 Abnormal accruals

To estimate abnormal accruals, we used the Jones (1991) model as follows[2]:

$$TA_{i,t} = \alpha + \beta_1 \Delta Sales_{i,t} + \beta_2 PPE_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $TA_{i,t}$ is total accruals, $\Delta Sales$ is the change of sales, PPE is equal to gross property, plant, and equity in the period t. All the variables are scaled by the average of total assets. Total accruals are obtained by subtracting CFO from net income using a cash flow statement approach, which is consistent with Hribar and Collins (2002). Although income before extraordinary items has been used to obtain total accruals in previous research examining U.S. firms, net income is used in this study. Since the definition of extraordinary items in Japan is different from that in the U.S., and we do not have unusual and/or infrequent items in income statements in Japan, net income for Japanese firms has similar characteristics to income before extraordinary items in the U.S. Therefore, we estimate total accruals as the difference between net income and CFO. Abnormal accruals are determined as the difference between total accruals and normal accruals, with expected total accruals estimated from this equation. Normal accruals are estimated in cross-section for each two-digit Nikkei Industrial Code and year combination, where the firm of interest is excluded in estimating the model. In short, we estimate normal accruals in out of sample analysis.

3.2 Informed Trading Activity Measure

3.2.1 Probability of informed trading

We use probability of informed trading (PIN) to capture the trading activity of the informed trader. Easley *et al.* (2002) (hereafter EHO) propose the structural model based on Glosten and Milgrom (1985) and Easley and O'Hara (1987) to develop an estimation model of PIN. The model consists of three players; market maker, uninformed trader, and informed trader. The uninformed trader and informed trader are assumed to trade a stock with competitive and risk neutral market markers. The market marker sets bid and ask prices, and revises the quotes

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[2] Our main results which are shows in section 4 are robust to using alternative estimation procedure of abnormal accruals, such as modified Jones model (Dechow *et al.* 1995) and CFO Jones model (Kasznik 1999).

depending on trades that occur. Because the market maker is competitive and risk neutral, these prices are expected value of asset conditional on his information at the time of trade. On any day, the uninformed trader buys or sells for reasons that are exogenous to the model. That trading is determined by the independent Poisson process. On the other hand, the informed trader buys or sells only on days for which information events have occurred. That trading is also determined by the independent Poisson process. The informed trader is assumed to be risk neutral and trades to maximize his expected profit. If the informed trader observes a high signal about an asset, then he will buy; conversely, he will sell if he observes a low signal. Therefore, the excess buy or sell order (i.e., abnormal order flow) is generated by the occurrence of information event. The EHO model estimates the PIN measure based on the occurrence of information event and abnormal order flow.

The EHO model assumes that the information events occur only once per day, and the probability that an information event will occur on a given day is α. These information events are low signal with δ or high signal with $1-\delta$. Uninformed traders arrive the market regardless of the occurrence of information events, and daily arrival rates are ε_b for buy orders and ε_s for sell orders. On the other hand, informed traders arrive at the market conditional on days for which information events will occur. That is, on low (high) signal event days, arrival rates are μ for sell (buy) orders from informed traders. Therefore, on days with an information event, buy or sell arrival rates will be increased by μ depending on the signal content; arrival rates are ε_b for buy orders and $\varepsilon_s + \mu$ for sell orders if the signal is low, and arrival rates are $\varepsilon_b + \mu$ for buy orders and ε_s for sell orders if the signal is high.

All of these arrival processes are determined by an independent Poisson process and each event type is assumed to be independent of each other. As the probability of a no event day, a day with a low signal, and a day with a high signal, respectively, is given by $1-\alpha$, $\alpha\delta$, $\alpha(1-\delta)$, so the likelihood of observing B buys and S sells on a certain day is:

$$\begin{aligned}\mathcal{L}(\theta|B,S) &= \alpha(1-\delta)e^{-(\mu+\varepsilon_b)}\frac{(\mu+\varepsilon_b)^B}{B!}e^{-\varepsilon_s}\frac{(\varepsilon_s)^S}{S!} \\ &+\alpha\delta e^{-\varepsilon_b}\frac{(\varepsilon_b)^B}{B!}e^{-(\mu+\varepsilon_s)}\frac{(\mu+\varepsilon_s)^S}{S!} + (1-\alpha)e^{-\varepsilon_b}\frac{(\varepsilon_b)^B}{B!}e^{-\varepsilon_s}\frac{(\varepsilon_s)^S}{S!}, \end{aligned} \tag{2}$$

where (B,S) is the total number of buys and sells for the day and $\theta = (\mu, \varepsilon_b, \varepsilon_s, \alpha, \delta)$ is the parameter vector. This function consists of the sum of three Poisson probabilities weighted by the probability of each event type. The data set over multiple days allows us to estimate the parameters. Because days are independent, the likelihood function for T days is a product of the above likelihood over days,

$$\mathcal{L}(\theta|M) = \prod_{i}^{T} \mathcal{L}(\theta|B_i, S_i), \tag{3}$$

where (B_i, S_i) is trading data for day $i = 1 \ldots, T$ and $M = ((B_1, S_1), \ldots, (B_T, S_T))$ is the data set. In quarterly earnings announcement drift analysis, Vega (2006) set T equal to the 40 trading days before an earnings announcement is released. In contrast, we analyze an annual earnings announcement, then we set T equal to trading days during from July of year $t-1$ to June of year t. We estimate the parameter vector by maximizing the likelihood function. The probability of informed-based trading (PIN) is defined as

$$PIN = \frac{\hat{\alpha}\hat{\mu}}{\hat{\alpha}\hat{\mu} + \hat{\varepsilon_b} + \hat{\varepsilon_s}}. \tag{4}$$

High PIN means that the proportion of executed orders originating from an informed trader is high. In short, informed traders trade the stocks frequently.

3.2.2 Algorithm for classifying as buyer- or seller-initiated trade

We need the number of buyer- and seller-initiated trades each day to estimate PIN. Previous research in analysis of PIN in the U.S. uses the Lee and Ready (1991) algorithm, i.e., the combination of quote and tick test to classify trades as buys or sells (e.g., Easley *et al.* 2002; Vega 2006; Duarte *et al.* 2008). On the other hand, we do not use the Lee and Ready (1991) algorithm but only the quote test.

The mechanism for trading equities on Japanese stock market differs from that in the U.S. Trading on the NYSE and the AMEX is managed by exchange-designated specialists. The specialists collect public limit orders (which are maintained in a private limit order book that cannot be readily viewed by the public), match incoming buy and sell orders, and purchase and sell securities for their own account (Lehmann and Modest 1994). Contrary to the U.S. stock market structure, the main Japanese market, the Tokyo Stock Exchange (TSE) is order-driven; all orders except for opening and closing are executed based on price and time priority rules. As a result of this structure, it is extremely improbable that executed price is different from the last quoted ask or bid price; therefore using the quote test is sufficient to classify trades as buys or sells in the TSE. In fact, the percentage of unclassified trades to total trades in TSE using the quote test is no more than 1 percent since 2001.

3.3 Abnormal return

Most prior research in the U.S. examines the accrual anomaly with the hedge portfolio return test, estimating the Fama and French (1993) three-factor model and/or the Carhart (1997) four-factor model alpha (e.g., Mashruwala *et al.* 2006; Xie 2001). However, we do not use these methods to test hedge portfolio returns, but a characteristic-based performance measure developed by Daniel *et al.* (1997) because the factor model is rejected in the TSE, while the characteristic model is not (Daniel *et al.* 2001).

Chan *et al.* (1991) reveal a significant relationship between expected returns and two variables, market capitalization and book-to-market ratio, in the Japanese market. Therefore, we choose these two characteristics to calculate the abnormal return of each stock. Although Daniel *et al.* (2001) take the momentum effect into account, we do not control that effect, because previous research provides weak and insignificant evidence of momentum in Japan (e.g., Chui *et al.* 2000).

We calculate abnormal return using the following procedure. We begin by constructing 25 similar characteristic portfolios through a 5×5 sort on market capitalization and book-to market quintiles using all non-financial stocks. In August of each year t from 2001 to 2006, all TSE stocks on the Nikkei Japanese daily stock return database, like the CRSP in the U.S., are ranked on market capitalization, which is stock price times the number of shares outstanding for a stock. These quintile breakpoints for market capitalization are used to allocate all TSE and other stock exchanges stocks to five market capitalization quintiles. Similar, TSE quintile breakpoints for book-to-market are used to allocate all TSE and other stock exchange stocks to five book-to-market quintiles. Book-to-market is book value of equity for the fiscal year from April of year $t-1$ to March of year t divided by market capitalization at the end of March of year t. Negative book value stocks are excluded. We sort book-to-market at the end of August to be sure that book value from April of year $t-1$ to March of year t is known thoroughly by market participants.

We construct the 25 size-BE/ME portfolios as intersections of the five sizes and the five BE/ME groups and calculate value-weighted returns on the portfolios from September of t to

August of $t + 1$. The abnormal return of a particular stock then is calculated by subtracting the value-weighted portfolio's return from the stock's return.

3.4 Other variables affecting abnormal accruals anomaly

Mashruwala *et al.* (2006) find that future abnormal returns to the accrual-based hedge portfolio are higher in stocks with higher idiosyncratic volatility proxied for lack of a close substitute in the U. S. markets[3]. In addition, Mashruwala *et al.* (2006) show that the accruals-based hedge portfolio yields higher future abnormal returns for stocks with higher transaction costs. They conclude that two sources of barriers to arbitrage—lack of close substitutes and transaction costs—prevent arbitrageurs from eliminating accrual mispricing. Therefore, we control for these effects in our research.

3.4.1 Lack of closed substitutes

High idiosyncratic volatility proxied for absence of a close substitute deters arbitrage activity because it makes arbitrage activity riskier, i.e., higher arbitrage risk (e.g., Shleifer and Vishny 1997). This argument suggests that high arbitrage risk (absence of close substitutes) creates barriers to arbitrage away accrual mispricing. Following Mashruwala *et al.* (2006) and Mendenhall (2004), we employ the residual variance from a standard market model regression of the returns of the weighted average market index over the 48 months ending June 30 of year t as a proxy for arbitrage risk.

3.4.2 Transaction costs

Mashruwala *et al.* (2006) find that transaction costs also impose barriers to arbitrage away accrual mispricing. We employ two variables to capture the transaction costs: trading volume and frequency of zero daily returns. Numerous studies show that trading volume is negatively associated with one cost of trading—bid-ask spread (see Callahan *et al.* 1997). In addition, Lesmond *et al.* (1999) assert that zero return is positively associated with transaction costs; stocks with high transaction costs have more zero returns than stocks with low transaction

[3]Further, Pincus *et al.* (2007) provide the evidence that this phenomenon is generalizable to some other countries including Japan.

costs. Thus, we employ these two variables as a proxy for transaction costs, and define trading volume as average daily trading volume (closing share price times daily number of shares traded) on June of year t and the frequency of zero returns as those frequency of zero daily returns over the period from July of year $t-1$ to June of year t.

3.5 Data description

Our sample consists of all March fiscal year end non-financial firms on the TSE during from the period 2001 to 2006, together with required data from the Nikkei NEEDS TICK database, Nikkei daily returns database, and Nikkei NEEDS financial data files. We obtain trade and quote data from the Nikkei NEEDS TICK database, market price and volume data from Nikkei daily returns database, and financial data from Nikkei NEEDS financial data files[4].

Following Brown *et al.* (2004), we eliminate observations with stocks with corner solutions for α and δ, additionally using the following filters: (1) $\alpha < 0.02 \mid 0.98 < \alpha$ and (2) $\delta < 0.02 \mid 0.98 < \delta$, because these cases are unrealistic. Finally, the number of observations is 7,315 firm-year and ranges from 1,100 in year 2001 to 1,298 in year 2006.

4 Empirical Results

4.1 Descriptive statistics

Table 1 presents descriptive statistics for estimated parameters of PIN. The time-series patterns of the cross-sectional median of the parameters (α, the probability that an information event occurs and δ, the probability that the information is a low signal) in Figure 2 (a), and three parameters relating to traders composition (μ, the arrival rate of informed traders, and ε_b and ε_s, the arrival rate of uninformed buyers and sellers) in Figure 2 (b).

Similar to Easley *et al.* (2002), who estimate parameters by using the EHO model for NYSE stocks from 1983 to 1998, the estimates of α and δ are stable across years, and so they do not have a trend. On the other hand, the estimates of μ, ε_b, and ε_s have an upward trend. This evidence is dovetailed with the fact that the number of trades and trading volume increases significantly by disseminating online trades over this period.

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[4]Nikkei NEEDS TICK database, Nikkei daily returns database, and Nikkei NEEDS financial data files in Japan correspond to the trade and quotes (TAQ) database, CRSP, and Compustat in the U.S., respectively.

The mean (median) of δ, 0.35 (0.33), suggests that the probability of bad news was generally lower than that of good news. Most of our sample period, especially from 2002 to 2006, enjoyed an economic boom; thus, this evidence is in accord with our intuition.

Figure 2 (c) shows the time-series pattern of the cross-sectional distribution of PIN. Although α is stable over time, PIN actually decreases year-by-year because uninformed buyers and sellers in 2006 are five times and four times, respectively, while informed traders are two-and-a-half times higher than in 2001. Further, we also show that cross-sectional PIN distribution has been becoming tighter during the sample period; thus, the cross-sectional difference of raw PIN is becoming smaller, which leads to deteriorating power of the test that PIN affects accrual mispricing. Therefore, we do not report the result using raw PIN data, but the result of a portfolio test based on ranked PIN in our analyses.

Table 2 shows the descriptive statistics of overall variables with the exception of PIN. In keeping with prior research in the U.S., mean TA is negative in Japan, reflecting depreciation and amortization charges included in the calculation. On the other hand, contrary to the U.S. market, mean BE/ME in the Japanese stock market is closed to 1. This suggests that averaged stock's market value is approximately equal to the liquidating value over our sample period.

Table 3 present the Spearman correlation matrix for the primary variables of interest. Consistent with prior research in the U.S. (e.g., Easley *et al.* 2002), PIN is negatively correlated with $Size$. This suggests that smaller stocks tend to have higher PIN. Additionally, PIN is highly correlated with transaction cost measures, Vol and $Zerofreq$. Then, in a multivariate setting, we control for these variables. As Lesmond *et al.* (1999) report, $Zerofreq$ is negatively correlated with $Size$ and Vol in our sample. This means that zero returns are very common for small stocks. The highly negative correlation between Vol and $Zerofreq$ implies that these variables are likely to capture the same aspect, namely transaction costs; low Vol and high $Zerofreq$ indicate that transaction costs are high.

In addition, *Abnac* is significantly correlated with $Aret12$ ($\rho = -0.07$) at the 0.01 level. This suggests that low (high) *Abnac* stocks tend to experience high (low) future returns, and that there is a possibility observing the abnormal accrual anomaly in Japan. We further investigate it by using a hedge portfolio return test in next section.

4.2 Replication in the Japanese stock market

Pincus *et al.* (2007) investigate whether accruals mispricing is observed in other non-U.S. countries, including Japan, by using Global Vantage Industrial/Commercial (GVIC) and Global Vantage Issues (GVI) database over 1994–2002. They find that accrual mispricing, but not abnormal accrual mispricing, is observed in Japan. However, Kubota *et al.* (2006) find that not only total accruals but also abnormal accruals can predict future return using the Japanese database over 1980–2002, and then conclude that abnormal accrual mispricing is also observed in Japan and that the accrual anomaly is due largely to abnormal accruals by managerial discretion. Thus, there are mixed results for abnormal accrual mispricing in Japan, so we start investigating whether abnormal accrual mispricing occurs in Japan using our sample.

Table 4 reports the mean value of X-month buy-and-hold raw return ($RretX$) and size-BE/ME adjusted X-month buy-and-hold abnormal return ($AretX$), and other selected variables for each portfolio. We use the following procedure for constructing each portfolio: for each year, we rank stocks by abnormal accruals and assign them to quintiles. The return accumulation period begins on July 1 to ensure complete dissemination of information to estimate abnormal accruals for all traders.

This table shows that over 3, 6, 9, and 12-month periods following portfolio formation, stocks with small abnormal accruals generally have larger raw return than those of large abnormal accruals. For example, the lowest abnormal accrual quintile earns, on average, a raw return over 12 months of 16.7 percent, while the highest abnormal accrual quintile earns an average raw return of 11.2 percent. Similarly, we find that stocks in the lowest abnormal accrual quintile earn, on average, abnormal annual return of 3.8 percent while those in the highest abnormal accrual quintile earns of -1.6 percent. In other words, over the following year, the abnormal return to this hedge portfolio, i.e., $Q1-Q5$, is 5.4 percent ($p < 0.01$). These findings suggest that as market participants misunderstand current abnormal accruals implications for future earnings, stock prices diverge from the intrinsic value of reflected abnormal accruals information. Therefore, the current abnormal accruals can predict the future return in the process of converging to the intrinsic value of the stocks. This is contrary to Pincus *et al.* (2007). We demonstrate that as in the U.S. as demonstrated by Xie (2001), the abnormal accruals anomaly is also observed in the Japanese stock market, at least for our sample period.

In addition, we also find that stocks with extreme abnormal accruals have attributes that are undesirable to most traders, for example, high beta, small size, high arbitrage risk, or high transaction cost (i.e., high frequency of zero returns), from Table 4. These findings are consistent with the U.S. research (e.g., Mashruwala *et al.* 2006; Lev and Nissim 2006). Also in Japan, these attributes may prevent the accrual information from being impounded into stock. Therefore, we show the results controlling for these attributes later.

4.3 Hedge portfolio abnormal return tests

Our hypothesis predicts that future stock returns for high PIN are less sensitive to the abnormal accrual information, but that there is a strong relationship between the abnormal accruals and future stock returns among low PIN stocks. For high PIN stocks, this is because private information about intrinsic value that correctly reflects the persistence of abnormal accruals already has been revealed to the market at the earnings announcements due to informed trading activity. In addition, even if prices of high PIN stocks diverge from the intrinsic value at the earnings announcements, they become efficient quickly as a result of trading from informed traders. Thus, we should observe a negative relationship between the predictive ability of abnormal accruals for long-term future returns and PIN.

To evaluate the effect of informed trading activity on the predictive ability of abnormal accruals for future returns, each annual sample is ranked based on informed trading activity measure, PIN, and abnormal accruals. Low (High) PIN is defined as stocks with PIN below (above) bottom (top) 20 percent of annual raw PIN across stocks. Likewise, Low (High) Abnac is defined as stocks with abnormal accruals below (above) bottom (top) 20 percent of annually abnormal accruals across stocks.

Panel A of Table 5 shows that the abnormal accrual mispricing of low PIN stocks is generally higher than that of high PIN stocks as expected. The average hedge portfolio abnormal return for low PIN stocks is significantly positive, 3.04 percent and 6.35 percent over 6- and 12-month periods, respectively, while that for high PIN stocks is insignificant, 2.38 percent and 0.59 percent over 6- and 12-month periods, respectively. This result is also demonstrable from Figure 3. This figure illustrates the cumulative abnormal returns from a 12-month buy-and-hold strategy based on abnormal accruals. To construct this graph, a long-position is taken in the bottom quintile stocks based on abnormal accruals, and a short-position is taken in the top quintile stocks.

This graph reports the difference in cumulative buy-and-hold abnormal returns between the bottom and top quintiles at monthly intervals over the next one year. This figure shows that the abnormal accrual-based hedge returns for high PIN stocks are consistently smaller than those for low PIN stocks.

PIN is strongly negatively correlated with market capitalization, so the result of Panel A of Table 5 and Figure 3 has possibilities that examine the relationship between abnormal mispricing and market capitalization. Thus, Panel B of Table 5 reports the relationships among the predictive ability of abnormal accruals for future returns, PIN, and market capitalization. In addition to sorting based on abnormal accruals and PIN, we further classified the stocks into two groups, Large stocks and Small stocks, within each *Abnac-PIN* portfolio. Consistent with Panel A of Table 5 and Figure 3, the 12-month hedge portfolio abnormal return is significantly positive for low PIN stocks but insignificant for high PIN stocks even after controlling for market capitalization. The returns are 8.9 percent ($p < 0.01$) and 4.9 percent ($p < 0.01$) for Small/Low PIN stocks and Large/Low PIN stocks, and -2.8 percent and 2.2 percent for Small/High PIN stocks and Large/High PIN stocks. This suggests that the result of Panel A of Table 5 does not reflect just the fact that market capitalization affects the abnormal accruals mispricing.

These results demonstrate that among low PIN stocks, abnormal accruals information has not been impounded into stocks prices soon after earnings announcements but is impounded into stock prices over the long time, while among high PIN stocks, abnormal accruals information have been impounded into stock prices before or soon after earnings announcements. Thus, we are able to support our hypothesis in univariate setting.

Figure 4 provides evidence on the stability of these results that abnormal accrual-based hedge abnormal returns for high PIN are smaller than those for low PIN stocks. This figure plots the annual hedge portfolio abnormal return for each of the six fiscal years in our sample. The result holds in of the five of six years, with 2001 the exception. Therefore, we interpret that this phenomenon is not time-specific, but occur constantly.

4.4 Cross-sectional regression results

In the previous section, we used a univariate analysis and provided evidence supporting our hypothesis that the abnormal accrual mispricing is cross-sectionally correlated with the informed traders' activity measure, PIN. Next, we use multivariate analysis and investigate whether PIN plays an important role in impounding accrual information into stock prices. We start by estimating the following standard asset pricing regression:

$$
\begin{aligned}
Aret12_{i,t} &= \alpha_0 + \sum_{\tau=2002}^{2006} \alpha_{\tau-2001} YD_{\tau,i,t} + \beta_1 Abnac_{i,t} \\
&\quad + \beta_2 Beta_{i,t} + \beta_3 Size_{i,t} + \beta_4 BE/ME_{i,t} + \varepsilon_{i,t},
\end{aligned} \tag{5}
$$

where $Aret12$ is the size-BE/ME adjusted return during the 12-month period beginning the fourth month after the end of the fiscal year. YD is an annual indicator variable. $Beta$, $Size$, and BE/ME are included to control for the effects that prior research have documented (e.g., Fama and French 1992; Chan *et al.* 1991). To mitigate the influence of outliers of abnormal returns, we eliminate observations with the lowest and highest 1 percent of $Aret12$ each year.

In this regression, the coefficient β_1 measures the predictive ability of abnormal accruals for future returns. If more active informed trading, indicated by high PIN, mitigates the abnormal accrual mispricing, then the coefficient β_1 is much toward zero for high PIN stocks. Table 6 presents the regression results for the highest PIN quintile and other four quintiles (i.e., $Q1$ to $Q4$). The t-statistics in parentheses are based on White (1980) heteroscedasticity-consistent standard errors. The coefficient on $Abnac$ is close to zero ($\beta_1 = -1.58$) for the highest-PIN quintile but significantly negative ($\beta_1 = -13.07$) for the other quintiles at the 0.01 level (one-tailed test), even after controlling for some factors known to be associated with future returns. Consistent with the earlier results, this result shows that the negative association between abnormal accruals and subsequent annual returns is stronger for low PIN stocks.

Finally, we use Mashruwala *et al.* (2006)-type regression to control for several factors that are known to affect the mispricing; we regress size-BE/ME adjusted returns for stocks on abnormal accruals, abnormal accruals interacted with proxy for informed trading activity, PIN, lack of substitutes, $Arbrisk$, and transaction costs proxies, Vol and $Zerofreq$. In addition, we control for $Beta$, $Size$, and BE/ME that are known to affect the stock returns in this equation. We estimate the following regression:

$$
\begin{aligned}
Aret12_{i,t} &= \alpha_0 + \sum_{\tau=2002}^{2006} \alpha_{\tau-2001} YD_{\tau,i,t} + \beta_1 Abnac_{i,t}^{dec} + \beta_2 Abnac_{i,t}^{dec} * DHPIN_{i,t} \\
&\quad + \beta_3 Abnac_{i,t}^{dec} * Arbrisk_{i,t}^{dec} + \beta_4 Abnac_{i,t}^{dec} * Vol_{i,t}^{dec} + \beta_5 Abnac_{i,t}^{dec} * Zerofreq_{i,t}^{dec} \\
&\quad + \beta_6 Beta_{i,t}^{dec} + \beta_7 Size_{i,t}^{dec} + \beta_8 BE/ME_{i,t}^{dec} + \varepsilon_{i,t}.
\end{aligned} \tag{6}
$$

Following Mashruwala *et al.* (2006), we do use not raw data, but decile rank for independent variables except for PIN. The superscript "*dec*" indicates the scaled annual decile rank (-0.5 to 0.5) for the respective variables. The ranking process is executed as follows. Every year, we assign a decile-based rank to each variable from one to ten and transform this rank by subtracting one and dividing by nine. Finally, we subtract 0.5 from each of these transformed ranks such that the decile ranks range from -0.5 to 0.5. The coefficient on $Abnac$ using this coding means the returns to a hedge portfolio are long in the lowest decile and short in the highest decile.

We do not transform to decile rank for PIN, and instead we use an indicator variable, $DHPIN$, taking the value of one if stocks assign the highest-PIN quintile and zero otherwise. There are two reasons why we use indicator variable for PIN. First, Easley and O'Hara (1992b) and Easley and O'Hara (1992a) demonstrate nonlinear association between the speed of price convergence to efficient value and informed trading activity. However, as we are not able to a priori specify the appropriate function form in real stock markets, we use an indicator variable so that we should not lose the statistical power to test the hypothesis that abnormal accrual mipricing is not pronounced among high PIN stocks. Second, as Figure 2 (c) shows, cross-sectional PIN distribution is tight. Because of this tight distribution, cross-sectional differences of PIN are less observable. Therefore, in order to isolate the effect of extreme high PIN stocks on abnormal accrual mispricing, we compare stocks with extremely high PIN with others to test the hypothesis. This idea strengthens our statistical power.

Table 7 presents the result of estimating Eq. (6). Similar to estimating Eq. (5), we estimate the Eq. (6) with sample after excluding observations of the lowest and highest 1 percent of $Aret12$ each year. The first column (1) shows the result when we regress the size-BE/ME adjusted returns on $Abnac^{dec}$. The coefficient on the $Abnac^{dec}$ is -5.30 ($t = -4.86$). This means that the abnormal returns from an abnormal accrual-based trading strategy yields an annual abnormal return of 5.3 percent.

The second column (2) shows that the interaction of $Abnac^{dec}$ and $DHPIN$ is insignificant (coef. $= 4.24$, $t = 1.22$) but $\beta_1 + \beta_2$, which measures the total impact of abnormal accruals on abnormal stock returns for the highest-PIN quintile, is statistically insignificant (coef. $= -1.96$, $F = 0.55$) at the conventional level. This result implies that the size-BE/ME adjusted returns are not significantly different from zero for the highest-PIN quintile stocks and significantly negative for the others, and therefore abnormal accrual mispricing is not pronounced among high PIN stocks. Consistent with our hypothesis, abnormal accruals for high PIN stocks have lower explanatory power for future returns. This result is robust to control for arbitrage risk and transaction costs in column (3) and also other risk factors in column (4).

The column to the extreme right reports the Fama and MacBeth (1973) estimation result of the regression. The coefficients are averaged over the six years and the t-statistics are computed from the average and standard deviation of the estimated coefficients, although the degree of freedom is problematic. Consistent with the result in the U.S. markets reported by Mashruwala *et al.* (2006), the coefficient on the interaction term $Abnac^{dec} \times Arbrisk^{dec}$ is significantly negative (coef. $= -5.61$, $t = -2.80$). This result suggests that abnormal returns to the abnormal accrual trading strategy increase in arbitrage risk (lack of close substitutes) also in Japan. On the other hand, contrary to Mashruwala *et al.* (2006), the interaction of $Abnac^{dec}$ and Vol^{dec} or $Zerofreq^{dec}$, which are proxied for transaction costs, are not statistically insignificant in using our sample. The other interaction term $Abnac^{dec} \times DHPIN$ is significantly positive at the 0.05 level or higher (one-tailed test), as expected. This result means that abnormal returns from trading strategy based on abnormal accruals for high PIN stocks are lower than those for the other stocks, that is, stock returns for high PIN are less sensitive to the abnormal accrual information.

Overall, the results from the cross-sectional regression support our hypothesis that stocks with more active informed trading exhibit less abnormal accrual mispricing relative to stocks with less active informed trading. We interpret these results as the evidence that more active informed trading decreases the probability that stock prices deviate from efficient prices, reflecting abnormal accruals, and that the stock prices become efficient in the short-term by active informed trading utilizing both public and private information, even if the stock prices are temporarily mispriced. In sum, our results show that abnormal accruals mipricing is not pronounced among high PIN stocks. Then, the association between abnormal accruals and long-term future returns for high PIN stocks is lower than that for low PIN stocks. Consistent with analytical research and empirical research for PEAD, a high PIN helps the market become more efficient even for abnormal accruals.

5 Conclusion

Xie (2001) finds that market participants overprice the abnormal component of accruals, and then stocks with high abnormal accruals tend to have low future returns. He interpreted this result as evidence that market participants do not see through managers' attempts to manipulate earnings. Xie (2001) result leads to a question: do all market participants fail to assess the persistence of abnormal accruals correctly?

We assume that informed traders correctly understand the properties of abnormal accruals by accessing both public and private information sources and having higher analyzing skills for the information than uninformed traders. We then investigate whether informed trading activity affects the abnormal accrual mispricing.

Using PIN measure to capture the informed trading activity, we find that the mispricing is more pronounced for stocks with relatively low PIN. This result is consistent with analytical research (Callen *et al.* 2000; Easley and O'Hara 1992b) and empirical research for PEAD (Vega 2006) that high PIN helps the market become more efficient.

Mashruwala *et al.* (2006) find that arbitrage risk and transaction costs impose barriers to exploiting accrual mispricing, and conclude that even if smart investors see through the implication of accruals, they would find it difficult to eliminate such mispricing. Inconsistent with Mashruwala *et al.* (2006), our result implies that if many smart informed traders trade the stock, its price can be impounded quickly even by recondite information such as abnormal accruals. Thus, this research suggests that informed trades play an important role in the speed and efficiency of the price discovery process.

Our research has the following implications for accrual anomaly research. In the U.S., there are mixed results for the cause of the anomaly, that is, the mispricing explanation (Sloan 1996; Xie 2001) or the risk explanation (Khan 2007). We find that the mispricing explanation is valid for the accrual anomaly by examining the association between PIN and abnormal accruals. Accrual anomaly is observed in many countries (Pincus *et al.* 2007). Our research design is able to apply for accrual anomaly research in other countries in order to examine the cause of the anomaly.

In addition, our research has also important implications for regulators and policy planners concerned with the stock markets. Our findings suggest that more active trading from traders who have much information makes the market more efficient. Therefore, as Callen *et al.* (2000) argued, by reducing uninformed noise trading through disclosure regulations, policy makers could diminish wasteful trading exponentially, and thereby increase economic welfare.

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	Obs.	Mean	SD	Q1	Median	Q3
α	7,315	0.27	0.12	0.17	0.26	0.36
δ	7,315	0.35	0.20	0.21	0.33	0.50
μ	7,315	70.6	71.3	20.0	47.4	99.1
ε_b	7,315	54.3	84.1	5.8	20.2	64.7
ε_s	7,315	60.7	91.3	7.9	25.6	73.8
PIN (%)	7,315	20.7	9.8	14.8	18.9	24.5

Table 1: Summary statistics for PIN

This table reports the summary statistics for estimated parameters of PIN. The parameters are estimated using the EHO model given by the likelihood function in Eq. (2) and (3), for each year from 2001 to 2006. The parameters α and δ denote the probability of an information event and that information is low signal, respectively. The arrival rate of informed traders is μ, the arrival rate of uninformed buyers and sellers are ε_b and ε_s, respectively.

	Obs.	Mean	SD	Q1	Median	Q3
TA	7,315	-0.04	0.06	-0.06	-0.04	-0.01
$Abnac$	7,315	0.00	0.08	-0.02	0.00	0.02
$Aret3$ (%)	7,256	0.5	16.0	-8.8	-0.8	7.7
$Aret6$ (%)	7,211	-0.1	26.8	-14.1	-2.0	10.2
$Aret9$ (%)	7,193	1.2	30.6	-16.1	-1.9	13.2
$Aret12$ (%)	7,150	1.3	37.3	-18.3	-3.4	13.6
$Beta$	7,315	0.98	0.64	0.56	0.91	1.33
$Size$	7,315	24.47	1.57	23.36	24.24	25.47
BE/ME	7,315	0.98	0.79	0.55	0.85	1.26
$Arbrisk$ ($\times$100)	7,315	1.2	0.3	0.6	1.0	1.7
Vol (million yen)	7,315	563	2,010	17	73	329
$Zerofreq$	7,315	25	21	11	19	32

Table 2: Summary statistics for overall variables except for PIN

This table reports summary statistics for overall variables with the exception of PIN. TA is total accruals defined as CFO minus net income using a cash flow statement approach, deflated by averaged total assets. *Abnac* is abnormal accruals determined as the difference between total accruals and normal accruals, expected total accruals estimated from Jones (1991) model, equation (1). Normal accruals are estimated in cross-section for each two-digit Nikkei Industrial Code and year combination, where the firm of interest is excluded in estimating the model (out-of-sample method). *AretX* is the size-BE/ME adjusted X-month buy-and-hold return. *Beta* is CAPM beta measured using 48 monthly return observations ending June 30 of year t. *Size* is market value of equity as of June 30 of year t. BE/ME is book-to-market ratio calculated as the ratio of the year-end of book value of equity to the market value of equity on June-end of year t. *Arbrisk* is arbitrage risk estimated as the residual variance from a standard market model regression of its returns on the returns of the weighted average market index over the 48 months ending June 30 of year t. Vol is trading volume (proxy for transaction costs), measured as daily average trading volume (closing share price times daily number of shares traded) on June of year t. $Zerofreq$ is also proxy for transaction costs, denoting the frequency of zero daily return calculated as the frequency of zero daily returns over the period July of year $t-1$ to June of year t.

	$Abnac$	$Aret12$	PIN	$Beta$	$Size$	BE/ME	$Arbrisk$	Vol	$Zerofreq$
$Abnac$	1.00								
$Aret12$	−0.07	1.00							
PIN	0.06	−0.04	1.00						
$Beta$	−0.04	0.03	−0.14	1.00					
$Size$	−0.04	0.02	−0.57	−0.03	1.00				
BE/ME	0.09	0.01	0.29	−0.22	−0.46	1.00			
$Arbrisk$	−0.01	−0.05	0.15	0.45	−0.26	−0.15	1.00		
Vol	−0.05	0.02	−0.63	0.19	0.85	−0.55	−0.04	1.00	
$Zerofreq$	0.03	0.01	0.49	−0.14	−0.65	0.37	0.07	−0.64	1.00

Table 3: Spearman correlation matrix

This table reports the spearman correlation matrix. The parameters are for PIN estimated by using the EHO model given by the likelihood function in equation (2) and (3), and PIN are is calculated as Eq. (4). Other variables are as defined in Table 2.

	Low Abnac				High Abnac		
	$Q1$	$Q2$	$Q3$	$Q4$	$Q5$	$Total$	$Q1-Q5$
$Abnac$	-0.09	-0.02	0.00	0.02	0.08	0.00	
$Rret3$ (%)	-0.2	-0.1	-0.3	-0.9	-1.5	-0.6	1.2*
$Rret6$ (%)	2.4	3.9	1.8	1.3	-0.7	1.7	3.1**
$Rret9$ (%)	12.2	14.0	10.7	11.8	9.4	11.6	2.8*
$Rret12$ (%)	16.7	17.2	13.4	14.5	11.2	14.6	5.5**
$Aret3$ (%)	1.3	0.7	0.6	-0.2	0.1	0.5	1.2*
$Aret6$ (%)	1.1	1.6	-0.5	-0.8	-1.7	-0.1	2.8**
$Aret9$ (%)	2.7	3.3	0.0	0.5	-0.5	1.2	3.2**
$Aret12$ (%)	3.8	3.7	0.3	0.4	-1.6	1.3	5.4**
PIN (%)	20.3	20.1	19.9	21.1	22.0	20.7	
$Beta$	1.12	0.95	0.87	0.90	1.08	0.98	
$Size$	24.35	24.66	24.70	24.48	24.16	24.47	
BE/ME	0.87	0.95	0.99	1.06	1.02	0.98	
$Arbrisk$ ($\times 100$)	1.46	1.11	0.99	1.04	1.48	1.21	
Vol (million yen)	662	621	580	458	494	563	
$Zerofreq$	25	24	24	25	26	25	

Table 4: Mean values of selected characteristics for each portfolio

This table reports mean values of selected characteristics for each portfolio of stocks to quintiles based on the abnormal accruals. We use the following procedure for constructing each portfolio: for each year, we rank stocks by abnormal accruals and assign them to quintiles. The return accumulation period begins on July 1. $Q1-Q5$ means the average size-BE/ME adjusted abnormal return to hedge strategy, i.e., long in the lowest abnormal accrual quintile and short in the highest quintile. $RretX$ is the raw X-month buy-and-hold return. Other variables are as defined in Table 2. ** (*) indicates significant difference at the 0.01 (0.05) level using one-tailed t-test.

Panel A: Test of return to the abnormal accrual-based trading strategy after controlling for PIN

	Low *Abnac*	High *Abnac*	Low− High		Low *Abnac*	High *Abnac*	Low− High
Low PIN				High PIN			
3 months	0.03	−1.72	1.74	3 months	1.96	1.47	0.49
6 months	1.70	−1.34	3.04*	6 months	2.34	−0.04	2.38
9 months	2.32	−1.19	3.50*	9 months	2.47	1.72	0.75
12 months	4.19	−2.16	6.35**	12 months	0.82	0.24	0.59

Panel B: Test of return to the abnormal accrual-based trading strategy after controlling for Size and PIN

	Low *Abnac*	High *Abnac*	Low− High		Low *Abnac*	High *Abnac*	Low− High
Small/ Low PIN				Small/ High PIN			
12 months	4.02	−4.86	8.89*	12 months	0.38	3.14	−2.76
Large/ Low PIN				Large/ High PIN			
12 months	4.28	−0.65	4.93*	12 months	1.01	− 1.14	2.15

Table 5: Mean hedge portfolio abnormal returns

Panel A of this table shows mean values of the size-BE/ME adjusted abnormal returns from abnormal accruals-based trading strategy for each portfolio. We use the following procedure for constructing each portfolio; each annual sample is ranked based on PIN and abnormal accruals. Low (High) PIN is defined as stocks with PIN below (above) bottom (top) 20% of annually raw PIN across stock. Low (High) *Abnac* is defined as stocks with *Abnac* below (above) bottom (top) 20% of annually the abnormal accruals across stock. The return accumulation period begins on July 1. Low − High means the average size-BE/ME adjusted abnormal return to hedge strategy, i.e., long in the lowest abnormal accruals quintile and short in the highest quintile. Panel B of this table presents mean values of the size-BE/ME adjusted abnormal returns from abnormal accruals-based trading strategy for each three-dimension portfolio, *Abnac*, PIN, and market capitalization. We use the following procedure for constructing each portfolio; in addition to sorting based on *Abnac* and PIN, we further sorted the stocks into two groups with in each *Abnac*-PIN portfolio. ** (*) indicates significant difference at the 0.01 (0.05) level using one-tailed t-test.

	Pred.	$Q1 - Q4$		$Q5$	
Intercept	?	-4.85	-9.50	-1.99	-37.59
		(-7.72)	(-1.20)	(-1.52)	(-1.57)
Abnac	$-$	-13.07	-13.17	-1.58	-2.11
		(-2.45)	(-2.47)	(-0.17)	(-0.22)
Beta	$+$		1.11		1.05
			(1.67)		(0.60)
Size	$-$		0.08		1.34
			(0.28)		(1.38)
BE/ME	$+$		1.53		2.62
			(1.79)		(1.64)
adj. R^2		2.30%	2.37%	0.62%	0.75%
obs.		5,624	1,378	5,624	1,378

Table 6: Annual cross-sectional return regression

This table shows the estimation result of regression model Eq. (5) for the highest-PIN quintile and other four quintiles (i.e., $Q1$ to $Q4$). The t-statistics in parentheses are based on White (1980) heteroscedasticity-consistent standard errors. The dependent variable, $Aret12$, is defined as subtracting the value-weighted portfolio's return from the stock's return over a 12-month period. *Abnac* is abnormal accruals determined as the difference between total accruals and normal accruals, with expected total accruals estimated from the Jones (1991) model. Normal accruals are estimated in cross-section for each two-digit Nikkei Industrial Code and year combination, where the firm of interest is excluded in estimating the model (out-of-sample method). *Beta* is CAPM beta measured using 48 monthly return observations ending June 30 of year t. *Size* is market value of equity as of June 30 of year t. BE/ME is book-to-market ratio calculated as the ratio of book value of equity to the market value of equity on the June end of year t. The t-statistics in parentheses are based on White (1980) heteroscedasticity-consistent standard errors.

	Pred.	(1)	(2)	(3)	(4)	FM
$Intercept$	?	−4.26	−4.19	−4.12	−4.13	0.19
		(−4.80)	(−7.01)	(−6.88)	(−6.75)	(0.08)
$Abnac^{dec}$	−	−5.30	−6.20	−5.95	−5.95	−5.83
		(−4.86)	(−4.90)	(−4.68)	(−4.68)	(−5.26)
$Abnac^{dec} * DHPIN$	+		4.24	4.04	4.03	3.77
			(1.44)	(1.22)	(1.22)	(2.24)
$Abnac^{dec} * Arbrisk^{dec}$	−			−4.52	−4.62	−5.61
				(−1.24)	(−1.25)	(−2.80)
$Abnac^{dec} * Vol^{dec}$	+			3.28	3.42	1.97
				(0.70)	(0.73)	(0.52)
$Abnac^{dec} * Zerofreq^{dec}$	−			4.32	4.49	3.06
				(0.94)	(0.97)	(0.54)
$DHPIN$	?		−0.47	−0.48	−0.40	−0.93
			(−0.51)	(−0.52)	(−0.39)	(−0.31)
$Beta^{dec}$	+				2.72	1.80
					(2.34)	(0.62)
$Size^{dec}$	−				−0.10	−0.86
					(−0.07)	(−0.13)
BE/ME^{dec}	+				1.05	0.84
					(0.75)	(0.27)
$\beta_1 + \beta_2$	0		−1.96	−1.91	−1.92	−2.06
F-Stat.$(\beta_1 + \beta_2 = 0)$			0.55	0.43	0.43	
Prob. F			0.46	0.51	0.51	
adj. R^2		2.05%	2.06%	2.05%	2.10%	3.14%

Table 7: Cross-sectional regression of abnormal returns on abnormal accruals and PIN

This table shows the estimation result of regression model Eq. (6). The dependent variable, $Aret12$, is defined as subtracting the value-weighted portfolio's return from the stock's return over 12-month. $DHPIN$ is an indicator variable taking the value of one if stocks are assigned to the highest-PIN quintile and zero otherwise. $Arbrisk$ is arbitrage risk estimated as the residual variance from a standard market model regression of its returns on the returns of the weighted average market index over the 48 months ending June 30 of year t. Vol is trading volume (proxy for transaction costs), measured as daily average trading volume (closing share price times daily number of shares traded) on June of year t. $Zerofreq$ is also proxy for transaction costs, denoting the frequency of zero daily return calculated as the frequency of zero daily returns over the period July of year $t-1$ to June of year t. $Beta$ is CAPM beta measured using 48 monthly return observations ending June 30 of year t. $Size$ is market value of equity as of June 30 of year t. BE/ME is book-to-market ratio calculated as the ratio of book value of equity to the market value of equity on the June end of year t. The t-statistics in parentheses except for the column to the extreme right are based on White (1980) heteroscedasticity-consistent standard errors. The far right column reports the Fama and MacBeth (1973) estimation result. The superscript "*dec*" denotes the scaled annual decile rank (−0.5 to 0.5) for the respective variable.

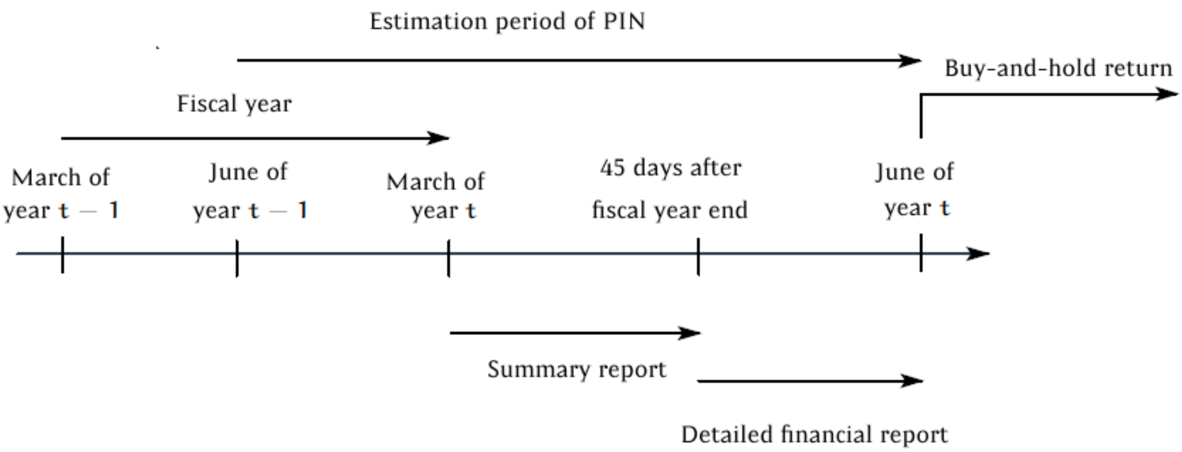
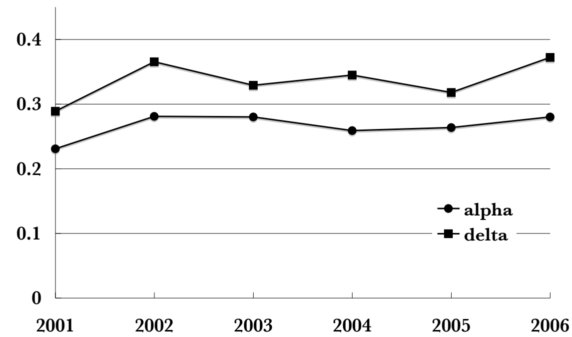
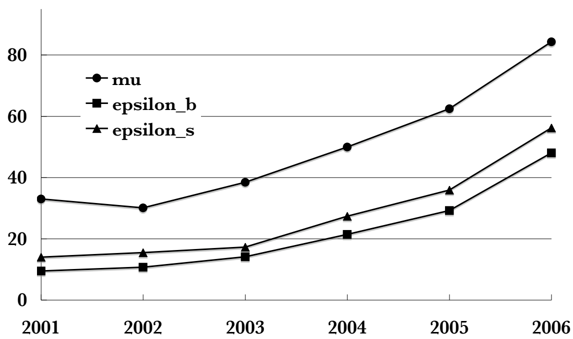


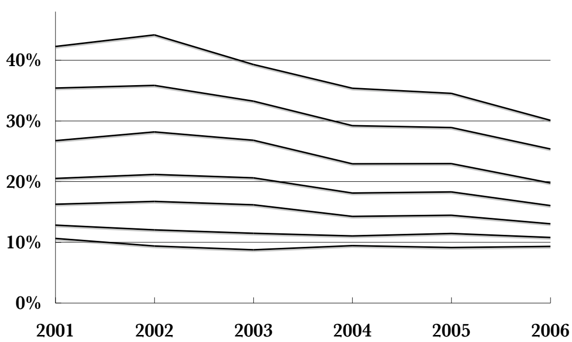
Figure 1: Timeline of Japanese financial reporting and overview of the measurement of main variables



(a)



(b)



(c)

Figure 2: Time-series properties of estimated parameters and distribution of PIN

Figure (a) shows the median estimated parameters, α and δ, in the structural model given by the likelihood function in equation (2) and (3) each year. Similarly, Figure (b) shows the median estimated parameters, μ, ε_b, and ε_s, each year. Figure (c) shows the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles each year in the sample period for the cross-sectional distribution of PIN given by the function in equation (4).

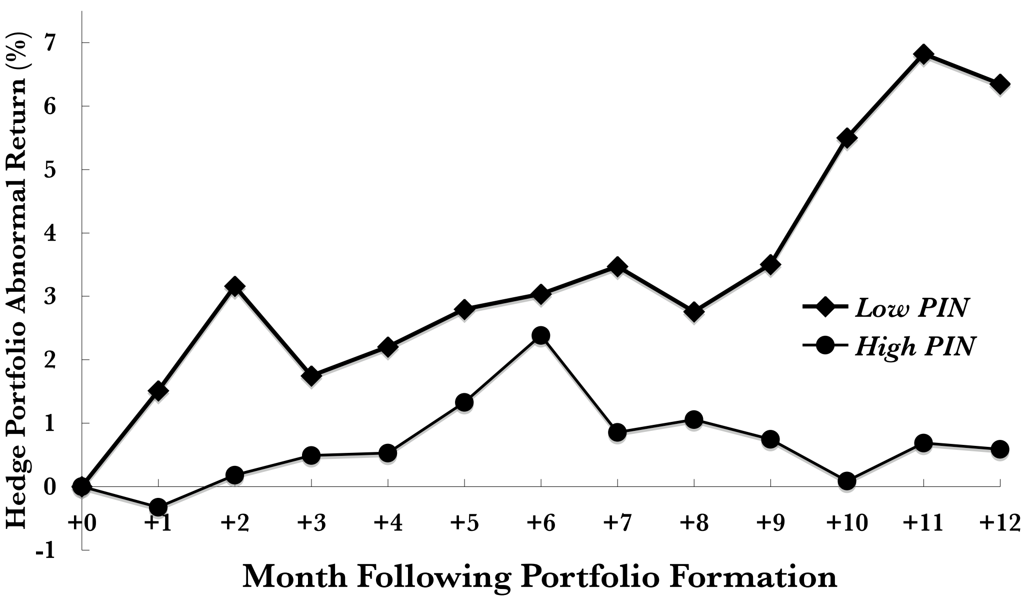


Figure 3: Buy-and-hold returns from abnormal accrual-based trading strategy

This figure shows average buy-and-hold size-BE/ME adjusted abnormal returns for Low PIN quintile and High PIN quintile produced by abnormal accrual-based trading strategy. To construct this graph, a long-position is taken in the bottom quintile stocks based on abnormal accruals and a short-position is taken in the top quintile stocks. This graph reports the difference in cumulative buy-and-hold abnormal returns between the bottom and top quintiles at monthly intervals over the next one year. Low (High) PIN quintile consists of stocks with PIN below (above) bottom (top) 20 percent of annual raw PIN across stock. The return accumulation period begins on July 1 each year.

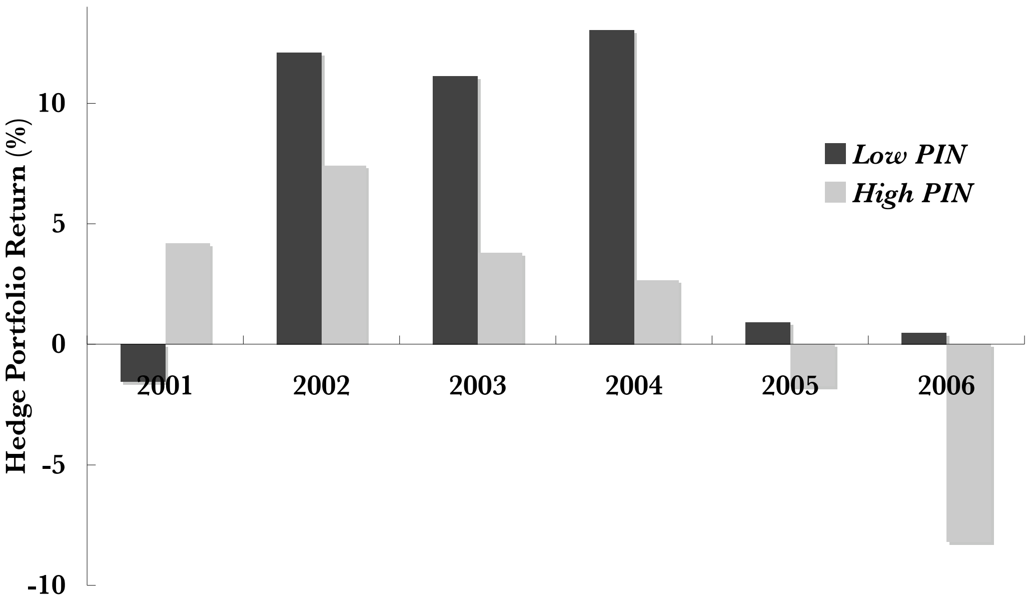


Figure 4: Year-by-year 12-month abnormal returns from abnormal accrual-based trading strategy

This figure presents average size-BE/ME adjusted abnormal returns for Low PIN quintile and High PIN quintile by each year to a hedge portfolio taking a long position in the stock with the lowest quintile of abnormal accruals and short position in the stock with the highest quintile of abnormal accruals. Low (High) PIN quintile consists stocks with PIN below (above) bottom (top) 20 percent of annual raw PIN across stock. The return accumulation period begins on July 1 each year.