# Noise or Information: When Stock Price Synchronicity Meets Accounting Restatements

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**Abstract** This paper examines how and why *stock price synchronicity* responds to *accounting restatements* in China. Using a matching sample, we document that accounting restatements drive down price synchronicity. A set of regression analyses show that the declined price synchronicity reflects the increased firm-level noise/uncertainty rather than firm-level information. Further investigations with PIN and ERC/FERC confirm the noise story of price synchronicity following accounting restatements. Our results challenge the dominant view of taking price synchronicity always as an information-based measure. It implies that caution must be exercised in future research when price synchronicity is taken to measure the level of private information in stock prices.

**Keywords** Accounting restatements · price synchronicity · noise
**JEL classification** D8 · G12

## 1 Introduction

Stock price synchronicity has widely been adopted in both finance and accounting research as a measure for how much *private information* is impounded into stock price. It is a simple transformation of the R-square statistic of the market model in asset pricing. In the current literature, price synchronicity and R-square are often interchangeably used. Roll (1988) offers an interesting and innovative discussion of R-square, suggesting that a low R-square is indicative of either *private information* or else *occasional frenzy* (noise). Later, a few prominent studies support the information story of the measure. Many other studies have contentedly adopted the information interpretation of this measure. Ironically, the noise component, as equally emphasized by Roll (1988), of R-square is literally ignored or neglected in subsequent research, as if it would never exist. We intend to correct the misconception in this study, by investigating the case of accounting restatements in China. We document that accounting restatements lead to drops in price synchronicity and demonstrate that noise, rather than information, comprises the main cause of the declined price synchronicity.

It is important to understand if changes in stock price synchronicity are driven by information or noise. The former represents informational efficiency while the latter reflects noise trading (see, for example, Durnev, Morck, Yeung and Zarowin (2003)). Stock price with more information (noise) becomes more (less) accurate to track a firm's fundamental. Accurate price directs capital to its highest value use as "functional efficiency". From a social welfare point of view, more informative stock prices are thus preferred to less informative stock prices. Noise, on the other hand, causes markets to be less efficient, business cycles, inflation, etc. (Black (1986)). If noise is mistakenly viewed as information by some traders, the noise can be impounded into price. Inferences and trading strategies based on noise, when it is mistakenly viewed as information, lead to faulty conclusions and wrong decisions.

Three studies in the recent literature make price synchronicity or R-square widely-accepted as a measure for private information in stock price. Morck, Yeung and Yu (2000) document an interesting pattern on stock price synchronicity across countries. They find that in the country level, the less developed an economy is, the higher price synchronicity it possesses. Therefore, emerging economies have higher price synchronicity than developed ones. They attribute the underlying force of driving the stock price synchronicity pattern to the cross-country differences in property rights. More protection in public shareholders' property rights against corporate insiders helps promote informed arbitrage which in turn makes more firm-specific information incorporated into stock price. Durnev, Morck, Yeung and Zarowin (2003) look into the information story more closely and show that firms and industries with lower market model R-squares contain more information about future earnings in current stock returns. This means that lower price synchronicity signals more information-laden stock prices, therefore, more efficient stock markets. Using a theoretical framework, Jin and Myers (2006) attempt to address what is behind the R-square pattern in Morck et al. (2000). They essentially argue that lack of transparency is the key to understanding why firms in emerging economies move more synchronically than those in developed economies.[1]

The information interpretation of price synchronicity or R-square has generated a wide range of interesting application studies in both finance and accounting. We briefly mention a few of them as examples. Durnev, Morck and Yeung (2004) and Chen, Goldstein and Jiang (2007) take this measure to study the behavior of corporate investments and find that firm managers learn from the private information in stock price about their own firms' fundamentals. The managers then incorporate this information into their corporate investment decisions. In a study of stock market

[1] In contrast to Jin and Mayer (2006), Dasgupta, Gan and Gao (2009) claim that transparency increases rather than decreases price synchronicity.

liberalization, Charia and Henry (2008) link the firm-specific information, as measured by price synchronicity, to investment efficiency in emerging markets. To examine corporate governance policy, Ferreira and Laux (2007) take this measure to show that firms with fewer antitakeover provisions display lower price synchronicity, which implies that openness to the market for corporate control leads to more informative stock prices. Fernandes and Ferreira (2008)) investigate the issue of firm cross-listing and find cross-listing impacts price informativeness, as measured by price synchronicity, asymmetrically for developed market firms and emerging market firms. For the present, it is not hard to predict that more research papers will emerge on basis of the informational view on price synchronicity.[2]

Back to the two opposing interpretations of R-square in Roll (1988), we ask if price synchronicity *always* represent private information in stock price. Theoretically, it seems hard, if not impossible, to believe that this is true. In his theoretical model, Balck (1986) argues forcefully that stock price reflects *both* information and noise. When market participants trade on their private information, the information is incorporated into stock price; when they trade on noise, possibly because they treat the noise as if it were information, noise is incorporated into stock price. Pragmatically, stock price contains both information and noise. West (1981) proposes a theoretical model to suggest that higher firm specific volatility (lower price synchronicity) is associated with less firm-specific information and more noise in price. He empirically finds that individual stock volatility is positively related to bubbles, fad and some other non-fundamental variables. Shiller (1981) claims that the level of stock price volatility is too high to be explained by

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[2] Teoh, Yang and Zhang (2007) turn to claim that price synchronicity or R-square represents noise rather than information in the cases of existing studies. They argue that if the measures are related to information, lower R-square values should be associated with weak financial anomalies. Their empirical results reject the prediction. Lee and Liu (2007) take a theoretical approach to the issue, and show that volatility caused by information is U-shaped, decreasing initially and then increasing with price informativeness. Volatility caused by noise always decreases with price informativenss. It seems hard to empirically test the prediction.

firms' fundamentals. Collectively, these imply that a big chunk of price variation seems to be due to noise trading rather than purely information. If some events lead to more noise in price, then R-square or price synchronicity should become lower too. Therefore, it could be misleading to claim that there is more information in stock price by simply looking at the increased R-square or price synchronicity! Unfortunately, the current literature seems to dominantly believe that this situation never exists, so that we can *always* use the measures as proxies for information in price. The accounting restatements in China, as we study in this paper, offers an interesting situation in which we find that price synchronicity is driven lower but stock prices do not become more informative.

Accounting restatements have attracted growing research attention over the past two decades. Two early studies by Kinney and McDaniel (1989) and DeFond and Jiambalvo (1991) analyze firm characteristics of restating firms. They document that restating firms are usually smaller, less profitable, highly leveraged, of lower growth, of diffuse ownership, and of lower growth in earnings, etc. Recent studies shift interests to market reactions to restatements. Anderson and Yonh (2002), Palmrose, Richardson and Scholz (2004) find a negative cumulative abnormal return (CAR) associated with restatements. Wu (2002) and Akhigbe, Kudla and Madura (2005) find that market's negative reaction increases with the magnitude of the restatements and is more severe for restating firms admitting fraud or reporting errors in revenue recognition policy. In addition, Lev, Ryan and Wu (2007) find that earnings restatements that eliminate or shorten historical earnings growth or positive earnings bring about a stronger negative market reaction. Despite the dominant studies in the US, some research on accounting restatements in China has emerged too. For example, a recent paper by Wang and Wu (2008) is instrumental, which examines the issue of accounting restatements in China by taking a comparative analysis. Two of their findings are interesting: First, restatements are a much more common phenomenon in China than in the US; second, the market does not significantly react to restatements, which is in sharp contrast to the case in the US. They attribute the unique results from Chinese firms to the differences of regulatory and financial reporting environments between the two countries.

This paper examines how and why accounting restatements in China drive changes in price synchronicity. By merging the two lines of research – accounting restatements and price synchronicity, we document that price synchronicity decreases following accounting restatements. Using a matching sample and taking a "difference-in-differences" approach, we find a negative effect of accounting restatements on price synchronicity. Taking a set of regression analyses, we further confirm the negative relation between accounting restatements and price synchronicity. In particular, we ask and test if the reduction in price synchronicity is due to private information or noise. By taking three approaches, we demonstrate that noise rather than information lies behind the declined price synchronicity in the event of accounting restatements in China. The first approach is to run a set of regression models. We run price synchronicity on a restatement variable, controlling for other relevant factors. No matter whether the matching sample is included in, our results suggest a noise story of price synchronicity.

The second approach is to adopt the Probability of Informed Trading (PIN) as an accepted measure for private information in stock price. This measure is constructed from a microstructure model developed by Easley, Kiefer, and O'Hara (1996, 1997a and 1997b). In our current setting, the logic behind PIN is simple: If accounting restatements lead to more private information impounded into stock price, then trading is the "vehicle" of transforming the information into price. The increased informed trading makes PIN larger. However, if accounting restatements mainly reflect added noise in price, then PIN should not be larger. So far, the PIN measure has broadly been used in recent finance and accounting research as an information measure for stock price. We find that accounting restatements do not enhance PIN, though they move up price synchronicity. This is consistent with the noise interpretation of price synchronicity.

The final approach is to assess whether accounting restatements reduce the ability of stock prices to forecast future earnings. This is well known in accounting research as future earnings response coefficient (FERC) developed by Collins, Kothari, Shanken, and Sloan (CKSS, 1994). FERC is the estimated coefficient of future earnings in a regression of current return on current and future earnings, controlling for future returns. A higher FERC implies a closer relation between current return and future earnings, and thus a more informative price. We argue that accounting restatements, if they reflect noise, are negatively correlated with FERC; they are positively related to FERC, if they represent information. Our results support the noise interpretation of price synchronicity.

Various robust analyses have been done to confirm the noise story of price synchronicity in the event of accounting restatements in China. For example, we deal with outliers, different sample periods and replacing weekly returns by daily returns, etc. Overall, we find that our main claim on the noise story of price synchronicity remains unchanged under the situation of accounting restatements in China.

This paper is organized as follows. Section 2 presents data and preliminary analysis. Section 3 set up our research design and empirical results are reported in Section 4. We do the robust analysis in Section 5. Finally we conclude the paper in Section 6.

## 2 Regulations, Data and Descriptive Statistics

### 2.1 Development of Regulations and Data Collection

As an important part of the economic reform in the People's Republish China (PRC), Shanghai and Shenzhen stock exchanges were established in the early 1990's. The major regulatory body of the stock markets is China's Securities and Regulatory Commission (CSRC), while Ministry of Finance (MOF), PRC's accounting standard setter, plays an important role too.

Accounting errors and irregularities had not been regulated for reporting until January 1, 1999 when the *Accounting Standard for Business Enterprises* (ASBE), issued by MOF, became effective. The ASBE specified what material accounting errors[3] were and required disclosure of reasons and total amount of restatements, in particular for retained earnings. In January 2001, the ASBE was slightly modified by adding that abusive changes in accounting policies or accounting estimates would be treated as material accounting errors and were required to be stated in the forthcoming annual reports.

On December 1, 2003, CSRC issued *Rules on Information Disclosure for Listed Firms*. Chapter 19 of the *Rules* specified the Correction of Financial Information and Its Disclosure (Rule 19). Rule 19 required an immediate official report filed with CSRC once accounting errors were spotted for any listed firms. On January 8, 2004, CSRC issued *Notice on Further Improving Financial Information disclosure of Listed Companies*, and took effect immediately. Besides emphasizing on immediate reporting of accounting errors, the *Notice* prohibits firms from abusing assets impairment and changing accounting estimates to manipulate financial results. The new ABSE was adopted by all listed firms on January 1, 2007, and appears more aligned with the IFRS (International Financial Reporting Standard).

We manually collect restatements data for material accounting errors, reported by all A-share firms over the period from January 1, 2000 to December 31, 2007. Despite requirement of immediate reporting on accounting errors after 2004, most restatements were still filed in annual reports. Therefore, we search for accounting restatements in both annual and immediate reports. We collected all annual reports from the two stock

[3] According to *Companies' Accounting System* 2001, material accounting errors are those making financial reporting of listed firms unreliable. They are usually large in amount, accounting for more than 10% of one transaction or item.

exchanges and the WIND database, and obtained the immediate reports from the Website Cninfo, the designated website of information disclosure by the CSRC and the WIND database. To be consistent with other studies, we exclude restatements issued by financial firms[4] and those caused by mergers or acquisitions.

The high frequency data including bid and ask prices used to construct PINs were taken from the CSMAR database. The weekly stock return data used to calculate price synchronicity were from the Sinofin database, which is developed by the Sinofin Information Services and the China Center of Economic Research.

**2.2 Descriptive Statistics**

The descriptive statistics of accounting restatements, as well as other relevant variables, are reported in Table 1. A total number of 1465 firm-year restatements were collected for the period between January1, 2000 and December 31, 2007. Out of the observations, 1416 were found in annual reports and 49 were recorded as immediate reports.[5] Among the restating firms, 767 are those from the Shanghai stock exchange, a bit more than those from the Shenzhen stock exchange. During the period between 2002 and 2004, there was a dramatic increase in the number of restatements, probably because of the enhanced regulations on information disclosure.[6] In comparison with restatements in the U.S., we observe a much larger proportion of the listed companies restating in China. In particular, Panel A of Table 1 shows that more than 20% of the listed firms are restating in 2002 and 2003, while this number in the U.S. was around 2%. As also pointed out by

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4 Financial firms have relatively higher leverage ratios and are more likely to be classified into firms with financial distress. There are only two financial firms issuing restatements in our sample. Adding them into our analysis does not qualitatively change our results and claim.

5 When instant restatements are reported at the same day with annual reports, we treat them as restatements in annual reports.

6 During the period from year 2001 to year 2004, five related rules on accounting errors were effective, they are *Companies' Accounting System* 2001, ASBE: Changes in Accounting Policies and Estimates and Corrections of Material Accounting Errors (Revised), Procedure for Inspecting the Listed Companies (Revised), Rules on Information Disclosure for Listed companies and Notice on Further Improving Financial Information Disclosure of Listed Companies.

Wang and Wu (2008), filing accounting restatements is a common phenomenon in China. In addition, we find, but do not report in our tables, that among 739 restating firms, 336 firms (45.47%) restated once, 202 firms restated twice, and 116 firms did three times.

Panel B of Table 1 displays an industry distribution for restating firms. The manufacturing industry overwhelmingly dominates all the others in issuing restatements. In total, 811 restatements issued by firms in the manufacturing industry, which is slightly above 50% of total number of restatements. The conglomerate industry and the wholesale and retail trade industry are ranked second and third, though two of them put together are only 17% of the total restatements, much smaller than those in the manufacturing industry. However, it is noted that the manufacturing industry is actually an extremely large industry in China, as the total number of firms in it takes more than 50% of the total number of listed firms. In this regard, it is not surprising to see such a large number of restating firms in this industry. Restating in other industries takes a much smaller proportion in the industry distribution, with the mining industry being smallest.

Panel C of Table 1 presents descriptive statistics of firms' characteristics and fundamental variables. A matching firm (to be discussed in Section 3. 2) is a non-restating firm randomly chosen to match the size and earnings of the restating firm around one of its restating dates. Compared to matching firms, restating firms have similar (but slightly lower) size, lower profitability (ROA), and higher leverage ratio and volatility of ROA. In addition, restating firms are more likely to be "Specially Treated" and less likely to be included in a market index and to be listed abroad. In terms of trading volume and book-to-market ratio, no significant differences are found between restating and matching firms. The last row of Panel C reports the average absolute value of change in retained earnings for restating firms. Such a change accounts for 13.3% of total assets at the fiscal year end. Moreover, 1134 restatements are downward revision (adjust the retained earnings down), 256 are upward revision (adjust the retained earnings up), 52 are neutral (no adjustment in retained earnings), and 21 are unclear revision (no classification can be identified for a revision in retained earnings).

Insert Table 1 about here

## 3. Research Design

This section designs tests to document changes in price synchronicity around accounting restatements and to identify which of the two opposing views (information and noise) is more plausible behind the synchronicity changes. To do so, we start with a reviewing discussion of price synchronicity in our current setting. By taking an event study analysis, we gain some preliminary evidence on changes in price synchronicity following accounting restatements. Next, we design regression models for further examination as we are able to control for other relevant factors in this framework. Lastly, we propose tests to investigate which of the two stories is more aligned with evidence from the data.

### 3.1. Price Synchronicity

Price synchronicity is a simple transformation of the R-square statistic of the market model in asset pricing. By using weekly data, we regress individual stock returns on market returns (*MKTRET*), industry returns (*INDRET*) and their lags:

$$r_{i,t} = \alpha_i + \beta_{i1} MKTRET_t + \beta_{i2} INDRET_t + \beta_{i3} MKTRET_{t-1} + \beta_{i4} INDRET_{t-1} + \varepsilon_{i,t}. \quad (1)$$

Market and industry returns are both value-weighted, constructed from all A-share firms.[7] The lagged market and industry returns are included in the model to capture the

[7] It is noted that the total market value of a firm is not a clear concept in the stock markets of China. The reason is that before the share structure reform between 2004 and 2006, roughly 2/3 of the A-shares in the markets were non-floating. Obviously, the value of a non-floating A-share is different or smaller than a floating A-share to the same firm. We have to use a proxy for the total market value of a firm to compute the value-weight of the firm in its industry or in the market index. We take the product of a firm's share price and its total number of shares outstanding as the "pseudo" market value of the firm.

autocorrelations possibly caused by some thin trading. We use weekly averaged returns excluding firm *i* when computing market and industry returns, following Durnev et al. (2003).[8] The return on industry *k* in week *t* is defined as follows:

$$INDRET_t = \frac{\sum_{j \in k} w_{j,t-1} r_{j,k,t} - w_{i,t-1} r_{i,k,t}}{1 - w_{i,t-1}} \quad (2)$$

where $w_{j,\,t-1}$ is the value-weight for firm j in industry *k* at the end of week *t-1*. We drop subscript *k* in variable *INDRET* for convenience. Market return $MKTRET_t$ is similarly constructed.

Running regression model (1) for each firm, we get an R-square statistic. Following Morck et al. (2000), we transform R-square into price synchronicity for firm i to yield,

$$SYN_i = \ln\left[\frac{R_i^2}{1 - R_i^2}\right]. \quad (3)$$

As *SYN* is a monotonically increasing function of $R^2$, the two measures are often interpreted similarly or interchangeably. It is easy to see that *SYN* is more normally distributed than $R^2$ due to the transformation and sounds more intuitive to our understanding. Therefore, *SYN* becomes preferred to $R^2$ in most recent empirical studies.

### 3.2. Preliminary Tests

In this subsection, we offer preliminary evidence on a drop in price synchronicity following an accounting restatement. Roll's (1988) discussion implies that an accounting restatement, no matter whether it represents information or noise, can lead to a reduction in price synchronicity. Before any further analysis, we wish to extract the

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The firm's value-weight in its industry is calculated as the ratio of its pseudo market value to the sum of the pseudo market values of all firms in the industry. Another proxy of computing a firm's value weight in its industry is to base on the firm's floating A-shares rather than the total number of A-shares. The results we report are all based on the former calculation while we put the latter calculation as an additional robust test in Section 5.

[8] It is noted that there is a typo in the definition of *INDRET* given by Durnev et al. (2003). We have corrected it in Eq. (2) of this paper.

evidence from the data, without controlling for any other factors. We compute two *SYN*s around an accounting restatement: $SYN_-$ and $SYN_+$. The week of issuing a restatement is denoted as week 0. $SYN_-$ is calculated over the period of week -52 to week -2 and $SYN_+$ is calculated over the period of week 2 to week 52. We exclude the periods from week -1 to week 1 to remove the confounding effect of the transition period. We require at least 25 weeks for construction of the two measures, if there are any missing data.

The paired comparisons test is adopted for the preliminary analysis. To explain, we calculate the difference between $SYN_+$ and $SNY_-$ at each restating date for each restating firm. Taking all the differences roughly as a random sample, we come up with a standard t-test for the simple null hypothesis of no difference between the two population means. The two populations are the population for $SYN_-$ and that for $SYN_+$. It is noted that the transformation from $R^2$ to *SYN* now makes a better sense as *SYN* is distributed closer to a normal distribution than $R^2$. This t-test is known as the paired comparisons test. Similarly, we can also compare the medians of the two populations by taking a nonparametric Wilcoxon signed rank test.

Despite intuitive appealing of the designs, two concerns can arise. First, most restatements were actually contained in the annual financial reports restating firms filed. In other words, a financial reporting date and a restating date are often the same for a restating firm. Therefore, we cannot identify whether the effect, if any, on price synchronicity is due to a restatement or an earnings announcement. As argued and documented by Wei and Zhang (2006), lower earnings drive up idiosyncratic volatility or equivalently drive down price synchronicity. This implies that "poor" earnings in a firm's financial report would generate lower price synchronicity, even without any accounting restatement. Given that most restatements are "bad" news, it is necessary to design a test disentangling the two effects on price synchronicity? Second, market conditions often change over time too. In particular, the stock market in mainland China is often called a "policy market" in which macroeconomic policies move the market substantially (see Callen, Lai and Wei (2009)). Thus, it is possible that non-restating firms show similar changes in price synchronicity around restating dates of the restating firms. If so, it is not clear that change in price synchronicity for a restating firm is due to earning information conveyed by annual financial report or the change of market conditions.

The two problems are addressed by using a matching sample. We draw a matching sample according to the following criteria: Given a restating firm and a restating date, we randomly draw a non-restating firm at the restating date to closely match with the restating firm the dates of annual report announcements, the sign and magnitude of earning surprises, and the industry. It is understood that any change in price synchronicity for a matching firm can only be attributed to either changing market conditions or news from its annual financial report. We compare change in price synchronicity for a restating firm with that for its matching firm to gauge the effect from restatements. This is known as the "*difference-in-differences*" test, which is designed to eliminate the effect from the above two concerns. Technically, the paired comparisons test and the nonparametric Wilcoxon signed rank test are still valid in this situation.

### 3.3. Regression Models

This subsection designs regression models for further analysis. Price synchronicity changes with other relevant factors, as mentioned in previous studies. These factors should be controlled for to assess the effect of accounting restatements on price synchronicity. Two models are specified for this purpose.

The first model is given by,

$$\begin{aligned} SYN_{i,t} &= \alpha_0 + \alpha_1 RES_{i,t} + \beta_1 TREND_{i,t} + \beta_2 SS_{i,t} + \beta_3 ST_{i,t} + \beta_4 FSHARE_{i,t} \\ &+ \beta_5 VROA_{i,t} + \beta_6 VOL_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 ROA_{i,t} + \beta_9 LEV_{i,t} \\ &+ \beta_{10} B/M_{i,t} + \beta_{11} AGE_{i,t} + \beta_{12} LagSYN_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{4}$$

where *RES* is a dummy variable taking value 1 after an announcement date and value 0 before an announcement data. This is the key variable for our analysis. We run the regression model separately for the restating firms and for the matching firms. If accounting restatements affect price synchronicity, then we expect that $\alpha_1$, the coefficient of *RES*, for the restating firms is smaller than that for the matching firms. In addition, if restatements impound either noise or information into stock price, $\alpha_1$- is expected to be negative for the restating firms and zero for the matching firms.

We discuss briefly the other independent variables in the regression model. *TREND* is a variable to capture the time trend in price synchronicity. Using the US data, Campbell, Lettau, Malkiel and Xu (2001) document an upward trend of idiosyncratic volatility over the past three or four decades. Adding up the trend is to control a possibly similar effect to the one in the US, though the stock markets of the two countries could be different in many aspects. Based on our sample period, *TREND* takes values 1 to 9 over the years 1999 to 2007, respectively. Apparently, *TREND* does not depend on which firm we refer to. Because time subscript *t* just takes two values: -1 and 1. The former means the time before an accounting statement date, while the latter implies the time after it. It cannot properly describe the *TREND* variable for different firms. For easy presentation, we still add two subscripts *i* and *t* to *TREND* in order to identify the value of *TREND* for a particular firm. For instance, the issuing date of a restatement from firm i was in 2000, then we have t = -1 and $TREND_{i,-1} = 2$. If the majority of time after the restatement is in 2001, then we put $TREND_{i,+1} = 3$. The assignment of a value to *TREND* is mainly based on the majority principle: we determine which year the majority of the time before or after a restatement is located in.

*SS* is another dummy variable. It takes value 1 if firm *i* is included in the Shanghai Stock Exchange 180 Index or Shenzhen Stock Exchange 100 Index and take value 0 otherwise. It is widely known that if a stock is added into a stock market index, its price synchronicity becomes higher as its price tends to co-move more closely with the prices of the other stocks in the index. We control for it by adding the variable into our regression model. *ST* stands for Special Treatment, a special group of firms with poor performances. *ST* is also a dummy variable by taking value 1 if a firm falls into the special treatment group and value 0 otherwise. Usually, the *ST* firms have earning losses over a few consecutive years and weak accounting systems, etc. They are less likely to be followed by analysts, and have poorer information environments. Very likely, *ST* would affect price synchronicity so that we control for it too. *FSHARE* is an indicator variable to distinguish whether firm *i* is purely A-share firm or A-share firm with some issues of foreign shares, such as B-shares or H-shares. If firm *i* also issued foreign shares, we set *FSHARE* = 1. Otherwise, we set *FSHARE* = 0. In mainland China, firms with foreign shares are relatively large and high quality firms. As these firms have lower total volatility, we expect that this group of firms would have different price synchronicity than the other firms. *FSHARE* is taken to control for this possible effect.

The other control variables are the identified ones in the current literature (see, for example, Wei and Zhang (2006), Ashbaugh-Skife, Gassen and LaFond (2006)). *SIZE* is not a clear concept for Chinese firms, as many firms have a big chunk of outstanding non-floating shares. The market values of these non-floating shares are unknown. In this study, we use the logarithm of total equity value in a firm as a proxy for the total market value of the firm. *VROA* is the volatility of return on total assets to capture the volatility of a firm's fundamental. Wei and Zhang (2006) find that stock return volatility is positively associated with volatility of return on equity in the US. Here we do not adopt volatility of ROE because restating firms in China usually involve in earnings management for survival or financing purposes. It seems misleading to include the volatility of ROE into the regression. *VOL* is defined as total number of shares traded in a year divided by total number of shares outstanding at the end of this fiscal year.

B/M is the ratio of the total book value to total "market value" of the firm (see footnote [7]), *LEV* is the ratio of total liabilities to total assets, Lagged *SYN* is also included to capture its persistence, and *AGE* is the number of quarters from the list date of firms to the announcement date of accounting restatements or financial report.

The second model, by pooling the data of restating and matching firms together, is given by,

$$\begin{aligned} SYN_{i,t} &= \alpha_0 + \alpha_1 RES_{i,t} + \alpha_2 NOMAT_{i,t} + \alpha_3 RES_{i,t} * NOMAT_{i,t} + \beta_1 TREND_{i,t} + \beta_2 SS_{i,t} \\ &+ \beta_3 ST_{i,t} + \beta_4 FSHARE_{i,t} + \beta_5 VROA_{i,t} + \beta_6 VOL_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 ROA \\ &+ \beta_9 LEV_{i,t} + \beta_{10} B/M_{i,t} + \beta_{11} AGE_{i,t} + \beta_{12} LAGSYN_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (5)$$

where *NOMAT* is a dummy variable to take value 1, if firm *i* is not restating firm, and value 0 otherwise; all other variables are defined in the same way as those in regression model (4).

Model (5) is intended to offer additional evidence to model (4) from the data. In principle, this model is a *conditional version of the "difference-in-differences" test*, while its unconditional version was discussed in Section 3.2. To understand the model, the three parameters, $\alpha_1$, $\alpha_2$ and $\alpha_3$, deserve a discussion. The parameter, $\alpha_1$, captures the difference effect of *SYN*s after and before restatements for matching firms. The parameter, $\alpha_2$, stands for the different effect of *SYN*s between restating firms and matching firms, before restatements. Most importantly, the parameter, $\alpha_3$, identifies the "difference-in-differences" effect on price synchronicity, *i.e.*, the effect purely from the accounting restatement. Although model (4) can be nested into model (5), we prefer to separate them for a clear presentation and discussion.

### 3.4. Regression Analysis with *PIN*

This subsection assesses whether change in price synchronicity from accounting restatements is due to information or noise, by looking at the Probability of Informed

Trading (*PIN*).

*PIN* is widely used to measure how much *private information* is incorporated into stock price. Unlike other measures, it is uniquely developed from a microstructure model developed by Easley et al. (1996a, 1996b, 1997a and 1997b). The intuition behind this measure is rather simple: in our current setting, if accounting restatements lead to more informed trading, informed traders trade based on their private information, which would increase the arrival rates of informed order flows. The *PIN* measure is defined as the ratio of informed order flows to total order flows. If the information story is true, we expect to observe a larger *PIN* after restatements. The noise story should not drive up *PIN*, and very likely should drive down *PIN*. Therefore, we can use *PIN* as an alternative measure to comparatively test whether change in price synchronicity is due to noise or information in the event of accounting restatements.

Putting the *PIN* measure more formally, traders are classified into two categories: informed and uninformed. Informed traders trade on their information. It is assumed that on any trading day, arrivals of uninformed buyers (sellers) follow independent Poisson processes. Uninformed traders submit their buy (sell) orders at a daily rate of $\varepsilon_b$ ($\varepsilon_s$). On each day, an information event occurs with probability $\alpha$. Conditioning on the information event, the probability of the information being bad (good) news is $\delta$ ($1-\delta$). If bad (good) news arrives, informed traders submit sell (buy) orders at a daily rate of $\mu$. Thus the *PIN* is defined as the ratio of orders (buy and sell) initiated by informed traders to total orders initiated by all traders (informed and uninformed traders):

$$PIN = \frac{\alpha\mu}{\varepsilon_s + \varepsilon_b + \alpha\mu}. \qquad (6)$$

The parameter vector $\theta = (\alpha, \delta, \mu, \varepsilon_s, \varepsilon_b)$ in equation (6) can be obtained using MLE (maximum likelihood estimate). The likelihood function of a trading day t is given by,

$$L(\theta | b_t, s_t) = (1-\alpha)\frac{e^{-\varepsilon_s}\varepsilon_s^{\ s_t}}{s_t}\frac{e^{-\varepsilon_b}\varepsilon_b^{\ b_t}}{b_t} + \alpha\delta\frac{e^{-(\varepsilon_s+\mu)}(\varepsilon_s+\mu)^{s_t}}{s_t}\frac{e^{-\varepsilon_b}\varepsilon_b^{\ b_t}}{b_t}$$
$$+\alpha(1-\delta)\frac{e^{-\varepsilon_s}\varepsilon_s^{\ s_t}}{s_t}\frac{e^{-(\varepsilon_b+\mu)}(\varepsilon_b+\mu)^{b_t}}{b_t}.$$

And the likelihood function for a period of T trading days is $L(\theta | B,S) = \prod_{t=1}^{T} L(\theta | b_t, s_t)$ where $b_t$ ($s_t$) denotes the number of buy (sell) orders on day t. We use the quote data provided by the CSMAR database to estimate *PIN*. On day t, if a transaction is executed at B1 (the highest buy quote), then this transaction is classified into a sell-initiated order. Similarly, if a transaction is executed at S1 (the lowest sell quote), then the transaction is classified into a buy-initiated order. After determining the number of sell and buy orders on a day, we can estimate quarterly *PIN*s for restating firms and non-restating firms. For quarter t in which accounting restatements (financial reporting for matching firms) are issued, we define *PIN* before announcement date ($PIN_-$) as the average of *PIN*s from quarter t-3 to quarter t, and *PIN* after announcement date ($PIN_+$) as the average of *PIN*s from quarter t+1 to quarter t+4.

We replace *SYN* by *PIN* in regression models (4) and (5) to similarly identify the effects of accounting restatements on *PIN*. The discussions on *SYN* in the last subsection can easily be carried over to those on *PIN* here. We ignore the repeated discussions for simplicity.

### 3.5. Regression Analysis with ERC/FERC

If price synchronicity always reflects the amount of private information incorporated into stock price, we expect lower price synchronicity values to be associated with prices that are more informative regarding future earnings. The original idea of this approach stems from Durnev, et al. (2003). We first consider a modified and simple version of the model for an our purpose as follows,

$$AR_i = \alpha_0 + \alpha_1 NOMAT_i + \left(\beta_0 + \beta_1 NOMAT_i\right)\Delta E_i + \left(\gamma_0 + \gamma_1 NOMAT\right)\Delta E_i^1 + \eta_1 AR_i^1 + \eta_2 SIZE_i + \eta_3 VROA_i + \varepsilon_i \quad (7)$$

where *AR* is the market-adjusted annual return on individual stock *i* for the one year period immediately after a restatement date. $AR^1$ is similarly defined for the next one year period. We only take the observations after restatements. This is corresponding to the case with t = +1 in our previous analyses. We pool the restating firms and non-restating firms together. *NOMAT*, as defined before, is a dummy variable taking value 1 for the restating firms and value 0 for the matching firms. $\Delta E$ is the difference between earnings per share in the next two fiscal year ends immediately after a restatement date, scaled by the share price in the first fiscal year end. $\Delta E^1$ is similarly defined for the period from the second and third fiscal year ends after a restatement date.

To understand the model, we discuss the terms in its two brackets. The first bracket is corresponding to the earnings response coefficient (ERC) and the second is to capture the future earnings response coefficient (FERC). Usually, the two brackets are assumed to be two constant numbers. We modify them into a simple linear function of *NOMAT* in order to identify the effects of restatements on the forecast ability of current stock return to the current and future earnings. If restatements represent information (noise), then we expect that $\beta_1$ and $\gamma_1$ are positive (non-positive) as the current stock return reflects more (less) information of future earnings.

Alternatively, if we replace *NOMAT* by *ERROR* in model (7), we expect the same signs for $\beta_1$ and $\gamma_1$ as discussed above. *ERROR* is the absolute value of a restating amount, adjusted by current year's total assets. For a matching firm, *ERROR* is zero. If we replace *NOMAT* by *SYN*, we expect the opposite signs for $\beta_1$ and $\gamma_1$ as discussed above. The three measures, *NOMAT, SYN* and *ERROR*, are all proxies for measuring accounting restatements. Apparently, *NOMAT* is qualitative while *SYN* and *ERROR* are quantitative.

To identify the effect of restatements on the forecast ability of current stock return to current and future earnings, it is better to consider the "difference-in-differences" effect in the model design too. Now, we modify model (7) into the following model:

$$\begin{aligned} AR_{i,t} &= \alpha_0 + \alpha_1 NOMAT_i + \alpha_2 RES_{i,t} + \alpha_3 NOMAT_i * RES_{i,t} \\ &+ \left(\beta_0 + \beta_1 NOMAT_i + \beta_2 RES_{i,t} + \beta_3 NOMAT_i * RES_{i,t}\right)\Delta E_{i,t} \\ &+ \left(\gamma_0 + \gamma_1 NOMAT + \gamma_2 RES_{i,t} + \gamma_3 NOMAT_i * RES_{i,t}\right)\Delta E_{i,t}^1 \\ &+ \eta_1 AR_{i,1,t} + \eta_2 SIZE_{i,t} + \eta_3 VROA_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{8}$$

where the notations are similarly defined as before. The subscript $t$ takes values -1 and 1, where $t=1$ means the observations are taken after restatements and t = -1 implies the observations are taken before restatements. The key parameters for our concern are $\beta_3$ and $\gamma_3$. Parameter $\beta_3$ captures the "difference-in-differences" effect of restatements on marginal stock return with respect to change in earnings, i.e., $dAR/d\Delta E_{i,t}$, while parameter $\gamma_3$ captures the "difference-in-differences" effect of restatements on marginal stock return with respect to change in future earnings, i.e., $dAR/d\Delta E^1_{i,t}$. If the information story of restatements is true, both of the two parameters are expected to be positive. On the contrary, if the noise story is correct, the two parameters should be non-positive, or very likely negative. Similarly to model (7), we can also replace *NOMAT* by *SYN* and ERROR, respectively, in model (8). If we replace *NOMAT* by ERROR in model (7), we expect the same signs for $\beta_1$ and $\gamma_1$ as discussed above. If we replace *NOMAT* by SYN, we expect the opposite signs for $\beta_1$ and $\gamma_1$.

## 4 Empirical Results

This section reports and discusses the empirical results based on the research design in the last section.

### *4.1* Results with Preliminary Analysis

We offer preliminary results of our analysis, helping gain some initial thought before further investigation. The research design in Section 3.2 is implemented to simply compare *SYN*s around accounting restatements. If accounting restatements exert an impact on *SYN*, we anticipate find a systematic change in *SYN*s following a restatement. However, finding such a change is necessary but not sufficient to identify an effect of restatements on price synchronicity. As we mentioned in Section 3, both changes in market conditions and the embedding of restatements into annual financial reports could muddy the finding. To address this issue, we select a matching sample and conduct the "difference-in-differences" test. The preliminary evidence generated from the simple testing suggests a significant and negative effect on price synchronicity from an accounting restatement.

Panel A of Table 2 reports descriptive statistics of *SYN*s and *PIN*s around accounting restatements. For the restating firms, average (median) *SYN* declines from .0415 (.0753) calculated over the period before a restatement to -.1178 (-.942) computed over the period after a restatement. The drop in price synchronicity looks substantial. For the matching firms, price synchronicity moves down from .0662 (.1032) to -.0155 (.0165), a smaller magnitude than that for the restating firms. As *PIN* has widely been used in the literature to measure how much private information incorporated into stock prices, we present the results of *PIN*s with a similar analysis to *SYN*s as a reference. It is easy to see, from Panel A, that *PIN* seems to experience less change than *SYN* around restatements. Panel B of Table 2 shows the correlation coefficients between *SYN* and *PIN*. They are all negative, which is consistent with the findings in the literature.

Insert Table 2 about Here

To assess whether changes in price synchronicity as well as in PIN are significant, we form three hypotheses, as designed in Section 3.2,

$H_a$: $SYN_+ = SYN$- for restating firms;

$H_b$: $SYN_+ = SYN$- for matching firms;

$H_c$: $SYN_+$ - $SYN$- (for restating firms) = $SYN_+$ - $SYN$- (for matching firms).

The first two hypotheses test if changes in *SYN*s around restatements are significant for the restating firms and the matching firms, respectively. The last hypothesis, the so-called "difference-in-differences", is intended to identify, if any, the effect of restatements on price synchronicity, after certain controls for the market conditions and the embedding effect of the restatements into annual financial reports.

The testing results are displayed in Panel A of Table 3. Looking at the p-values for $H_a$ and $H_b$, we reckon that the differences of price synchronicity around accounting restatements are significant at any conventional level of significance, for both the restating and matching firms and for both the mean and median tests. Although restatements did not occur at all for the matching firms, we still observe a significant decline in synchronicity for the matching firms. This means that the market conditions and/or the embedding effect mentioned above matter so as to call for control for them. The results in $H_c$ of Panel A show that the effects of restatements on price synchronicity, reflected in the "difference-in-differences" test, are -.0777 for the mean test and -.0396 for the median test, respectively. Both are significant at the 5% level of significance. Our preliminary tests so far have shown that accounting restatements lead to a decline in price synchronicity. However, from Panel B of Table 3, it is seen that *PIN*s decline too after accounting restatements. But the declines are of similar-magnitude to both the restating firms and the matching firms, suggesting that there is no "difference-in-differences" effect. Therefore, we cannot claim that accounting restatements lead to a decline in PINs.

Insert Table 3 about Here

## 4.2. Results with Regression Analysis

Price synchronicity changes with many factors other than accounting restatements, as documented in the literature. This subsection further examines the effect of accounting restatements on price synchronicity, by controlling for the other relevant factors. Given the research design in Section 3.3, we report the regression results of models (4) and (5). The evidence so extracted confirms our basic findings in the preliminary analysis of last subsection.

We run model (4) separately for the restating firms and the matching firms. The results are put in Panels A and B of Table 4, respectively. Model (1) conducts a similar analysis to those jointly in Tables 2 and 3 in a regression framework. The additional control in model (1) is a time trend. It is easy to see that variable *TREND* is strongly significant in both Panels A and B, which shows a strong trend in *SYN*, but different from the idiosyncratic volatility trend in the US. The trend issue is interesting in the US market and various explanations have been offered in the literature. Exploring it in the stock market of mainland China is beyond the scope of this paper. Here we simply control for it in our analysis. The key variable to look at is *RES*, which is -.0796 for the restating firms and 0.0135 for the matching firms. After controlling for the time trend, price synchronicity drops significantly for the restating firms at the 5% level of significance, but has no significant change for the matching firms. Moving from model (2) to model (4) in the table, we control for different variables and find that *RES* is always negatively associated with price synchronicity for the restating firms. The relationship is significant at the 5% significance level for models (3) and (4) and at the 10% significance level for model (2). On the other hand, we do not find significance for *RES* in Panel B because all the p-values pertaining to *RES* from model (1) to model (4) are much larger than 10%. The sharp contrast between the estimate of RES in Panel A and that in Panel B offers clearer evidence to support that there is a decline in price synchronicity following accounting restatements.

It might be useful to look at some further details of the results. It seems that the reduced significance in model (2) is somewhat related to the introduction of variable *ST*. Restating firms are those which are more likely to involve in earnings management or to experience consecutive years of loss. Therefore, they are more likely to be "Specially Treated". If *ST* is excluded from model (2), RES becomes readily significant at the 5% significance level for the restating firms. However, this does not hold either in Panel B. This suggests that changes in price synchronicity are unlikely driven by (mainly negative) annual reports or changes in market conditions.

The estimates of other coefficients are largely consistent with those in the literature. For example, *SS* plays a positive significant role in all the regressions. Intuitively, being included into a stock market index would enhance a firm's price synchronicity. *ST*, special to China's stock market, always exerts a significant negative effect on price synchronicity. *VROA*, as a similarly important variable identified by Wei and Zhang (2006), is significant at the 5% level of significance and is negatively associated with price synchronicity in both Panels A and B. As expected, *B/M* contributes significantly and positively to price synchronicity. Lagged *SYN* is estimated between .22 and .26 in the two panels, implying that there is some persistence in price synchronicity. Other variables, such as *FSHARE*, *VOL*, *SIZE*, *ROA* and *LEV* do not offer either consistent or significant estimates in the two panels. We simply skip the discussion of these variables.

Insert Table 4 about here

Table 5 reports the regression results of model (5) in which both the restating and matching firms are pooled together. The key variable is *RES*NOMAT* which captures the "difference-in-differences" effect. Over all the models in Table 5, we find that the coefficient estimates of *RES*NOMAT* are significant at the 10% level of significance.

But, we cannot identify significant coefficients of *RES* and *NOMAT*. Overall, our results suggest a decline in price synchronicity following accounting restatements, even after controlling for the other relevant factors.

Insert Table 5 about here

**4.3 Results with PIN regressions**

As a measure for price informativeness, PIN has been widely used in the literature. If the reduction in price synchronicity from accounting restatements represents information rather than noise, we expect to find an increase in PIN measure after accounting restatements. This subsection takes a similar analysis to that in Section 4.2, by replacing *SYN* by *PIN* in models (4) and (5). We rescale *PIN* by multiplication by 100 for the purpose of computational and reporting conveniences.

From Panel A of Table 2, the mean and median *PIN*s after restatements are smaller than those before the restatements for both restating and matching firms. Panel B shows that the differences of *PIN*s after and before restatements are significant for both the restating firms and the matching firms (see $H_a$ and $H_b$ in Panel B of Table 3). But the "difference-in-differences" effect in $H_c$ of Panel B of Table 3 is no longer significant in any conventional level of significance. This unconditional evidence implies that accounting restatements do not increase the price informativeness measured by *PIN*.

The conditional evidence to support the noise story is offered in Table 6. Panel A of Table 6 reports the results with the restating firms and Panel B gives those with the matching firms. Panel C reports the estimation results of pooling the two groups of firms together. In Panel A, the results of Model 1 show that the differences of *PIN*s after and before restatements are mainly due to a time trend. After controlling the trend, *RES* does not exert a significant effect on *PIN* at all. This is true for all regression models in the table. The "difference-in-differences" test, reflected in the coefficient of

*RES*NOMAT*, in Panel C of Table 6, shows that *PIN* does not change with accounting restatements. This holds for all the regression models in the panel.

Insert Table 6 about here

In sections 4.1 and 4.2, we find that price synchronicity declines significantly following accounting restatements after controlling for the time trend and other factors. Our results with PIN suggest that drops in synchronicity from accounting restatements are unlikely due to increased private information, as otherwise *PIN* should be higher. However, we do not find a significant effect of accounting restatements on *PIN* at all. Overall, it does not seem plausible to claim an information story behind the declined price synchronicity caused by accounting restatements.

**4.4 Results with ERC/FERC**

Table 7 reports the results from the research design in Section 3.5. As stated before, if restatements represent information (noise), in regression models (7) and (8), $\beta_i$ and $\gamma_i$, i=1,2,3 are expected to be positive (non-positive), as a restating firm's current and future earnings should be more (less) incorporated into the firm's current stock return.

In Panel A of Table 7, we present the regression results with model (7) for the period after accounting restatements. We reject that $\beta_1 > 0$ and $\gamma_1 > 0$, respectively, as the estimated value, -.4659, of $\beta_1$ is significantly negative and the estimated value, 0.0216, of $\gamma_1$ is insignificant with the p-value, .9120. Replacing *NOMAT* by *ERROR* in Panel A, we find that the estimate of $\beta_1$ is still negative and the estimate of $\gamma_1$ is still insignificant. Similarly, replacing *NOMAT* by *SYN* and repeating the regression, we find both estimates of $\beta_1$ and $\gamma_1$ are positive but insignificant. Collectively, the results presented in Panel A strongly support a noise rather than information story associated with accounting restatements.

In Panel B of Table 7, we display the results from running regression model (8) with all the data pooled together. Now, we focus on parameters $\beta_i$ and $\gamma_i$, i=1,2,3, in particular $\beta_3$ and $\gamma_3$ which captures the "difference-in-differences" effect as we emphasized before. We find that from the first three columns of the panel, the estimate of $\beta_3$ is significantly negative at the 1% level significance while the estimate of $\gamma_3$ is negative but insignificant. This again suggests a noise story of accounting restatements. Replacing *NOMAT* by *ERROR,* we have similar findings for $\beta_3$ and $\gamma_3$, but they are both insignificant. Finally, replacing *NOMAT* by *SYN,* the estimate of $\beta_3$ is significantly greater than zero at the 5% level of significance and the estimate of $\gamma_3$ is insignificantly positive. Again, all the results here collectively suggest a noise interpretation of accounting restatements.

Insert Table 7 about here

### 4.5 Further Discussion

We have demonstrated that accounting restatements lead to a decline in price synchronicity and in addition the synchronicity decline makes stock price less informative rather than more informative. In other words, noise, rather than information, is behind the decline in price synchronicity following accounting restatements. In this subsection, we attempt to discuss the other factors which are not easy to measure quantitatively may contribute to our claim.

#### 4.5.1 Earnings management and weaker accounting systems

As Wang and Wu (2008) state, restating firms in China have weaker profitability and diffused ownership. Firms experiencing weaker probability face pressures of delisting and more financial constraints, so that they are more likely to involve in earnings management for survival purposes. Meanwhile, restating firms are more likely to be largely owned by the state. When choosing managers for the firms, the state does not necessarily have the right incentive to select a compatible manger, which may generate low quality of financial reporting. Therefore, the issuance of accounting restatements conveys an adverse signal to investors, leading to higher risk/uncertainty faced by investors. The higher risk/uncertainty produces larger price synchronicity.

We document a significantly negative abnormal return -0.28% on the restatement date and a -0.31% cumulative abnormal return during the three days around event days. The negative market reaction indicates that accounting restatements convey a bad signal to invertors and introduce more noise into stock price. This conclusion is enhanced by the findings that there are significant abnormal returns, -0.487% and -0.352%, in the event week and one week before the event week, respectively. However, our findings do not look economically significant, when compared with a -11.2% abnormal returns for the three-day interval around restatements in the US (Wu (2002)). Therefore, in mainland China, the first order issue concerning about abnormal returns from accounting restatements becomes a second order issue. Interestingly, the issue of noise versus information behind changes in price synchronicity appears to be of the first order importance.

### 4.5.2 Penalties and restrictions on financing

The issuance of accounting restatements lowers the quality of financial reporting, and increases the risk/uncertainty faced by investors. On the other hand, restating firms are more likely to involve in earnings management. When the completeness, timeliness and veracity of information disclosure are challenged, penalties can be imposed by regulators .

During the period between 1998 and 2008, the CSRC imposed 619 penalties on breaking out the security market rules. Of the 619 penalties, 420 were due to violation of information disclosure rules, such as intentionally overstating income, not reporting some material accounting information and fraud in information disclosure. Restating firms and their managers are usually warned and fined. In some cases, listed companies were prohibited to be traded in stock market if they did not revise financial reports according to the CSRC or they experienced two consecutive years' loss after financial reports revised.

Financing constraints are imposed for restating firms. There exists a financing (the issuance of convertible bonds, seasoned offering and shares allotment) line for listed firms, i.e. ROE in each of the previous three years should exceed 10%.[9] If a restating firm's ROE does not reach the financing line, the restating firm would not be allowed to issue new shares. In addition, if a listed company's accounting and/or financial documents for the most recent three years contain(s) false entries or misleading statements or material omissions therein, then the company would not be allowed to issue new shares. Therefore, restating firms are financially more constrained than non-restating firms. The financial constraints may increase the risk/uncertainty of the restating firms. Therefore, we can observe higher price synchronicity after restatements.

## 5 Robust Checks

This section conducts robust analyses for our results in Section 4. We consider the effects of outliers, different ways of defining price synchronicity and using daily returns.

### 5.1 Outliers

To address the concern on outliers, the R-square values are winsorized at 1 percentile and 99 percentile. Using winsorized data does not change the results qualitatively and statistically for Panel A of Tables 2 and 3. Similarly, we find that using the winsorized

[9] Rules on issuing new shares include: *Notice on Problems in Shares Allotment for Listed Companies,* issued by the CSRC, effective on March 17, 1999; *Supplemental Notice on Problems in Shares Allotment for Listed Companies,* issued by the CSRC and effective on March 16, 2000; *Procedure of Issuing New Shares for Listed Companies,* issued by the CSRC and effective on March 28, 2001; *Notice on Seasoned Offerings for Listed Companies,* issued by the CSRC and effective on July 24, 2002.

data for Tables 3, 4, 5 and 6 obtains similar and more significant results. The results for Table 7 are similar too to those with the original data. Overall, eliminating outliers seem to strengthen our results and claim.

### 5.2 Price synchronicity measure

Price synchronicity obtained from common asset pricing model is probably affected by time period and pricing factors. To make sure our main conclusion that price synchronicity declines after restatements, and this decline is not affected by different time periods, we calculate price synchronicity measures in Section 4.1 for the period of (-36, -12) weeks and (+12, +36) weeks respectively, and perform the same procedure within Section 4. In Table 2, we obtain similar quantities at the same significance levels except hypothesis $H_c$ in Panel C in which we cannot reject the null hypothesis that price synchronicity difference of restating firms is the same as that of non-restating firms. However, after controlling for the time trend, we find that restating firms have a smaller price synchronicity after announcement date (Table 4) and restatements have an effect on price synchronicity (Table 5). In addition, similar price synchronicity patterns are obtained after deleting industry return and its lag, or only keeping market return.

### 5.3 Using daily stock returns

We use daily returns to calculate price synchronicity measure and repeat the analysis in Section 4. We calculate price synchronicity measures for the period of (-250, -30) days and (+30, +250) days respectively. Generally speaking, using daily stock returns does not change the empirical results qualitatively. In particular, when compared with the use of weekly returns, the results with daily stock returns becomes more significant. For example, in Panel A of Table 3, we reject the null hypothesis of $H_c$ at the 5% significance level for the mean test and at the 1% significance level for the median test respectively when daily returns are used. On the other hand, the corresponding levels of significances are 10% and 5%, respectively when the weekly returns are used. The results in Table 4 and Panel A of Table 5 with daily returns are significant at the similar significance levels to those with weekly returns.

Robustness checks indicate that our results and claims are not driven by outliers, factors affecting price synchronicity and the frequency of stock returns.

## 6 Conclusions

A wide range of recent studies rely on price synchronicity as a measure for private information in stock price. Surprisingly, it is observed that the information view of this measure has been taken for granted almost everywhere in both accounting and finance research. Although it might be true that in most existing studies price synchronicity indeed represents information, it remains disturbing or shocking to have the full-fledged adoption of the information view of price synchronicity measure in current research. To challenge the dominant view, we investigate changes in price synchronicity following accounting restatements in China.

Our empirical results are easy to summarize. We take a matching sample to identify the effect of restatements from the reported earnings, and then documents that restatements lead to lower price synchronicity. By taking different approaches, our analyses provide strong evidence to support that the declined synchronicity is driven by noise rather than information. In particular, we find that performances of price synchronicity are inconsistent with those of other information-based measures in the event of accounting restatements in China. Collectively, our results imply that price synchronicity does not represent information in stock prices when it meets accounting restatements in China.

We also explore the underlying economic reasons behind our findings. Accounting restatements are treated in accounting as low quality of financial reporting. The increased uncertainty rather than information due to less reliability of accounting information moves firm-level volatility higher, so as to have lower price synchronicity. In addition, some financing restrictions might be implicitly imposed upon firms with restatements. This would make the stocks of the restating firms more volatile as well.

The importance of our findings is easy to understand. First, our results support the existence of "noise" component in stock price, claimed by Black (1986) and Roll (1988). This is also consistent with West (1988) and Shiller (1981). In addition, we examine thoroughly accounting restatements in China, a real situation in which "noise" trading shows up clearly. Second, our results raise a bar on using price synchronicity as an information-based measure in future research, at least at the firm-level. It is strongly suggested that some other information-based measures are taken too to see if consistent results with this measure can be reached, before making any conclusions or claims.

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**Table 1 A**ccounting Restatements Distribution and Control Variables 2000 - 2007

Panel A: Distribution of Accounting Restatements

| Reporting Year | Shanghai Exchange | Shenzhen Exchange | Total no. of restatements | No. of A-share Firms | Percentage (%) |
|---|---|---|---|---|---|
| 2000 | 9 | 25 | 34 | 1060 | 3.21 |
| 2001 | 30 | 23 | 53 | 1139 | 4.65 |
| 2002 | 169 | 147 | 316 | 1206 | 26.20 |
| 2003 | 148 | 129 | 277 | 1266 | 21.88 |
| 2004 | 121 | 106 | 227 | 1362 | 16.67 |
| 2005 | 107 | 98 | 205 | 1365 | 15.02 |
| 2006 | 109 | 96 | 205 | 1417 | 14.47 |
| 2007 | 74 | 74 | 148 | 1516 | 9.76 |
| All Years | 767 | 698 | 1465 | 10331 | 14.18 |

Panel B: Industry Distribution of Restating Firms

| Industry | Total no. of restatements | Percentage (%) |
|---|---|---|
| Agriculture, Forestry, Fishing, Hunting | 58 | 3.96 |
| Mining | 15 | 1.02 |
| Manufacturing | 811 | 55.36 |
| Electricity, Gas, Water Supply | 72 | 4.91 |
| Construction | 28 | 1.91 |
| Transport, Storage | 42 | 2.87 |
| Information, Technology | 79 | 5.39 |
| Wholesale and Retail Trade | 111 | 7.58 |
| Real Estate | 56 | 3.82 |
| Social Services | 39 | 2.66 |
| Transmission, Culture | 16 | 1.09 |
| Conglomerate | 138 | 9.42 |
| Total | 1465 | 100.00 |

Panel C: Descriptive Statistics of Control Variables

| | Restating Firms | | | | Matching Firms | | |
|---|---|---|---|---|---|---|---|
| Variables | N | Mean | Std | | N | Mean | Std |
| ROA | 1454 | 0.002 | 0.145 | | 1440 | 0.025 | 0.129 |
| LEV | 1450 | 0.701 | 1.465 | | 1440 | 0.556 | 0.952 |
| VROA | 1450 | 0.041 | 0.077 | | 1465 | 0.037 | 0.079 |
| VOL | 1442 | 3.759 | 3.115 | | 1461 | 3.654 | 3.125 |
| B/M | 1445 | 0.335 | 0.433 | | 1440 | 0.406 | 0.388 |
| SIZE | 1454 | 21.23 | 0.843 | | 1461 | 21.52 | 0.999 |
| AGE | 1450 | 32.14 | 12.32 | | 1439 | 29.00 | 13.28 |
| SS | 1450 | 0.159 | 0.365 | | 1465 | 0.268 | 0.443 |
| ST | 1450 | 0.195 | 0.396 | | 1440 | 0.060 | 0.237 |
| FSHARE | 1450 | 0.066 | 0.248 | | 1465 | 0.129 | 0.335 |
| ERROR | 1444 | 0.133 | 3.288 | | | | |

Panel A reports the distribution of accounting restatements over year and stock exchange. Last column is ratio (in %) of the number of restatements to the total number of firms. Panel B displays the distribution of restating firms over industries. The industry categorization is based on the Index of Companies' Industry Classification issued by CSRC on April 4, 2001. Before 2007, there are 13 two-digit industries but we exclude the financial industry. The last column is the ratio (in %) of total number of restatements in an industry to the total number of restatements in all industries. Panel C gives briefly the descriptive statistics of the control variables in annual basis for restating firms and matching firms, respectively. The variables are defined in Section 3.3 and are also listed in the Appendix.

**Table 2** Descriptive Statistics of *SYN* and *PIN* 2000 -2007

Panel A: Descriptive Statistics

Restating Firms

| Variables | N | Mean | Std | Min | Median | Max |
|---|---|---|---|---|---|---|
| $SYN_-$ | 1325 | 0.0415 | 0.8544 | -3.4406 | 0.0753 | 2.3147 |
| $SYN_+$ | 1325 | -0.1178 | 0.8145 | -3.8131 | -0.0941 | 2.1335 |
| $PIN_-$ | 1380 | 0.1571 | 0.0322 | 0.0765 | 0.1541 | 0.3376 |
| $PIN_+$ | 1380 | 0.1530 | 0.0342 | 0.0678 | 0.1491 | 0.3905 |

Matching Firms

| Variables | N | Mean | Std | Min | Median | Max |
|---|---|---|---|---|---|---|
| $SYN_-$ | 1348 | 0.0679 | 0.8477 | -3.3058 | 0.1042 | 2.2721 |
| $SYN_+$ | 1348 | -0.0138 | 0.7921 | -3.3073 | 0.0190 | 2.3619 |
| $PIN_-$ | 1398 | 0.1556 | 0.0333 | 0.0659 | 0.1518 | 0.3136 |
| $PIN_+$ | 1398 | 0.1497 | 0.0329 | 0.0647 | 0.1465 | 0.3084 |

Panel B: Correlation of Variables

| | $\rho(SYN_-, PIN_-)$ | $\rho(SYN_+, PIN_+)$ |
|---|---|---|
| Restating Firms | -0.2768 | -0.3195 |
| | (<.0001) | (<.0001) |
| Matching Firms | -0.2617 | -0.2689 |
| | (<.0001) | (<.0001) |

Panel A reports descriptive statistics for *SYN*s and *PIN*s. Pricey synchronicity, *SYN*, is transformed from $R^2$ of running regression model (1). On each restating date, we calculate two price synchronicity measures, $SYN_-$ and $SYN_+$, based on weekly stock returns from week -50 to week -2 and those from week +2 to week +50, respectively. Week 0 is the one including the restating date. The market and industry returns are value-weighted, excluding the firm in question to avoid spurious results. At least 25 week return data are required in order to calculate each of $SYN_-$ and $SYN_+$. $PIN_-$ is the average of quarterly *PIN*s from quarter -4 to quarter -1. $PIN_+$ is the average of quarterly *PIN*s form quarter 1 to quarter 4. Quarter 0 is the one including the restating date. At least two quarterly *PIN*s are required for the calculation. *Panel B* reports the Pearson correlation coefficients of variables in Panel A. The numbers in parentheses are *p*-values.

**Table 3** Preliminary Tests

Panel A: Hypothesis Tests on Price Synchronicity

| Hypothesis | Mean Difference | *P* Value | Median Difference | *P* Value |
|---|---|---|---|---|
| $H_a$ | -0.1593 | <.0001 | -0.1250 | <.0001 |
| $H_b$ | -0.0816 | 0.0021 | -0.0854 | 0.0004 |
| $H_c$ | -0.0777 | 0.0400 | -0.0396 | 0.0286 |

Panel B: Hypothesis Tests on *PIN*

| Hypothesis | Mean Difference | *P* Value | Median Difference | *P* Value |
|---|---|---|---|---|
| $H_a$ | -0.0042 | <.0001 | -0.0036 | <.0001 |
| $H_b$ | -0.0059 | <.0001 | -0.0050 | <.0001 |
| $H_c$ | 0.0017 | 0.1922 | 0.0014 | 0.2748 |

Panel A reports the results of testing the following hypotheses:

$H_a$: $SYN_+ = SYN_-$ for restating firms;

$H_b$: $SYN_+ = SYN_-$ for matching firms;

$H_c$: $SYN_+ - SYN_-$ (for restating firms) = $SYN_+ - SYN_-$ (for matching firms).

The last hypothesis is the so-called "difference-in-differences" hypothesis. P value is calculated based on the standard two-sample paired t-test for the mean difference and the Wilcoxon signed-rank test for the median difference. Panel B reports the results of testing the following hypotheses:

$H_a$: $PIN_+ = PIN_-$ for restating firms;

$H_b$: $PIN_+ = PIN_-$ for matching firms;

$H_c$: $PIN_+ - PIN_-$ (for restating firms) = $PIN_+ - PIN_-$ (for matching firms).

P value in this panel is calculated in the same way as that in Panel A.

**Table 4** Changes in Price Synchronicity around Accounting Restatements

Panel A: Restating Firms (Dependent Variable is Price Synchronicity, *SYN* )

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| Variables | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value |
| INTERCEPT | 0.4272 | <.0001 | 0.4062 | <.0001 | -0.1514 | 0.7438 | 1.6437 | 0.0022 |
| RES | -0.0796 | 0.0165 | -0.0560 | 0.0848 | -0.1023 | 0.0012 | -0.0914 | 0.0035 |
| TREND | -0.0798 | <.0001 | -0.0730 | <.0001 | -0.0760 | <.0001 | -0.0904 | <.0001 |
| SS | | | 0.1645 | <.0001 | | | 0.1831 | <.0001 |
| ST | | | -0.4586 | <.0001 | | | -0.2330 | <.0001 |
| FSHARE | | | 0.0901 | 0.1590 | | | 0.1501 | 0.0190 |
| VROA | | | | | | | -0.8960 | 0.0270 |
| VOL | | | | | | | 0.0226 | 0.0014 |
| SIZE | | | | | 0.0259 | 0.2243 | -0.0565 | 0.0229 |
| ROA | | | | | 0.3368 | 0.0373 | 0.2112 | 0.2535 |
| LEV | | | | | -0.0215 | 0.1426 | -0.0100 | 0.5068 |
| B/M | | | | | 0.2749 | <.0001 | 0.1837 | <.0001 |
| AGE | | | | | -0.0017 | 0.2384 | -0.0018 | 0.2289 |
| LAGSYN | | | | | 0.2613 | <.0001 | 0.2545 | <.0001 |
| Obs | 2650 | | 2650 | | 2649 | | 2649 | |
| Adj. $R^2$ | 0.0375 | | 0.0817 | | 0.1486 | | 0.1665 | |

Panel B: Matching Firms (Dependent Variable is Price Synchronicity, *SYN*)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| Variables | Coeff. | *P* value | Coeff. | *P* value | Coeff. | Sig. | Coeff. | *P* value |
| INTERCEPT | 0.5366 | <.0001 | 0.5175 | <.0001 | -0.7281 | 0.0649 | 0.2960 | 0.5431 |
| RES | 0.0135 | 0.6732 | 0.2879 | 0.3576 | -0.0176 | 0.5656 | -0.0067 | 0.8261 |
| TREND | -0.0952 | <.0001 | -0.0942 | <.0001 | -0.0923 | <.0001 | -0.0923 | <.0001 |
| SS | | | 0.1549 | <.0001 | | | 0.1746 | <.0001 |
| ST | | | -0.7265 | <.0001 | | | -0.5024 | <.0001 |
| FSHARE | | | -0.0334 | <.0001 | | | -0.0663 | 0.1601 |
| VROA | | | | | | | -1.4780 | 0.0016 |
| VOL | | | | | | | 0.0003 | 0.9638 |
| SIZE | | | | | 0.0541 | 0.0028 | -0.0078 | 0.7320 |
| ROA | | | | | -0.3624 | 0.0469 | -0.9226 | <.0001 |
| LEV | | | | | -0.0688 | 0.0068 | -0.0055 | 0.8423 |
| B/M | | | | | 0.3070 | <.0001 | 0.1882 | <.0001 |
| AGE | | | | | 0.0008 | 0.5335 | 0.0017 | 0.1739 |
| LAGSYN | | | | | 0.2519 | <.0001 | 0.2259 | <.0001 |
| Obs | 2696 | | 2696 | | 2695 | | 2695 | |
| Adj. $R^2$ | 0.0470 | | 0.0917 | | 0.1428 | | 0.1686 | |

Panel A reports the regression results of model (4) for the restating firms. For each restating firm, t takes two values -1 and 1. The former means the time period from week -50 to week -2, while the latter represents the period from week +2 to week +50. Week 0 is the one in which an accounting restatement is issued. *RES* takes value 0 before an announcement date and value 1 after it. *LAGSYN* is calculated from week -100 to week -51 when t takes value -1 and from week -50 to week -2 when t takes 1. All other variables are defined in Section 3.3 and listed in the Appendix. Panel B reports the regression results of model (4) for the matching firms. The note with *Panel A* applies here too.

**Table 5** Changes in Price Synchronicity around Accounting Restatements: Pooling Restating and Matching Firms

Regressions (Dependent Variable is Price Synchronicity, *SYN*)

| | Model 1 | | Model 2 | | Model 4 | | Model 5 | |
|---|---|---|---|---|---|---|---|---|
| Variables | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value |
| INTERCEPT | 0.4998 | <.0001 | 0.4253 | <.0001 | -0.4083 | 0.1734 | 0.6393 | 0.0732 |
| RES | 0.0060 | 0.8505 | 0.0061 | 0.8468 | -0.0193 | 0.5238 | -0.0139 | 0.6431 |
| NOMAT | -0.0341 | 0.2780 | -0.0127 | 0.6861 | -0.0052 | 0.8639 | -0.0013 | 0.9651 |
| RES*NOMAT | -0.0776 | 0.0808 | -0.0759 | 0.0857 | -0.0770 | 0.0670 | -0.0789 | 0.0590 |
| TREND | -0.0877 | <.0001 | -0.0847 | <.0001 | -0.0875 | <.0001 | -0.0953 | <.0001 |
| SS | | | 0.2135 | <.0001 | | | 0.1815 | <.0001 |
| FSHARE | | | -0.0181 | 0.6296 | | | -0.0021 | 0.9568 |
| VROA | | | | | | | -1.7629 | <.0001 |
| VOL | | | | | | | 0.0105 | 0.0317 |
| SIZE | | | | | 0.0378 | 0.0057 | -0.0092 | 0.5803 |
| ROA | | | | | 0.0355 | 0.7636. | -0.3494 | 0.0110 |
| LEV | | | | | -0.0319 | 0.0114 | -0.0094 | 0.4752 |
| B/M | | | | | 0.2988 | <.0001 | 0.2236 | <.0001 |
| AGE | | | | | -0.0000 | 0.9817 | 0.0000 | 0.9892 |
| LAGSYN | | | | | 0.2580 | <.0001 | 0.2509 | <.0001 |
| Obs | 5346 | | 5346 | | 5344 | | 5344 | |
| Adj. $R^2$ | 0.0434 | | 0.0544 | | 0.1461 | | 0.1572 | |

This table reports the regression results of model (5). The sample consists of both restating and matching firms. For restating firms, *NOMAT* takes value 1 and for matching firms, *NOMAT* takes value 0. The definitions of all other variables are the same as those in Table 4 and the Appendix. In this regression model, we exclude the variable *ST*, for it is significantly and positively correlated with *NOMAT*, and including *ST* may cause biases.

**Table 6** Regression Results with PIN measure

Panel A: Restating Firms (Dependent Variable is PIN)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| Variables | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value |
| INTERCEPT | 18.068 | <.0001 | 18.31 | <.0001 | 25.761 | <.0001 | 19.661 | <.0001 |
| RES | 0.0666 | 0.6005 | 0.0057 | 0.9634 | 0.0286 | 0.8117 | 0.0190 | 0.8719 |
| TREND | -0.4812 | <.0001 | -0.5205 | <.0001 | -0.3804 | <.0001 | -0.1880 | <.0001 |
| SS | | | -1.1508 | <.0001 | | | -0.7670 | <.0001 |
| ST | | | 1.3360 | <.0001 | | | 0.5862 | 0.0021 |
| FSHARE | | | 0.1745 | 0.4633 | | | 0.3600 | 0.1313 |
| VROA | | | | | | | 5.9870 | <.0001 |
| VOL | | | | | | | -0.2377 | <.0001 |
| SIZE | | | | | -0.5523 | <.0001 | -0.2634 | 0.0049 |
| ROA | | | | | 0.9257 | 0.1355 | 1.8180 | 0.0084 |
| LEV | | | | | 0.1435 | 0.0123 | 0.0595 | 0.3034 |
| B/M | | | | | -0.9866 | <.0001 | -0.8407 | <.0001 |
| AGE | | | | | -0.0083 | 0.1357 | -0.0120 | 0.0297 |
| LAGPIN | | | | | 0.2549 | <.0001 | 0.2322 | <.0001 |
| Obs | 2760 | | 2757 | | 2708 | | 2708 | |
| Adj. $R^2$ | 0.0679 | | 0.1100 | | 0.1758 | | 0.2124 | |

Panel B: Matching Firms (Dependent Variable is PIN)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| Variables | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value |
| INTERCEPT | 18.504 | <.0001 | 18.973 | <.0001 | 22.389 | <.0001 | 15.540 | <.0001 |
| RES | 0.0048 | 0.9688 | -0.0062 | 0.9587 | 0.0642 | 0.5763 | 0.0269 | 0.8078 |
| TREND | -0.5972 | <.0001 | -0.6210 | <.0001 | -0.4869 | <.0001 | -0.2354 | <.0001 |
| SS | | | -1.4838 | <.0001 | | | -1.1727 | <.0001 |
| ST | | | 1.0009 | 0.0005 | | | 1.2604 | <.0001 |
| FSHARE | | | 0.2651 | 0.1254 | | | 0.5360 | <.0023 |
| VROA | | | | | | | 0.8686 | 0.5970 |
| VOL | | | | | | | -0.2970 | <.0001 |
| SIZE | | | | | -0.4269 | <.0001 | -0.0731 | 0.3785 |
| ROA | | | | | 2.8610 | <.0001 | 3.1265 | <.0001 |
| LEV | | | | | 0.2950 | 0.0008 | 0.1910 | 0.0464 |
| B/M | | | | | -0.7145 | <.0001 | -0.9517 | <.0001 |
| AGE | | | | | -0.0052 | 0.2456 | -0.0110 | 0.0130 |
| LAGPIN | | | | | 0.3092 | <.0001 | 0.2667 | <.0001 |
| Obs | 2796 | | 2792 | | 2735 | | 2735 | |
| Adj. $R^2$ | 0.1113 | | 0.1569 | | 0.2390 | | 0.2941 | |

**Table 6** (Continued) Regression Results with PIN measure

Panel C: Pooling Restating and Matching Firms (Dependent Variable is PIN)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| Variables | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value | Coeff. | *P* value |
| INTERCEPT | 18.226 | <.0001 | 18.709 | <.0001 | 23.848 | <.0001 | 18.568 | <.0001 |
| RES | -0.0516 | 0.6737 | -0.0422 | 0.7252 | 0.0073 | 0.9495 | -0.0185 | 0.8691 |
| NOMAT | 0.1339 | 0.2664 | 0.0078 | 0.9475 | 0.0469 | 0.6857 | 0.0743 | 0.5113 |
| RES*NOMAT | 0.1778 | 0.2967 | 0.1627 | 0.3305 | 0.0710 | 0.6582 | 0.1041 | 0.5049 |
| TREND | -0.5409 | <.0001 | -0.5628 | <.0001 | -0.4311 | <.0001 | -0.1978 | <.0001 |
| SS | | | -1.4657 | <.001 | | | -0.9774 | <.0001 |
| FSHARE | | | 0.3087 | 0.0291 | | | 0.5448 | 0.0001 |
| VROA | | | | | | | 5.3738 | <.0001 |
| VOL | | | | | | | -0.2699 | <.0001 |
| SIZE | | | | | -0.4799 | <.0001 | -0.2182 | 0.0004 |
| ROA | | | | | 1.6772 | 0.0002 | 2.5454 | <.0001 |
| LEV | | | | | 0.1834 | 0.0001 | 0.0907 | 0.0631 |
| B/M | | | | | -0.8867 | <.0001 | -1.0371 | <.0001 |
| AGE | | | | | -0.0060 | 0.0822 | -0.0098 | 0.0044 |
| LAGPIN | | | | | 0.2831 | <.0001 | 0.2512 | <.0001 |
| Obs | 5556 | | 5556 | | 5443 | | 5443 | |
| Adj. $R^2$ | 0.0900 | | 0.1232 | | 0.2065 | | 0.2487 | |

Panel A reports the regression results of model (4) for the restating firms, replacing *SYN* by *PIN*. Denote the quarter of issuing an accounting restatement as quarter 0. *LAGPIN* is the average of *PIN*s over the quarters -8 to -5 for t=-1 and that over quarter -4 to quarter -1 for t=1. Both *PIN* and *LAGPIN* are rescaled by multiplication by 100. Panel B reports the regression results of model (5) for the matching firms, replacing *SYN* by *PIN*. *LAGPIN* is similarly defined to Panel A, while the "restating date" for a matching firm means the restating date of its matched firm. Panel C presents the regression results of model (4) for pooling the restating and matching firms together, replacing *SYN* by *PIN*. *LAGPIN* is already defined in Panels A and B. The definitions of the other variables are the same as those in Table 5 and are listed in the Appendix. In this regression model, variable ST is excluded to avoid a multi-collinearity problem.

**Table 7** Regression Results with *ERC* and *FERC*

Panel A: Regressions (Dependent Variable is AR)

| Variable | Coeff. | Sig. | Variable | Coeff. | Sig. | Variable | Coeff. | Sig. |
|---|---|---|---|---|---|---|---|---|
| INTERCEPT | -1.3669 | <.0001 | INTERCEPT | -1.3956 | <.0001 | INTERCEPT | -1.3573 | <.0001 |
| NOMAT | -0.0186 | 0.3041 | ERROR | 0.2292 | 0.2540 | SYN | 0.0822 | <.0001 |
| $\Delta E$ | 0.1511 | 0.4043 | $\Delta E$ | -0.1143 | 0.3179 | $\Delta E$ | -0.0566 | 0.6418 |
| NOMAT*$\Delta E$ | -0.4659 | 0.0303 | ERROR*$\Delta E$ | -1.4227 | 0.3549 | SYN*$\Delta E$ | 0.2362 | 0.1426 |
| $\Delta E^1$ | -0.3798 | 0.0314 | $\Delta E^1$ | -0.3301 | <.0001 | $\Delta E^1$ | -0.3312 | 0.0002 |
| NOMAT*$\Delta E^1$ | 0.0216 | 0.9120 | ERROR*$\Delta E^1$ | -1.7760 | 0.6999 | SYN*$\Delta E^1$ | 0.0183 | 0.8799 |
| $AR^1$ | 0.0740 | <.0001 | $AR^1$ | 0.0751 | <.0001 | $AR^1$ | 0.0596 | <.0001 |
| SIZE | 0.0503 | <.0001 | SIZE | 0.0513 | 0.0001 | SIZE | 0.0491 | <.0001 |
| VROA | -0.5107 | 0.0163 | VROA | -0.5714 | 0.0084 | VROA | -0.3165 | 0.1354 |
| Obs | 2349 | | Obs | 2343 | | Obs | 2349 | |
| Adj. $R^2$ | 0.0410 | | Adj. R2 | 0.0393 | | Adj. R2 | 0.0615 | |

Panel B: Regressions (Dependent Variable is AR)

| Variable | Coeff. | Sig. | Variable | Coeff. | Sig. | Variable | Coeff. | Sig. |
|---|---|---|---|---|---|---|---|---|
| INTERCEPT | -1.5088 | <.0001 | INTERCEPT | -1.5872 | <.0001 | INTERCEPT | -1.5821 | <.0001 |
| NOMAT | -0.0513 | 0.0039 | ERROR | 0.0243 | 0.0012 | SYN | -0.0312 | 0.0023 |
| RES | -0.1993 | <.0001 | RES | -0.1779 | <.0001 | RES | -0.1811 | <.0001 |
| NOMAT*RES | 0.0354 | 0.1528 | ERROR*RES | 0.2745 | 0.1536 | SYN*RES | 0.1151 | <.0001 |
| $\Delta E$ | 0.0597 | 0.5009 | $\Delta E$ | 0.1382 | 0.1127 | $\Delta E$ | 0.2823 | 0.0442 |
| NOMAT*$\Delta E$ | 0.4586 | 0.0954 | ERROR*$\Delta E$ | -3.5149 | 0.3840 | SYN*$\Delta E$ | -0.2308 | 0.1133 |
| RES*$\Delta E$ | 0.1170 | 0.5476 | RES*$\Delta E$ | -0.2217 | 0.1093 | RES*$\Delta E$ | -0.2767 | 0.1289 |
| NOMAT*RES*$\Delta E$ | -0.9089 | 0.0084 | ERROR*RES*$\Delta E$ | 2.2184 | 0.6061 | SYN*RES*$\Delta E$ | 0.4590 | 0.0320 |
| $\Delta E^1$ | -0.3064 | 0.1958 | $\Delta E^1$ | -0.0151 | 0.7828 | $\Delta E^1$ | -0.0209 | 0.8263 |
| NOMAT*$\Delta E^1$ | 0.3249 | 0.1818 | ERROR*$\Delta E^1$ | 0.1943 | 0.8534 | SYN*$\Delta E^1$ | 0.0384 | 0.7334 |
| RES*$\Delta E^1$ | -0.0510 | 0.8614 | RES*$\Delta E^1$ | -0.2967 | 0.0028 | RES*$\Delta E^1$ | -0.2829 | 0.0271 |
| NOMAT*RES*$\Delta E^1$ | -0.3119 | 0.3110 | ERROR*RES*$\Delta E^1$ | -1.9358 | 0.6727 | SYN*RES*$\Delta E^1$ | -0.0263 | 0.8719 |
| $AR^1$ | 0.0353 | 0.0007 | $AR^1$ | 0.0347 | 0.0009 | $AR^1$ | 0.0250 | 0.0158 |
| SIZE | 0.0655 | <.0001 | SIZE | 0.0678 | <.0001 | SIZE | 0.0677 | <.0001 |
| VROA | -0.6048 | <.0001 | VROA | -0.5807 | <.0001 | VROA | -0.5639 | <.0001 |
| Obs | 4620 | | Obs | 4608 | | Obs | 4620 | |
| Adj. $R^2$ | 0.0856 | | Adj. $R^2$ | 0.0838 | | Adj. $R^2$ | 0.0883 | |

Panel A reports the regression results of model (7) over the periods after restatements, i.e, the periods corresponding to t = 1 in the previous analysis. AR is the market-adjusted annual return on an individual stock for the one year period immediately after a restating date. $AR^1$ is the market-adjusted annual return, similarly defined for the next one year period. The restating and matching firms are pooled together. $\Delta E$ is the difference of earnings per share between the next two fiscal year ends following a restating date, rescaled by the share price at the first fiscal year end. $\Delta E^1$ is the difference of earnings per share, similarly defined to $\Delta E$, for the period from the second and third fiscal year ends following a restating date. Panel B reports the regression results of model (8). This includes the time periods of both t =-1 and t=+1. At t=-1, $AR^1$ is the market-adjusted annual return on an individual stock for the one year period after a restatement date. $\Delta E^1$ is the difference of earnings per share between the two fiscal year ends just after a restating date, rescaled by the share price at the first fiscal year end. $\Delta E$ is similarly defined for the period from the second and third fiscal year ends before a restatement date. At t=1, the variables are defined in the same way as those in Panel A.

**Appendix:** Control Variables

| | |
|---|---|
| ROA | Net income divided by total asset at the end of the last fiscal year |
| LEV | Ratio of total liabilities to total assets in the fiscal year |
| VROA | Standard deviation of quarterly ROA over the past three years. |
| VOL | Total number of shares traded over the year divided by total number of shares outstanding at the end of the fiscal year |
| B/M | Book value of total equity divided by "market value" of total equity at the end of the fiscal year. "Market value" is the (tradable) share price multiplied by total number of shares outstanding. The "market value" of foreign shares is added too, if any |
| Size | Natural logarithm of the "market value" of total equity at the end of the fiscal year |
| Age | Number of quarters from a firm's listing date to the announcement date of its accounting restatement (It is defined accordingly for a matching firm). |
| SS | A dummy variable to be defined as 1 if the firm is included in Shanghai Stock Exchange 180 Index or Shenzhen Stock Exchange 100 Index, and as 0 otherwise |
| ST | A dummy variable with value 1 if the firm is classified as "Special Treatment" during the fiscal year, and value 0 otherwise |
| FSHARE | A dummy variable with value 1 if an A-share firm has also issued foreign shares, such as B shares or H shares, and value 0 otherwise |
| ERROR | Absolute value of retained earnings revised for restatements divided by total assets at the end of the fiscal year |
| TREND | Year trend taking values from 1 to 9 over the years from 1999 to 2007, respectively |
| RES | A dummy variable taking value 1 after accounting restatements and value 0 otherwise |
| NOMAT | A dummy variable taking value 1 if a firm is the restating sample, and value 0 otherwise (i.e., in the matching sample). |