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# Cost stickiness, earnings forecast accuracy, and the informativeness of stock prices about future earnings: evidence from China

Jia Li<sup>1</sup> & Zhoutianyang Sun<sup>2</sup>✉

This paper uses the data from the Chinese capital market to study the relationship between cost stickiness, earnings forecast accuracy and stock price information content. The empirical results show that: (1) Cost stickiness significantly affects the earnings response coefficient of stock prices. Lower cost stickiness improves the ability of current returns to reflect future earnings, which is manifested in higher future earnings response coefficient (FERC). (2) Cost stickiness significantly reduces the future earnings response coefficient of non-state-owned enterprises, but does not reduce the future earnings response coefficient of state-owned enterprises. It can be seen that investors have different attitudes towards cost stickiness of listed companies with different property rights in the process of investment decision-making. (3) Cost stickiness significantly increases stock prices synchronicity and decreases the number of company-specific information reflected in stock prices. Further analysis shows that cost stickiness increases earnings forecast accuracy, which is the partial intermediary mechanism for cost stickiness to improve FERC and reduce stock price synchronicity. This paper not only enriches the relevant literature of cost stickiness and earnings response coefficient, but also shows that cost stickiness is an important factor affecting the information efficiency of capital market.

<sup>1</sup>School of Wealth Management, Ningbo University of Finance & Economics, No. 899, Xueyuan Road, Ningbo, Zhejiang Province, China. <sup>2</sup>Suzhou City University, No. 1188, Wuzhong Avenue, Wuzhong District, Suzhou, Jiangsu Province, China. ✉email: [szty@szcu.edu.cn](mailto:szty@szcu.edu.cn)

## Introduction

Most of the traditional asset pricing studies focus on the analysis of financial factors and macroeconomic risks faced by enterprises, while the role of cost factors is abstracted or even ignored. In this study, we examine whether lower cost stickiness affects the information content of stock prices on future returns. Existing studies provide evidence that when the activity level decreases, costs decrease less than when the activity level increases by the same amount, that is, the cost is sticky (Anderson et al., 2003; Banker et al., 2013; Kama and Weiss 2013; He et al., 2020). Cost stickiness is proved to be common in different countries and different cost categories (Anderson et al., 2003; Dierynck et al., 2012; Banker et al., 2013). The existence of cost stickiness not only affects operational efficiency and operational risk (Anderson et al., 2003; Yao, 2018), but also have a significant impact on analysts' forecasting behavior (Weiss, 2010; Ciftci et al., 2016). At present, the view that cost stickiness affects the accuracy of analysts' earnings forecasts has been widely recognized by the academic community, and many literature have discussed this issue (Balakrishnan et al., 2004; Banker and Chen, 2006; Weiss, 2010). Analysts are the representatives of rational investors and have great influence on other investors (Driskill et al., 2020). Analysts release forecast analysis reports to help investors form more accurate ideas about the impact of current earnings on future company performance, enhance the information content of stock prices (Gleason and Lee, 2003; Jegadeesh and Kim, 2006; Cheng et al., 2016; Huang et al., 2016), improve the effectiveness of capital market (Lys and Sohn, 1990; Easley and O' Hara, 2004; Loh and Stulz, 2018) and the resource allocation efficiency of capital market (Schipper, 1991; Call et al., 2019). Cost stickiness increases the volatility of earnings, reduces the accuracy of analysts' forecasts, and significantly affects investors' judgments and decisions and the information valuation process of capital market. Then, how can cost stickiness affect the information efficiency of capital market?

We predict that lower cost stickiness can increase the information content of stock prices when the market impact is not considered, because lower cost stickiness reduces the volatility of company's earnings, helps investors better forecast future earnings, forms more accurate concepts of the company's value, which are reflected in the stock trading process and stock yield, and then promotes more company information to be integrated into stock prices. In order to test our predictions, we first measure the impact of cost stickiness on the ability of current stock returns to reflect future earnings. Specifically, we use the future return response coefficient (or FERC) to measure the information content of stock prices, which links current stock returns with earnings in the next year (Ayers and Freeman, 2003; Piotroski and Roulstone, 2004; Choi et al., 2019). The current stock price reflects the expectation of market for the future performance of the company. When stock price can better predict the realization of future earnings, its information content is greater (Collins et al., 1994; Lundholm and Myers, 2002; Choi et al., 2019). Choosing the future earnings response coefficient (FERC) model to measure the information content of future earnings reflected in the current stock price has the following three advantages (Collin et al., 1994; Lundholm and Myers, 2002; Bobae and Kooyul, 2008). First, earnings response coefficients (ERC) can measure the ability of investors to forecast the future profits of enterprises based on current earnings (or earnings changes) (Hayn, 1995), and can comprehensively reflect the degree of trust and dependence of investors on the earnings information disclosed by listed companies in the process of investment decision-making. Second, earnings response coefficient can deeply reflect whether current stock returns can accurately respond to current and future earnings based on short-term and long-term perspectives, and

fully reflect the value relevance between current earnings and future earnings, and then reflect the change in stock pricing efficiency. Third, earnings response coefficient can more accurately express the information content of stock prices, even in the case of more noise in the market and more noise trading in stock prices, and the use of stock price heterogeneity volatility to measure stock pricing efficiency may be potentially disturbed by many factors. The earnings response coefficient reflects the correlation between earnings and stock returns (Choi et al., 2019). Testing the impact of cost stickiness on the correlation between earnings and stock returns can provide a measure of the impact of cost stickiness on the valuation information content of accounting earnings, and also verify the impact of cost stickiness on the information efficiency of capital market.

In order to further prove the impact of cost stickiness on the information efficiency of capital market, as another method to test whether less cost stickiness improves the information content of stock prices, we also examine the relationship between cost stickiness and stock price synchronicity. Stock price synchronicity can negatively reflect the extent to which the firm level characteristic information is integrated into stock price, and is often used as an indicator to measure the efficiency of information transmission in stock market (Roll, 1988; Morck et al., 2000; Durnev et al., 2004; Qiu et al., 2020; Zeineb et al., 2022). Firm level information has an important impact on investors' capital allocation decisions. Abundant heterogeneous information at the firm level can enable investors to fully understand the differences in operating efficiency between different companies in a market, so as to invest funds in the most valuable enterprises. Therefore, the content of company level information contained in stock prices significantly affects the effectiveness of capital allocation in the securities market (Wurgler, 2000), and improves the pricing efficiency of capital market (Durnev et al., 2004). If cost stickiness allows stock prices to reflect more specific information at the company level, then cost stickiness should be negatively correlated with the synchronization of stock prices. FERC analysis and stock price synchronicity test in this paper are complementary, because although synchronicity tests measure the relative amount of company-specific information reflected in stock prices relative to market /industry level information, they do not measure the overall quantity or quality of information. In contrast, FERC measures the ability of current stock prices to incorporate future earnings information, thus providing insight into the overall quantity and quality of information contained in stock prices (Choi et al., 2019). However, one advantage of studying stock price synchronicity is that information reflected by the indicator is not limited to future earnings. Therefore, stock price synchronicity test implicitly tests the impact of cost stickiness on the inclusion of other value related information that affects stock prices. Finally, we examine whether analysts' forecast accuracy is the partial intermediary mechanism of cost stickiness affecting the information content of stock prices.

Chinese capital market environment is highly consistent with the research theme of this paper, specifically in the following aspects: (1) Investors in Chinese capital market are immature and highly dependent on analysts. The effectiveness of analysts' earnings forecasts has become the most concerned topic for investors. The average level of analysts is not high in China. Although they have a certain grasp of cost stickiness, they can not fully grasp the characteristics of cost stickiness of enterprises, resulting in large earnings forecast errors. Therefore, it is representative to select the growing sample data of Chinese capital market for testing. (2) Compared with the western developed countries, China's economic and financial development is relatively stable (Li and Zhong, 2020), so listed companies are

relatively less impacted by macroeconomic factors, and the predictability of future profits is high. This provides a good environment for testing the impact of cost stickiness on the earnings response coefficient and the synchronization of stock prices. It also provides conditions for a clearer explanation of the impact of cost stickiness on stock pricing efficiency. (3) In China, cost management behaviors of enterprises with different property rights are obviously different. Compared with private enterprises, due to political connections, state-owned enterprises are less inclined to layoff or reduce employees' wages when the level of activity declines, showing greater cost stickiness (Boycko et al., 1996; Shleifer and Vishny, 1994; Li and Luo, 2021). The diversity of cost stickiness is more conducive to testing the identification and grasp of cost stickiness by analysts and investors in the process of forecasting. However, using the comparative analysis of state-owned enterprises and private enterprises, we can also get more insights into the relationship between cost stickiness and future earnings response coefficient. Therefore, we choose to conduct empirical tests in the context of China's capital market. Finally, we select the annual observation samples of 15,070 A-share companies in Shanghai and Shenzhen, the available activity level and profits from 2009 to 2021, as well as the relevant data such as stock price returns, and use the measurement method of cost stickiness of Weiss (2010) to test the relationship between cost stickiness, earnings response coefficients and stock price synchronicity.

The results of this study show that the adverse impact of cost stickiness on analysts' and investors' earnings forecasts affects the earnings response coefficient. Cost stickiness reduces the earnings response coefficient that characterizes the quality of accounting information, that is, it reduces the correlation between stock price and enterprise value. Investors realize that cost stickiness can reduce the accuracy of earnings forecasts, and reduce the dependence on realized earnings information, because for companies with high-cost stickiness, the prediction ability of realized earnings information to future earnings is low. Similarly, we find that cost stickiness also reduces the future earnings response coefficient of stock prices, which indicates that cost stickiness reduces the informativeness of stock prices about future earnings. However, for state-owned enterprises, it is difficult to forecast their future earnings according to the income-cost method, so that cost stickiness does not significantly reduce the future earnings response coefficient of stock prices. Therefore, reducing cost stickiness is conducive to improving the earnings response coefficient of listed companies, and enhancing the ability of accounting earnings to explain and predict future stock returns. In addition, we find that cost stickiness is negatively correlated with stock price synchronicity, which shows that cost stickiness reduces the amount of company-specific information reflected in stock prices. Further analysis shows that earnings forecast accuracy is an important intermediary mechanism of cost stickiness affecting the information content of stock prices. In short, through FERC and stock price synchronicity test, we find that cost stickiness can greatly affect the value relevance of stocks and the efficiency of stock pricing. It can be seen that cost stickiness is an important factor affecting the information transmission of accounting earnings and the information efficiency of capital market, and then has a significant impact on the resource allocation.

This paper integrates a typical management accounting research topic (cost behavior) with two standard financial accounting topics (earnings response coefficient and stock price synchronicity). It enriches the literature on the interaction between management accounting and financial accounting, and also enriches the literature on understanding the information content of accounting earnings and the influencing factors of

information efficiency in capital market from the perspective of cost stickiness. Specifically, this paper contributes to the existing literature in the following two aspects:

First, it is the first time to explore the impact of cost stickiness on the information content of stock prices, including the impact on earnings response coefficient and stock price synchronicity. The information content of stock price is one hot spot of researches in the field of accounting and finance. More and more literature give the economic consequences of cost stickiness and record the benefits of reducing cost stickiness in various environments, but there are few literature discussing the relationship between cost stickiness and stock price information content. The existing literature studies the impact of cost stickiness on the response of market return surprises (Weiss, 2010), the impact of labor cost stickiness on stock returns (Li and Palomino, 2014; Favilukis and Lin, 2016a; 2016b), etc. As an important supplement to the literature, this paper studies the impact of cost stickiness on earnings response coefficient and stock price synchronicity, and finds that cost stickiness has a significant impact on earnings response coefficient and stock price synchronicity. This provides empirical evidence for the impact of cost stickiness on the information efficiency of capital market, and enriches the relevant literature on the economic consequences of cost stickiness and the factors affecting the information content of stock prices.

Second, based on the actual situation in China, this paper expands the scope of application of Weiss (2010) theory, compares and analyzes the similarities and differences of the impact of cost stickiness on future earnings response coefficient in state-owned enterprises and non-state-owned enterprises. We find that there is a significant difference between state-owned enterprises and non-state-owned enterprises. Cost stickiness reduces the future earnings response coefficient of non-state-owned enterprises, but for state-owned enterprises, cost stickiness has no significant impact on the future earnings response coefficient of stock prices. These findings are helpful to reveal the understanding of cost management behavior and decision-making differences in investment of enterprises with different property rights.

Other contents are arranged as follows: The second part is the development of hypotheses. After theoretical analysis, research hypotheses H1, H2 and H3 are put forward. The third part is the research design of this paper, including sample selection, variable definition and model setting. The fourth part is the analysis of empirical results and the test of robustness, the fifth part is further analysis of the intermediary mechanism, and the sixth part is the conclusion.

### Development of hypotheses

Earnings response coefficient may be affected by internal (microscopic characteristics) and external factors (macroscopic characteristics) of the company (Kothari, 2001; Lundholm and Myers, 2002; Ettredge et al., 2005; Orpurt and Zang, 2009; Choi et al., 2011; Hsu and Pourjalali, 2015), and investors' interpretation of information also affects the earnings response coefficient (Kormendi and Lipe, 1987; Lipe, 1990; Billings, 1999; Mendenhall and Fehrs, 1999; Ghosh et al., 2005). Lower cost stickiness benefits investors because it helps them process information at lower costs. However, if cost stickiness is high, it means that the company's information is more complex, and costs for investors to process the company's-specific information will increase. In capital market, investors consider the impact of cost stickiness on the company's value and future development, and treat companies with high-cost stickiness differently from those with low-cost stickiness (Banker and Chen, 2006).

If cost stickiness of the company is high, costs that can be adjusted is small when business volume decreases. Smaller cost cuts results in a sharp decline in the earning and increases the volatility of earnings (Balakrishnan et al., 2004). Earnings volatility increases unpredictability and reduces the accuracy of analysts' earnings forecasts (Weiss, 2010). The help of the existing accounting earnings information for forecasting future earnings is also reduced. On the one hand, for enterprises with high-cost stickiness, as the earnings predictability decreases, the reported earnings provide less useful information for the valuation and forecast of future earnings. If investors realize that cost stickiness increases the difficulty of earnings forecasting and reduce the accuracy of earnings forecasts, they will less rely on the realized earnings information for investment in decision-making, resulting in low earnings response coefficient (Lipe, 1990). On the other hand, if the accuracy of analysts' forecasts decreases, the consistency of the expectations of investors who trust these analysts will tend to be scattered (Abarbanell et al., 1995), and the scattered expectations will cause chaotic investment situation in capital market. So the information released by company is difficult to be reflected in the stock value, and ERC will decrease accordingly (Abarbanell et al., 1995). Cost stickiness also effects the ability of stock prices to anticipate the information in future earnings. Cost stickiness reduces the accuracy of analysts' and investors' future earnings forecasts, and the future earnings response coefficient (FERC) of stock prices also decreases, because investors' expectations of future earnings are reflected in the current stock price (Choi et al., 2019). Therefore, cost stickiness reduces the earnings response coefficient (ERC) and future earnings response coefficient (FERC) of stock prices.

However, the improvement of the accuracy of future earnings forecasts can increase ERC and FERC. As the earnings forecasts of analysts' and investors' are more accurate when cost stickiness is lower and these forecasts are reflected in the current stock price. Lower cost stickiness will result in higher ERC and FERC for enterprises. Based on this reasoning, we expect that reducing cost stickiness can improve the information content of stock prices on future earnings and increase ERC and FERC. Our first hypothesis is stated in another form as follows:

**H1: Cost stickiness reduces the earnings response coefficient and future earnings response coefficient.**

If H1 is established, it indicates that investors have some understanding of the role of cost stickiness in determining the accuracy of earnings forecasts, and can partially identify cost stickiness of enterprises. In other words, this hypothetical predicts that cost behavior is very important in forming investors' beliefs about the value of the company, and cost stickiness has been valued and considered by investors.

When investors make investment decisions on stock trading, they treat state-owned enterprises and non-state-owned enterprises differently. Owing to more regulation, the information transparency of state-owned enterprises is low (Bushman et al., 2004; Qiu et al., 2020). Future development is more likely to be disturbed by political factors, which increase the uncertainty of future profits (Shleifer and Vishny, 1994; Ronny et al., 2018). Moreover, state-owned enterprises themselves also undertake political tasks, which makes the future surplus of state-owned enterprises have the problem of soft budget constraints, and they are often supported by resources from the government and other departments in the process of production and operation (Lin and Li, 2008; Lin, 2012). It is difficult for investors to grasp the income and cost behavior caused by political factors and political connections. These factors lead to higher costs for investors to interpret the information of state-owned enterprises, while cost stickiness has less additional increase on costs of information interpretation, that is, cost stickiness has less additional increase

on the difficulty of forecasting future earnings. Therefore, for state-owned enterprises, the impact of cost stickiness on investors' future earnings analysis and investment decisions is significantly reduced, and the impact of cost stickiness on future earnings response coefficient is also reduced. Our second hypothesis is stated in another form as follows:

**H2: For state-owned enterprises, the impact of cost stickiness on future earnings response coefficient is weakened.**

If H2 is established, for non-state-owned enterprises, cost stickiness significantly reduces the response coefficient of future earnings, while for state-owned enterprises, the impact of cost stickiness on the response coefficient of future earnings is significantly weakened. This shows that investors may pay more attention to cost management behavior of non-state-owned enterprises when making investment decisions.

Cost stickiness increases the difficulty of forecasting future earnings of enterprises, and makes analysts' forecast errors increasing (Weiss, 2010). The expectation of investors who trust these analysts will tend to be scattered (Abarbanell et al., 1995), increasing the production of market noise. Cost stickiness actually plays the role of operating leverage, and amplifies the fluctuation level and uncertainty level of equity income belonging to owners (Balakrishnan et al., 2004), which makes it more difficult to estimate the market value of enterprises. These will increase the transaction cost and risk of information arbitrage, reduce investors' information arbitrage behavior, and increase the proportion of noisy transactions in the market, so the idiosyncratic information at the firm level can rarely be integrated into stock prices (Li et al., 2015). On the other hand, if investors realize the complexity of cost stickiness of listed companies (that is, they realize that it is difficult to use firm level information for valuation), they will integrate more market level and industry level information into stock prices, resulting in less firm level information into stock prices. According to the information efficiency theory (Morck et al., 2000; Durnev et al., 2004; Crawford et al., 2012), the information content of stock price is reduced and the synchronization of stock prices is increased.

However, in contrast, lower cost stickiness is conducive to investors and analysts for forecasting the future earnings of enterprises (Weiss, 2010). Under the same other conditions, lower cost stickiness reduces the volatility of earnings distribution, the uncertainty of future profits, and the generation of market noise. It means that the transaction cost and risk of information arbitrage are also reduced. This will increase investors' information arbitrage behavior and reduce the proportion of noise trading, helping to incorporate the information component of firm characteristics into stock prices (Li et al., 2015), and improve the information content at the firm level, so reducing the synchronization of stock prices (Morck et al., 2000; Durnev et al., 2004; Crawford et al., 2012). Therefore, there is an obvious positive correlation between cost stickiness and stock price synchronicity. Our third hypothesis is stated in another form as follows:

**H3: Cost stickiness increases stock price synchronicity.**

## Research design

### Variable definition

*Measuring cost stickiness.* This paper refers to the enterprise level cost stickiness measurement method proposed by Weiss (2010), which is a direct method to measure enterprise cost stickiness. This method is more applicable than cost stickiness measurement method of Anderson et al. (2003). We use the change of sales revenue as the imperfect proxy variable of activity change to estimate the difference between costs reduction rate of activity level decline in recent quarters and costs increase rate of activity



level rise in recent quarters:

$$Sticky_{it} = \log\left(\frac{\Delta Cost}{\Delta Sale}\right)_{i\tau} - \log\left(\frac{\Delta Cost}{\Delta Sale}\right)_{i\bar{\tau}}, \tau, \bar{\tau} \in \{t, \dots, t-3\}$$

Where  $\tau$  is the most recent season in which the activity level has decreased in the last four quarters, and  $\bar{\tau}$  is the most recent season in which the activity level has increased in the last four quarters.  $\Delta Sale_{it} = Sale_{it} - Sale_{it-1}$ .  $\Delta Cost_{it}$  is the change of total costs, which is because the analyst estimates total costs in the process of profit forecast. Therefore, the stickiness measurement focuses on total costs, so as to deeply understand the potential relationship between the stickiness of total costs and the accuracy of earnings forecasts. Since the accounting classification of COGS and SGA is easy to be judged by management, the total cost analysis also eliminates the management discretion in the cost classification (Anderson and Lanen, 2007; Weiss, 2010). We use the activity level amount minus the surplus to represent total costs, so  $\Delta Cost_{it} = (Sale_{it} - Earning_{it}) - (Sale_{it-1} - Earning_{it-1})$ , and  $Earning_{it}$  represents the surplus before deducting the non-current item profit and loss. We assume that costs changes in the same direction as the activity level, and exclude the possibility that costs increases when the activity decreases and costs decreases when the activity increases, that is, we exclude the observation that costs moves in the opposite direction to estimate cost stickiness. If costs is sticky, which means that when the activity increases, costs increases more than when the activity decreases by the same amount, then the proposed measure is negative. The low-cost stickiness value represents the strong stickiness cost behavior. In order to avoid the influence of outliers on the analysis results, we perform a bilateral 1% tailing treatment on the cost stickiness variable.

*Measuring stock price synchronicity.* Referring to the method of Morck et al. (2000), Gul et al. (2010), Xu et al. (2013) etc., we use the logarithmic transformation of market model regression  $R^2$  to measure stock price synchronicity ( $Syn_{it}$ ):

$$R_{i,w,t} = \alpha_0 + \alpha_1 R_{M,w,t} + \alpha_2 R_{I,w,t} + \varepsilon_{i,w,t}$$

where,  $R_{i,w,t}$  is the return rate of reinvestment of  $i$  stock considering cash dividends in the  $w$  week of  $t$  year.  $R_{M,w,t}$  is the weighted average return on the circulating market value of all A-share companies in the  $w$  week of the  $t$  year.  $R_{I,w,t}$  is the weighted average return on the market value of other stocks in circulation after excluding  $i$  stock in the industry in the  $w$  week of the  $t$  year of  $i$  stock. The industry classification in this paper is based on the two digit industry standard of China Securities Regulatory Commission in 2012, and  $R^2$  is calculated. By logarithmizing  $R^2$ , we get that  $Syn1_{it}$  is the index of stock price synchronicity of  $i$  stock in  $t$  year.

$$Syn1_{it} = \ln(R_{it}^2 / (1 - R_{it}^2))$$

Replace the above weekly yield data with daily yield, and use the same model method to obtain another measure of stock price synchronicity, which is recorded as  $Syn2_{it}$ .

**Model design**

*Test model for hypotheses H1 and H2.* Let's review the basic FERC model. In order to measure the ability of stock returns to reflect future earnings, the following benchmark models are often used:

$$R_{it} = \beta_0 + \beta_1 X_{it-1} + \beta_2 X_{it} + \beta_3 X_{it+1} + \beta_4 R_{it+1} + \varepsilon_{it}$$

Here, the year is  $t$ , the company is  $i$ .  $R_{it}$  is the cumulative rate of return on purchases and holdings measured over the financial  $t$  year, which refers to Choi et al. (2011).  $X_{it}$  is the profit available to ordinary shareholders before deducting extraordinary items,

which is standardized according to the initial market value of equity. The basic intuition behind the FERC model is that the current stock return depends on the unexpected earnings ( $UX_t = X_t - E_{t-1}(X_t)$ ) in the period, the expected change in future earnings ( $\Delta E_t(X_{t+i})$ ) and random noise. Since unexpected earnings are unobservable, we use Lundholm and Myers (2002) for reference and include the past and current earnings levels ( $X_{it-1}$  and  $X_{it}$ , respectively). This makes us avoid making assumptions about whether the return process follows random walk and white noise processes. In order to represent changes in future earnings expectations, we include the realized future earnings level ( $X_{t-1}$ ) and future return level ( $R_{it+1}$ ). We include  $R_{i,t+1}$  to control future events that affect  $X_{it+1}$  but cannot be predicted at the end of  $t$  year (Collins et al., 1994; Lundholm and Myers, 2002). Including both  $X_{it+1}$  and  $R_{it+1}$  in the model allows us to separate the expected part of future earnings. Based on the results of previous studies, we expect  $\beta_2$  and  $\beta_3$  are positive,  $\beta_1$  and  $\beta_4$  are negative. To test our hypotheses H1 and H2, we extend the base model as follows:

$$R_{it} = \varphi_0 + \varphi_1 X_{it-1} + \varphi_2 X_{it} + \varphi_3 X_{it+1} + \varphi_4 R_{it+1} + \varphi_5 Sticky_{it} + \varphi_6 Sticky_{it} \times X_{it-1} + \varphi_7 Sticky_{it} \times X_{it} + \varphi_8 Sticky_{it} \times X_{it+1} + \varphi_9 Sticky_{it} \times R_{it+1} + \sum \varphi_n control\ variables + \varepsilon_{it} \tag{1}$$

If reducing cost stickiness can improve the ability of capital market to forecast future earnings (i.e., FERC), the coefficient of the interaction term ( $\phi_8$ ) between cost stickiness and future earnings in Eq. (1) is positive. We also test the interaction coefficient ( $\phi_7$ ) between cost stickiness and current earnings to examine whether cost stickiness affects how current earnings are incorporated into returns (i.e., ERC). If the lower cost stickiness allows returns to contain future earnings information to a greater extent, current earnings could become less relevant (i.e.,  $\phi_7$  would be negative). Alternatively, the information about future earnings can be incorporated into returns without reducing the importance of current earnings (i.e.,  $\phi_7$  would be not significant), or current earnings are more value related when cost stickiness is low, so cost stickiness would strengthen the contemporaneous relationship between earnings and returns (i.e.,  $\phi_7$  would be positive). In addition, using the interaction coefficient ( $\phi_6$ ) between cost stickiness and past earnings, we can examine whether cost stickiness affects the relative importance of past earnings for stock returns.

In order to solve the problem that ERCs and FERCs are affected by multiple enterprise characteristics, including information environment quality, enterprise risk, growth and uncertainty (Ayers and Freeman, 2003; Piotroski and Roulstone, 2004), referring to the existing literature (Choi et al., 2019), we add the firm size ( $Lnsiz_{it}$ ), market capitalization to book ratio ( $MB_{it}$ ), earnings volatility ( $Earnvol_{it}$ ), stock return volatility ( $Retvol_{it}$ ), and analyst coverage ( $Analyst_{it}$ ) to the model, and control the industry and annual effects. The definition of control variables is in Supplementary Appendix 2. By discussing the impact of cost stickiness on earnings response coefficient, we can observe whether analysts and investors consider the problem of enterprise cost stickiness.

*Test model for hypothesis H3.* In order to determine whether cost stickiness is related to stock price synchronicity, we use the following model (3) to test whether cost stickiness significantly reduces stock price synchronicity of listed companies. In model (3), the explained variables are the measurement variables  $Syn1_{it}$  and  $Syn2_{it}$  of stock price synchronicity. What we care about is the coefficient  $\beta_2$  of  $Sticky_{it}$ . If cost stickiness increases the amount of company level information incorporated into stock prices

(relative to market and industry level information), the coefficient of  $Sticky_{it}$  variable will be negative. We expect  $\beta_2$  to be significantly negative, that is, when cost stickiness is low, the company information integrated into stock price is higher and stock price synchronicity is lower.

$$\begin{aligned}
 Syn_{n+1} = & \beta_0 + \beta_1 Sticky_{it} + \beta_2 Lnsiz_{it} + \beta_3 Roa_{it} + \beta_4 Lev_{it} \\
 & + \beta_5 SelManexprat_{it} + \beta_6 Loss_{it} + \beta_7 Seasonvol_{it} \\
 & + \beta_8 Ihold_{it} + \beta_9 Divident_{it} + \beta_{10} MB_{it} + \beta_{11} Retvol_{it} \\
 & + \beta_{12} Dturn_{it} + \beta_{13} Analyst_{it} + \beta_{14} Big_{it} + \beta_{15} ABACC_{it} \\
 & + \beta_{16} State_{it} + \sum Year + \sum Industry + \epsilon_{it}
 \end{aligned}
 \tag{2}$$

According to previous studies (e.g., Piotroski and Roulstone, 2004; Gul et al., 2010; Qiu et al., 2020; Zeineb et al., 2022), we control the following variables in the model: firm size  $Lnsiz_{it}$ , return on total assets  $Roa_{it}$ , asset liability ratio  $Lev_{it}$ , sales expense ratio  $SelManexprat_{it}$ , dummy variable of financial statement loss  $Loss_{it}$ , standard deviation of quarterly operating income  $Seasonvol_{it}$ , shareholding ratio of institutional investors  $Ihold_{it}$ , cash dividend per share  $Divident$ , market value to book ratio  $MB_{it}$ , stock return volatility  $Retvol_{it}$ , monthly average turnover rate of stocks  $Dturn_{it}$ , Analyst coverage  $Analyst_{it}$ , “big four” accounting firms’ audit dummy variable  $Big_{it}$ , accounting information transparency  $ABACC_{it}$ , enterprise property right nature  $State_{it}$ . Finally, we also add annual  $\sum Year$  and industry  $\sum Industry$  dummy variables to control the impact of annual effect and industry effect on stock price synchronicity. We provide variable definitions in the Supplementary Appendix.

Some control variables are explained as follows: firm size ( $Lnsiz_{it}$ ): there may be differences between the information content of stock prices of large and small companies (Durnev et al., 2004). In order to control the influence of scale factor on the information content of stock price, this paper uses the natural logarithm of total assets at the end of the period as the control variable. Institutional shareholding ratio ( $Ihold_{it}$ ): Piotroski and Roulstone (2004) believe that institutional investors’ shareholding helps to increase the content of idiosyncratic information in stock prices, thereby reducing the synchronization of stock prices. Stock liquidity ( $Dturn_{it}$ ): there is a positive correlation between stock liquidity and information efficiency of stock price. Turnover rate can represent the liquidity of stocks to some extent. The information content of stock price is closely related to turnover rate (Wurgler and Zhuravskaya, 2002). Therefore, we add the monthly average turnover rate of stocks to the model for analysis. Analyst coverage ( $Analyst_{it}$ ): Previous studies find that securities analysts are significantly and positively correlated with the performance of stock price synchronization (Chan and Hameed, 2006). Return on total assets ( $Roa_{it}$ ): Hutton et al. (2009) believes that the profitability of enterprises is an important factor affecting investors’ investment decisions. Too high or too low profit level deviates from the average expectation of the market, which will affect the synchronization of stock prices. Asset liability ratio ( $Lev_{it}$ ): when the debt level of an enterprise is high, the future operation and development of the enterprise will face greater uncertainty, and the possibility of abnormal fluctuation of stock price is higher, so the synchronization of stock price is lower (Hutton et al., 2009). Accounting information transparency ( $ABACC_{it}$ ): Through theoretical model analysis, Jin and Myers (2006) show that the difference of stock price information content actually depends on the difference of corporate information transparency. High-quality information disclosure can significantly enhance the information content of stock prices and reduce the synchronization of stock prices. Sales management expense ratio ( $SelManexprat_{it}$ ): the degree of management agency problem will affect the synchronization of stock prices. The

management fee rate can measure the management agency problem to a certain extent (Ang et al., 2000). Therefore, the rate of sales and management expenses is used as the measurement variable of the agency problem, which is calculated by dividing the sales and management expenses of the enterprise by the operating revenue.

**Sample selection.** Referring to Weiss (2010), we select all manufacturing companies from 2009 to 2021 as our samples (National Economical Industry Classification C1311-C4390). There are two main reasons for choosing companies in the manufacturing industry from 2009. First, the financial crisis in 2008 may have an impact on earnings forecasting behavior and the characteristics of stock prices, and then affect the relationship between cost stickiness, earnings forecast accuracy and stock price information content, making the research results disturbed. Second, industrial firms in contrast to utilities and other regulated industries generally operate in competitive markets, which partially mitigates the measurement error due to a potential pricing effect, rather than to a volume effect. The data are obtained from CSMAR (China Stock Market & Accounting Research Database) and iFinD database. Most analysts in China only forecast annual earnings. Therefore, for each firm year, we use the consensus forecast calculated as the average of all forecasts announced in the month preceding that of the earnings announcement. We exclude the sample data of ST or ST\* companies. In line with the model assumption, we limit the sample to firm-year observations, in which costs and sales change in the same direction. This reduces the sample size, and results in a final sample that consists for 15976 firm-year observations.

**Empirical results and robustness checks**

**Descriptive statistics.** As can be seen from Table 1, the average value and standard deviation of  $Sticky$  are  $-0.174$  and  $1.150$ , respectively, which indicates that cost stickiness of listed companies is high, but the gap between companies is large. The average value of  $Loss$  is  $0.098$ , indicating that 9.8% of the listed companies have suffered losses. The average value of  $Roa$  is  $0.044$ , indicating that the average profitability of Chinese listed companies is 4.4%. The average value and standard deviation of

Variable	Mean	sd	p25	p50	p75
<i>Syn1</i>	0.493	0.189	0.358	0.503	0.634
<i>Syn2</i>	0.474	0.196	0.332	0.480	0.618
<i>Sticky</i>	-0.174	1.150	-0.545	-0.098	0.211
<i>Lnsiz</i>	21.850	1.353	20.896	21.697	22.615
<i>Loss</i>	0.098	0.298	0.000	0.000	0.000
<i>Roa</i>	0.044	0.074	0.016	0.041	0.075
<i>Lev</i>	0.612	3.619	0.252	0.416	0.588
<i>MB</i>	4.156	7.007	1.821	2.856	4.664
<i>SelManexprat</i>	0.178	0.368	0.083	0.134	0.211
<i>Divident</i>	0.364	0.647	0.090	0.277	0.550
<i>Ihold</i>	0.370	0.236	0.165	0.369	0.554
<i>ABACC</i>	0.000	0.162	-0.041	-0.007	0.029
<i>Analyst</i>	2.017	0.878	1.386	2.079	2.708
<i>Big4</i>	0.054	0.227	0.000	0.000	0.000
<i>State</i>	0.391	0.488	0.000	0.000	1.000
<i>Earnvol</i>	0.027	0.286	0.005	0.011	0.022
<i>Retvol</i>	0.031	1.152	0.006	0.012	0.026
<i>Dturn</i>	2.809	3.621	0.844	1.750	3.457
<i>Seasonavol</i>	0.018	0.026	0.006	0.012	0.021
<i>R</i>	0.155	0.822	-0.334	-0.055	0.363
<i>X</i>	0.027	0.098	0.008	0.023	0.046

Table 2 Correlation coefficient of main variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) R	1.000													
(2) Syn1	-0.100***	1.000												
(3) Syn2	-0.107***	0.982***	1.000											
(4) Sticky	0.034***	-0.028***	0.211***	1.000										
(5) Lnsiz	-0.094***	0.223***	0.012*	0.130***	1.000									
(6) Roa	0.069***	0.006	0.021***	0.130***	-0.087***	1.000								
(7) Lev	-0.013**	-0.003	-0.003	0.019***	0.039***	-0.387***	1.000							
(8) SelMan	0.003	-0.039***	-0.037***	-0.025***	-0.126***	-0.071***	-0.093***	1.000						
(9) Retvol	0.010	0.098***	0.100***	-0.011*	-0.219***	-0.057***	-0.030***	0.023***	1.000					
(10) Ihold	-0.012*	0.071***	0.051***	0.029***	0.435***	0.051***	0.048***	-0.041***	-0.147***	1.000				
(11) X	0.052***	0.019***	0.029***	0.100***	0.073***	0.681***	-0.193***	-0.050***	-0.096***	0.102***	1.000			
(12) MB	0.014**	-0.009	-0.009	0.002	-0.071***	-0.033***	0.003	0.021***	0.026***	-0.012*	-0.013**	1.000		
(13) Dturn	0.060***	-0.170***	-0.143***	-0.005	-0.430***	0.105***	-0.231***	0.020***	0.532***	-0.479***	0.078***	0.024***	1.000	
(14) ABACC	0.013**	-0.013*	-0.009	0.021***	-0.064***	0.151***	-0.021***	-0.016**	0.025***	-0.040***	0.090***	0.016**	0.052***	1.000

\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

MB are 4.156 and 7.007, respectively, indicating that China's listed companies have good growth ability, but there is a large gap between companies. The average value of *Ihold* is 0.370, which indicates that the equity concentration of listed companies is high, and the proportion of institutional shares is 37.0%. The average value of *Big4is* 0.054, indicating that the audit proportion of the four major accounting firms in listed companies is 5.4%. The average value of *State* is 0.391, indicating that there are 39.1% state-owned enterprises in the sample of listed companies. The average value and standard deviation of *R* are 0.155 and 0.822, respectively, indicating that the average value of stock return during the sample period is 15.5%, but there is a large difference among companies. The average values of *Syn1* and *Syn2* are 0.493 and 0.474. Compared with the existing literature, it shows that stock price synchronicity of China's capital market is higher than that of the U.S. capital market. The average value of *Dturn* is 2.809, indicating that the average monthly turnover rate in China's capital market is high and the transaction is relatively active. The average value of *Seasonvol* is 0.018, indicating that the quarterly volatility of operating income is low. The average value of *X* is 0.027, indicating that the average earnings of listed companies are low.

**Correlation analysis.** It can be seen from Table 2 that *R* and *Syn1* are negatively correlated at the significance level of 1%, and the correlation coefficient is -0.100. *R* and *Syn2* are negatively correlated at the significance level of 1%, and the correlation coefficient is -0.107. *R* is positively correlated with *Sticky* at the significance level of 1%, and the correlation coefficient is 0.034. *R* and *Lnsiz* are negatively correlated at the significance level of 1%, and the correlation coefficient is -0.094. *R* and *Roa* are positively correlated at the significance level of 1%, and the correlation coefficient is 0.069. *R* and *Lev* are negatively correlated at the significance level of 5%, and the correlation coefficient is -0.013. *R* is negatively correlated with *Ihold* at the significance level of 10%, and the correlation coefficient is -0.012. *R* and *X* are positively correlated at the significance level of 1%, and the correlation coefficient is 0.052. *R* and *MB* are positively correlated at the significance level of 5%, and the correlation coefficient is 0.014. *R* and *Dturn* are positively correlated at the significance level of 1%, and the correlation coefficient is 0.060. *Sticky* and *Lnsiz* are positively correlated at the significance level of 10%, and the correlation coefficient is 0.012. *Sticky* is positively correlated with *Roa* at the significance level of 1%, and the correlation coefficient is 0.130. *Sticky* and *Lev* are positively correlated at the significance level of 1%, and the correlation coefficient is 0.019. *Sticky* and *X* are positively correlated at the significance level of 1%, and the correlation coefficient is 0.100. *Sticky* and *ABACC* are positively correlated at the significance level of 1%, and the correlation coefficient is 0.021. Because of the correlation between variables, we will conduct multicollinearity test in all subsequent regression to ensure that the regression results are not affected by the correlation of variables.

**Drawing comparison and analysis.** This part compares the statistical relationship between cost stickiness of state-owned enterprises and non-state-owned enterprises. According to the company sample, the median of *Sticky* per year is plotted as follows (see Supplementary Appendix 1 for image related data) (Fig. 1).

It can be seen from Fig. 1 that cost stickiness of state-owned enterprises is significantly greater than that of non-state-owned enterprises, mainly because of the particularity of state-owned enterprises. In China, the choice of resource allocation and factor adjustment of state-owned enterprises is very different from that



of non-state-owned enterprises represented by private enterprises and foreign-funded enterprises. Owing to the important position and unique functions of state-owned enterprises, they not only pursue economic goals, but also undertake more political tasks and social responsibilities (Lin and Lin, 2008). In the declining period of economic activities, “maintaining stability” and “promoting employment” have even become political tasks for state-owned enterprises. Undertaking political tasks will be supported by the government in terms of financial subsidies and preferential policies, and will be easier to get credit support from banks and other financial institutions. State-owned enterprises have strong ability to cope with possible losses and small demand for cost reduction. Therefore, in the face of declining income, state-owned enterprises often show “no layoff” and “no salary reduction”. The constant total number of employees and overall salary objectively determines that the matching raw materials, machinery and equipment, and other material resources will not fluctuate significantly, and state-owned enterprises show strong cost stickiness (Li and Luo, 2021). In addition, the absence of owners and the serious problem of insider control are also important reasons for cost stickiness of

state-owned enterprises. Investors also have the better understanding of cost stickiness of state-owned enterprises.

**Regression result analysis**

*Test of hypothesis H1 and H2: The effect of cost stickiness on the ERC and FERC.* In order to test the impact of cost stickiness on the earnings response coefficient of stock prices, and the impact of property rights on these relationships. We use model (4) to test hypothesis H1, group according to the property right, and use ordinary least squares (OLS) regression to test hypothesis H2. Through the data regression results, we can explain the impact of cost stickiness on the relationship between earnings and stock returns in the same period and one lag period.

It can be seen from Table 3 above that in the full sample regression, the coefficient of  $Sticky_{it} \times X_{it}$  is positive (0.249) at the significance level of 1%, indicating that cost stickiness significantly reduces the earnings response coefficient of stock prices. The coefficient of  $Sticky_{it} \times X_{it+1}$  is positive at the significance level of 1% (0.065, see column 1), indicating that cost stickiness also significantly reduces the response coefficient of future earnings. This supports the hypothesis H1 in this paper, namely, cost stickiness reduces the earnings response coefficient and future earnings response coefficient. In the sample of state-owned enterprises, the coefficient of  $Sticky_{it} \times X_{it}$  is positive at the significance level of 5% (0.252, see column 2), but the coefficient of  $Sticky_{it} \times X_{it+1}$  is not significant, indicating that cost stickiness of state-owned enterprises has a significant impact on the earnings response coefficient, but has no significant impact on the future earnings response coefficient. In the sample of private enterprises, the coefficient of  $Sticky_{it} \times X_{it}$  is positive at the significance level of 5% (0.264), and the coefficient of  $Sticky_{it} \times X_{it+1}$  is positive at the significance level of 1% (0.089, see column 3), which indicates that cost stickiness of non-state-owned enterprises reduces the current and future earnings response coefficient of stock prices. To sum up, for state-owned enterprises, cost stickiness reduces the current earnings response coefficient, but the impact of cost stickiness on the future earnings response coefficient is low, relative to non-state enterprises. This supports the



**Fig. 1** Comparison of cost stickiness between state-owned and non-state-owned enterprises.

**Table 3** Regression table of cost stickiness and earnings response coefficient.

Variables	(1) re1 $R_{it}$	(2) re2 $R_{it}$	(3) re3 $R_{it}$	Expected signs
$X_{it-1}$	-0.794*** (-6.336)	-0.804*** (-4.875)	-0.678*** (-4.121)	-
$X_{it}$	1.556*** (7.073)	1.509*** (4.979)	1.680*** (4.895)	+
$X_{it+1}$	0.495*** (5.128)	0.384*** (2.743)	0.592*** (4.298)	+
$R_{it+1}$	-0.094*** (-8.076)	-0.081*** (-5.100)	-0.091*** (-5.482)	-
$Sticky_{it}$	0.002 (0.392)	-0.000 (-0.024)	0.002 (0.244)	+/-
$Sticky_{it} \times X_{it-1}$	-0.184* (-1.797)	-0.228* (-1.657)	-0.072 (-0.454)	-
$Sticky_{it} \times X_{it}$	0.249*** (3.285)	0.252** (2.013)	0.264** (2.572)	+
$Sticky_{it} \times X_{it+1}$	0.065*** (2.875)	0.008 (0.100)	0.089*** (3.169)	+
$Sticky_{it} \times R_{it+1}$	0.011 (1.397)	0.023* (1.851)	0.004 (0.376)	+
$lnsize_{it}$	-0.005 (-0.749)	-0.001 (-0.093)	-0.033*** (-2.806)	-
$MB_{it}$	0.011*** (2.926)	0.013* (1.817)	0.009** (2.123)	+
$Retvol_{it}$	0.009*** (11.076)	0.010*** (7.679)	0.007*** (8.026)	+
$Roa_{it}$	0.000 (0.192)	-0.002 (-0.723)	0.000 (0.179)	+
$Lev_{it}$	0.001*** (3.615)	0.000 (0.074)	0.003*** (4.480)	+
$Earnvol_{it}$	-0.005 (-1.161)	-0.005 (-0.672)	-0.002 (-0.352)	-
$Analyst_{it}$	-0.018*** (-2.762)	-0.013 (-1.381)	-0.014 (-1.534)	-
Year	Control	Control	Control	
Industry	Control	Control	Control	
Constant	-1.082*** (-6.005)	-1.166*** (-4.288)	-0.557** (-2.162)	
Observations	8418	4021	4397	
R-squared	0.573	0.639	0.533	

Robust t-statistics in parentheses. \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.



**Table 4 Regression table of cost stickiness and stock price synchronicity.**

	(1) re1	(2) re2	(3) re3	(4) re4	Expected signs
Variables	Syn1 <sub>it+1</sub>	Syn1 <sub>it+1</sub>	Syn2 <sub>it+1</sub>	Syn2 <sub>it+1</sub>	
Sticky <sub>it</sub>	-0.005*** (-4.279)	-0.003*** (-2.716)	-0.005*** (-4.535)	-0.004*** (-2.940)	-
Lnsiz <sub>it</sub>		0.033*** (17.433)		0.032*** (17.260)	+
Roa <sub>it</sub>		-0.078* (-1.746)		-0.052 (-1.184)	-
Lev <sub>it</sub>		-0.116*** (-11.867)		-0.122*** (-12.588)	-
SelManexprat <sub>it</sub>		0.015 (1.147)		0.016 (1.169)	+
Loss <sub>it</sub>		-0.017*** (-3.012)		-0.019*** (-3.358)	-
Seasonvol <sub>it</sub>		-0.073*** (-4.504)		-0.087*** (-5.409)	-
Ihold <sub>it</sub>		-0.080*** (-10.741)		-0.087*** (-11.741)	-
Dividend <sub>it</sub>		-0.008* (-1.820)		-0.008* (-1.723)	-
MB <sub>it</sub>		-0.001 (-1.293)		-0.001 (-1.268)	-
Retvol <sub>it</sub>		-0.116*** (-3.395)		-0.070** (-2.165)	-
Dturn <sub>it</sub>		-0.012*** (-11.718)		-0.009*** (-9.002)	-
Analyst <sub>it</sub>		0.007*** (3.857)		0.006*** (3.480)	+
Big4 <sub>it</sub>		-0.003 (-0.394)		-0.003 (-0.417)	-
ABACC <sub>it</sub>		-0.016** (-2.098)		-0.017** (-2.202)	-
State <sub>it</sub>		0.030*** (9.305)		0.029*** (8.932)	+
Year	No-control	Control	No-control	Control	
Industry	No-control	Control	No-control	Control	
Constant	0.472*** (376.860)	0.025 (0.568)	0.473*** (381.424)	0.048 (1.127)	
Observations	25,317	14,044	25,317	14,044	
R-squared	0.001	0.291	0.001	0.287	

Robust t-statistics in parentheses. \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

hypothesis H2 in this paper, namely, for state-owned enterprises, the impact of cost stickiness on future earnings response coefficient is weakened. All the above regression results don't have significant collinearity in the VIF test.

*Test of hypothesis H3: The effect of cost stickiness on stock price synchronicity.* In order to test the impact of cost stickiness on the integration of company level information into stock prices, we examine the relationship between cost stickiness and stock price synchronicity. According to the information efficiency theory, when more company level information is integrated into stock prices, stock price synchronicity is significantly reduced. Cost stickiness is not conducive to the integration of company information into stock prices, so the synchronization of stock prices will be significantly increased, that is, hypothesis H3.

It can be seen from Table 4 above that when Syn1<sub>it+1</sub> is the explained variable, in the regression without control variable, the coefficient of Sticky<sub>it</sub> is -0.005 at the significance level of 1%. After adding all control variables, the coefficient of Sticky<sub>it</sub> is -0.003 at the significance level of 1%, indicating that cost stickiness significantly increases the synchronization of stock prices. When Syn2<sub>it+1</sub> is the explained variable, in the regression without control variable, the coefficient of Sticky<sub>it</sub> is -0.005 at the significance level of 1%. After adding all control variables, the coefficient of Sticky<sub>it</sub> is -0.004 at the significance level of 1%, which also shows that cost stickiness is significantly positively correlated with the synchronization of stock prices. The high-cost stickiness hinders the efficiency of integrating company level information into stock prices and improves the synchronization of stock prices. Therefore, reducing cost stickiness of the company is conducive to the integration of the company level information into stock prices, and can effectively improve the information efficiency of capital market. In the control variables, the coefficients of State<sub>it</sub> are positive (0.030 and 0.029) at the significance level of 1%, indicating that stock price synchronicity of state-owned listed companies is relatively higher and the information content of

stock prices is lower<sup>1</sup>. All the above regression results don't have significant collinearity in the VIF test.

*The effect of changes in cost stickiness on changes in synchronicity.* In order to further test the relationship between cost stickiness and stock price synchronicity, a dynamic model is used to test the relationship between the change of cost stickiness and the change of stock price synchronicity, that is, the following model (3) is used for regression test.

$$\begin{aligned}
 Syncha_{it+1} = & \beta_0 + \beta_1 Sticky_{it} + \beta_2 Syn_{it} + \beta_3 Lnsiz_{it} \\
 & + \beta_4 Roa_{it} + \beta_5 Lev_{it} + \beta_6 SelManexprat_{it} + \beta_7 Loss_{it} \\
 & + \beta_8 Seasonvol_{it} + \beta_9 Ihold_{it} + \beta_{10} Dividend_{it} + \beta_{11} MB_{it} \\
 & + \beta_{12} Retvol_{it} + \beta_{13} Dturn_{it} + \beta_{14} Analyst_{it} + \beta_{15} Big4_{it} \\
 & + \beta_{16} ABACC_{it} + \beta_{17} State_{it} + \sum Year + \sum Industry + \varepsilon_{it}
 \end{aligned}
 \tag{3}$$

In the model, Syncha<sub>it+1</sub> represents the change range of stock price synchronicity, which is calculated as Syncha<sub>it+1</sub> = Syn<sub>it+1</sub> - Syn<sub>it</sub>, and the specific explained variables are Syncha<sub>it+1</sub> and Syncha<sub>it+1</sub>. Sticky<sub>it</sub> represents the change range of cost stickiness and is calculated as Sticky<sub>it</sub> = Sticky<sub>it</sub> - Sticky<sub>it-1</sub>. The extent of stock price synchronicity affects the change of stock price synchronicity. Therefore, add stock price synchronicity Syn1<sub>it</sub> or Syn2<sub>it</sub> of the previous year as the control variable, and the other control variables are the same as above.

As can be seen from Table 5 above, when Syncha<sub>it+1</sub> is the explained variable, in the regression without control variable, the coefficient of Sticky<sub>it</sub> is -0.006 at the significance level of 1%. After adding all control variables, the coefficient of Sticky<sub>it</sub> is -0.003 at the significance level of 1%, indicating that the change of cost stickiness is significantly positively correlated with the change of stock price synchronicity. When Syncha<sub>it+1</sub> is the explained variable, in the regression without control variable, the coefficient of Sticky<sub>it</sub> is -0.006 at the significance level of 1%. After adding all control variables, the coefficient of Sticky<sub>it</sub> is -0.003 at the significance level of 1%, which also shows that the

**Table 5 Regression table of the change of cost stickiness and the change of stock price synchronicity.**

	(1) re1	(2) re2	(3) re3	(4) re4	Expected signs
Variables	Syncha1 <sub>it+1</sub>	Syncha1 <sub>it+1</sub>	Syncha2 <sub>it+1</sub>	Syncha2 <sub>it+1</sub>	
Sticky <sub>cha</sub> <sub>it</sub>	-0.006*** (-6.721)	-0.003*** (-2.676)	-0.006*** (-6.942)	-0.003*** (-2.823)	-
Syn1 <sub>it</sub>	0.706*** (98.298)	0.753*** (77.734)			+
Syn2 <sub>it</sub>			0.726*** (99.986)	0.770*** (79.346)	+
Lnsiz <sub>it</sub>		-0.029*** (-13.792)		-0.028*** (-13.955)	-
Roa <sub>it</sub>		0.134*** (2.785)		0.128*** (2.660)	+
Lev <sub>it</sub>		0.101*** (9.300)		0.110*** (10.210)	+
SelManexprat <sub>it</sub>		-0.019 (-1.356)		-0.018 (-1.342)	-
Loss <sub>it</sub>		0.010* (1.786)		0.010* (1.789)	+
Seasonvol <sub>it</sub>		0.042** (2.505)		0.051*** (3.082)	+
Ihold <sub>it</sub>		0.017** (2.073)		0.022*** (2.748)	+
Dividend <sub>it</sub>		0.021*** (4.912)		0.020*** (4.724)	+
MB <sub>it</sub>		0.002*** (2.907)		0.001*** (2.804)	+
Retvol <sub>it</sub>		0.186*** (2.911)		0.157*** (2.788)	+
Dturn <sub>it</sub>		0.002 (1.317)		0.000 (0.256)	+
Analyst <sub>it</sub>		-0.004** (-2.090)		-0.005** (-2.560)	-
Bih4 <sub>it</sub>		-0.000 (-0.025)		-0.001 (-0.224)	-
ABACC <sub>it</sub>		0.010 (1.157)		0.009 (1.048)	+
State <sub>it</sub>		-0.018*** (-5.199)		-0.015*** (-4.611)	-
Year	No-control	Control	No-control	Control	
Industry	No-control	Control	No-control	Control	
Constant	-0.332*** (-90.668)	0.060 (1.289)	-0.342*** (-92.916)	0.041 (0.900)	
Observations	19,899	12,078	19,899	12,078	
R-squared	0.348	0.554	0.358	0.562	

Robust t-statistics in parentheses. \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

change of cost stickiness has a significant positive impact on the change of stock price synchronicity. The reduction of cost stickiness can reduce the synchronization of stock prices, thus improving the efficiency of resource allocation in capital market. All the above regression results don't have significant collinearity in the VIF test.

**Robustness test.** We further perform some robustness tests to test the sensitivity of the results to model assumptions and potential measurement errors, and find that all these attempts produce conclusions similar to those we reach in the main tests. We perform five untabulated sensitivity analyses as follows.

First, we re-estimate our tests using several alternative measures of cost stickiness. We test the sensitivity of cost stickiness measure to a longer time window. We use data from  $t-7$  to  $t$  for the last eight quarters to calculate the ratio of changes in total costs to changes in activity levels. Then we estimate  $M\_Sticky_{it}$ , which is the average slope adjusted downward and the average slope adjusted upward. Therefore,  $M\_Sticky_{it}$  has explained the downward adjustment and upward adjustment in the past eight quarters, which can provide insight into the sustainability of the cost behavior of the enterprise over a long period of time. Using  $M\_Sticky_{it}$  instead of  $Sticky_{it}$  for regression analysis, the results are basically unchanged. We also use the method of He et al. (2020) to regain the measurement variable of cost stickiness, and control the fixed effect of the company in the model for regression test, and the results are basically the same.

Second, the increase or decrease of activities is not only due to changes in the level of activities, but also due to changes in the prices of products or resources or other management options (Anderson and Lanen, 2007). To minimize this problem, we limit the sample to competitive manufacturing companies. Then we test the sensitivity of the results to potential management discretion, and make a limited test of the impact of cost stickiness generated by past decisions (such as technology selection and

labor compensation contracts) on earnings response coefficient and stock price synchronicity. Specifically, we consider two forms of management discretion: current decisions based on realized market conditions in the current quarter  $t$ , and past decisions made before the quarter  $t$ . We view the adjustment of activity level as a response to the realized market conditions rather than a previous decision. Substituting  $Sticky_{it-1}$  for  $Sticky_{it}$  only allows you to estimate the impact of past decisions. In other words,  $Sticky_{it-1}$  proxies for the extent of cost stickiness in an earlier quarter, excluding all decisions made by the management in the  $t$  quarter, such as price discount or accrued profit manipulation, the results are basically unchanged.

Third, in order to test the robustness of the main findings, we add several additional control variables and their respective interactions to the FERC model. Specifically, we include: (i) accounting quality, measured by the absolute value of the residual from the Dechow and Dichev (2002) model; (ii) voluntary disclosure quality, measured using an indicator variable for management forecasts of annual earnings (Choi et al., 2011). In addition, for companies with high risk and uncertainty, the information content of stock prices should be less. Therefore, the model also includes indicators of risk and uncertainty other than the company size and earnings volatility: (iii) market beta, and (iv) Altman's z-score (Altman, 1968). After controlling these variables, we re-estimate FERC models and find that the conclusions of this paper are unchanged.

Fourth, cost stickiness is also dependent on the market/economic situation. Therefore, our model may have endogenous problems due to missing control variables. This concern can be alleviated by individual fixed effect regression, and the results obtained are basically unchanged. In order to further prevent endogenous problems caused by missing variables, we adopt the first order difference GMM dynamic panel method to make regression analysis on model (1), model (2) and model (3). GMM estimation is a robust estimator, because it does not require

accurate distribution information of the disturbance term, allows the random error term to have heteroscedasticity and serial correlation, and can also eliminate the endogenous problem between regression variables. Therefore, the parameter estimators obtained are more practical than other parameter estimation methods, and the regression results obtained are robust.

Finally, in order to further avoid possible endogenous problems, we conduct PSM sample test. In view of the fact that there may be some differences between high- and low-cost stickiness listed companies, that is, due to certain differences in corporate characteristics between high-cost stickiness companies and low-cost stickiness companies, these differences may cause significant differences in the stock prices information content for different cost stickiness companies, thus reducing the effectiveness of this empirical study. Therefore, we use the Propensity Score Matching (PSM) method to retest. Referring to the research of Chen et al. (2020), first, the sample enterprises are divided into high-cost stickiness group (experimental group,  $dum\_Sticky = 1$ ) and low-cost stickiness group (control group,  $dum\_Sticky = 0$ ) according to the mean value of cost stickiness, and **logit** model is selected to calculate the tendency score of each observation in the experimental group and the control group. The control variables used in model (1) are used to construct propensity scores, and 1:1 nearest neighbor matching is performed for each observation in the experimental group to match the closest sample of the year. The control group is obtained from the match, and the absolute value of the control group is the minimum value of the difference in propensity score. Secondly, the matched samples were obtained by combining the experimental group and the matched control group. The equilibrium test is carried out on the matching results, so that the standardized deviation of almost all covariant is less than 10%, and the samples without matching are deleted. Finally, the matched data are used to conduct regression analysis again to test whether there is a significant difference between the matched group and the experimental group in the earning response coefficient and stock price synchronicity. We find that by using the propensity score matching method to re-regression the matched samples, the results are basically consistent with the previous text.

**Further analysis: mediation mechanism test**

This part further analyzes the intermediary mechanism of cost stickiness affecting earnings response coefficient and stock price synchronicity. In the theoretical part, we believe that the accuracy of analysts' and investors' earning forecasts is part of the intermediary mechanism. Here, the Sobel mediator test method of Baron and Kenny (1986) is used for reference. First, we verify the negative impact of cost stickiness on earnings forecast accuracy, that is, cost stickiness is significantly negatively correlated with earnings forecast accuracy. Second, we add earnings forecast variables to model (1) and model (2) for regression analysis, and compare the sign and significance of  $Sticky_{it}$  coefficient with the regression analysis without earnings forecast variables. We observe the change of the significance and the absolute value of the  $Sticky_{it}$  coefficient, and observe the significance of the coefficient of earnings forecast accuracy variable. Finally, we observe whether the Sobel Z value is statistically significant to test whether there is a complete or partial mediation mechanism.

**Verification of the negative impact of cost stickiness on the accuracy of earnings forecasts**

*Measuring earnings forecast accuracy.* We use analysts' consensus earnings forecast errors as a reverse measure of the accuracy of earnings forecasts. Based on existing studies, we define earnings forecast errors as the absolute value of the difference between

analysts' earnings forecasts and actual earnings, and scale it according to the stock price at the beginning of the year (Lang and Lundholm, 1996; De Franco et al., 2011). Therefore, analysts' forecast accuracy  $absFE_{it}$  is defined as:

$$FE_{it} = \frac{foreEPS_{it} - EPS_{it}}{Price_{it-1}} \times 100$$

$$absFE_{it} = |FE_{it}|$$

$FE_{it}$  indicates the deviation of analysts' optimistic forecast.  $Price_{it-1}$  is the stock price at the beginning of the year, and  $EPS_{it}$  is the actual earnings per stock.  $foreEPS_{it}$  is the earnings per share unanimously predicted by analysts, which means the average value of the latest earnings per share predicted by the securities analysts of company  $i$  in  $t$  year. In order to ensure that analysts' forecasts are not affected by more factors, the data in the month before the earnings announcement are selected here. The relatively narrow time window and the control over the timeliness of the short-term forecast period mitigate the potential trade-off between timeliness and accuracy (Clement and Tse, 2003).

*Model design.* When testing the impact of cost stickiness on the accuracy of earnings forecasts, we control the characteristic variables of available company information and the uncertainty variables of incoming, which may be related to the accuracy of analysts' forecasts. First, in the basic performance components of the company, we control the quality of the information environment by adding common financial indicators such as company size ( $Lnsiz_{it}$ ), market value to book ratio ( $MB$ ), profitability ( $Roa$ ), loss in the financial statements ( $Loss$ ), accounting information transparency ( $ABACC$ ), institutional shareholding ratio ( $Ihold$ ), asset liability ratio ( $Lev$ ), etc, and analyst coverage ( $Analyst$ ), "Big four" accounting firm audit ( $Big4_n$ ) (Atiase, 1985; Gu and Wu, 2003; Hutton et al., 2009; Weiss, 2010; DeFranco et al., 2011). Second, we use eight proxy variables to measure the uncertainty of the income environment from different aspects (Hanlon, 2005; Hope, 2003; Weiss, 2010; DeFranco et al., 2011), namely, activity level variation coefficient ( $Vsale_{it}$ ), operating leverage ratio ( $Oplev_{it}$ ), foreign income ( $FI_{it}$ ), deferred tax expense ( $DTE_{it}$ ), unexpected earnings ( $Surprise_{it}$ ), volatility of earnings ( $Earnvol_{it}$ ), volatility of stock returns ( $Retvol_{it}$ ), unexpected seasonal fluctuation of revenue ( $Seasonvol_{it}$ ), and cash flow volatility ( $CFvol_{it}$ ). Finally, industry  $\sum Industry$  and annual  $\sum Year$  dummy variables are further added to the model of analyst forecast accuracy to control the impact of industry and annual fixed effects, respectively. The industry adopts two digit SIC code classification.

To sum up, we use the following model (4) to test whether cost stickiness significantly reduces the accuracy of analysts' forecasts. In order to control the potential cross-section related problems, this paper makes a cluster treatment based on the company dimension for standard errors in all regression (Petersen, 2009).

$$absFE_{it+1}/FE_{it+1} = \beta_0 + \beta_1 Sticky_{it} + \beta_2 Lnsiz_{it} + \beta_3 Loss_{it} + \beta_4 Roa + \beta_5 Lev_{it} + \beta_6 MB_{it} + \beta_7 Ihold_{it} + \beta_8 ABACC_{it} + \beta_9 Analyst_{it} + \beta_{10} Big4_{it} + \beta_{11} Surprise + \beta_{12} Oplev_{it} + \beta_{13} DTE_{it} + \beta_{14} FI_{it} + \beta_{15} Earnvol_{it} + \beta_{16} Retvol_{it} + \beta_{17} Vsale_{it} + \beta_{18} Seasonvol_{it} + \beta_{19} CFvol_{it} + \sum Year + \sum Industry + \epsilon_{it} \tag{4}$$

In model (4), cost stickiness  $Sticky_{it}$ , which changes with the change of managers' cost behavior, is used as the explanatory

variable. The explained variables are the measurement variables of analyst forecast accuracy,  $absFE_{it+1}$  and  $FE_{it+1}$ , respectively. What we care about is the coefficient of  $Sticky_{it}$ , i.e.,  $\beta_2$ . We expect  $\beta_2$  to be significantly positive to support this idea that more stickiness cost behavior leads to greater analysts' average consistent earnings forecast errors, that is, cost stickiness reduces earnings forecast accuracy.

*The effect of cost stickiness on earnings forecast accuracy.* In order to test the impact of cost stickiness on the accuracy of earnings forecasts, we use model (4) for regression analysis. The explained variables are  $absFE_{it+1}$  and  $FE_{it+1}$  in the case of no control variables and all control variables, respectively. The results are shown in Table 6.

It can be seen from Table 6 above that when  $absFE_{it+1}$  is the explained variable, in the regression without control variable, the coefficient of  $Sticky_{it}$  is  $-0.950$  at the 1% significance level. After adding all control variables, the coefficient of  $absFE_{it+1}$  is  $-0.456$  at the significance level of 5%, indicating that cost stickiness significantly increases the errors of analysts' forecasts, that is, cost stickiness significantly reduces the consistent accuracy of analysts' forecasts (Weiss, 2010). Other things being equal, if analysts ignore the existence of cost stickiness, or underestimate cost stickiness, their profit forecasts will deviate upward. When  $FE_{it+1}$  is the explained variable, in the regression without control variable, the coefficient of  $Sticky_{it}$  is  $-3.445$  at the significance level of 1%. After adding all control variables, the coefficient of  $Sticky_{it}$  is  $-1.538$  at the significance level of 1%. These results indicate that there is significant positive correlation between cost stickiness and analysts' optimistic forecast bias, and analysts only partially recognize cost stickiness, not all. All the above regression results don't have significant collinearity in the VIF test.

There are some potential bias resulting from omitted variables. For example, the supply chain aspect and trade openness are

integral factors influencing cost stickiness and are highly likely related to analysts' earnings forecast. This concern can be alleviated by individual fixed effect regression, and the results obtained are basically unchanged. In order to further prevent endogenous problems caused by missing variables, we adopt the first order difference GMM dynamic panel method to make regression analysis on model (4), and the regression results obtained are robust.

**The intermediary mechanism of cost stickiness reducing earnings response coefficient: earnings forecast accuracy.**

In order to further test whether the accuracy of earnings forecasts is part of the intermediary mechanism of cost stickiness reducing the earnings response coefficient, we use the earnings response coefficient to regress the analysts' forecast errors  $absFE_{it}$ , observe the changes of significance and absolute value of the correlation coefficient, and analyze the role of analysts' earnings forecast errors in cost stickiness reducing the earnings response coefficient. As can be seen from Table 7 above, in the full sample regression, the coefficient of  $Sticky_{it} \times X_{it}$  is significantly positive, and the absolute value of the coefficient is 0.276 (1 column). After adding the variable series of analyst forecast errors  $absFE_{it}$ , the significance of  $Sticky_{it} \times X_{it}$  coefficient decreases from 1% to 5%, the absolute value of the coefficient decreases to 0.192 (4 columns), and the coefficient of  $absFE_{it} \times X_{it}$  is negative at the significance level of 10% ( $-0.001$ , 4 columns). It can be seen that earnings forecast accuracy is part of the intermediary mechanism of cost stickiness reducing the earnings response coefficient. In the sample regression of state-owned enterprises, the coefficient of  $Sticky_{it} \times X_{it}$  is significantly positive at the level of 1%, and the absolute value is 0.344 (2 columns). After adding the variable series of analyst forecast errors  $absFE_{it}$ , the coefficient significance of  $Sticky_{it} \times X_{it}$  decreases from 1 to 5%, the absolute

**Table 6 Regression results of analysts' forecast accuracy on cost stickiness.**

	(1) re1	(2) re2	(3) re3	(4) re4
Variables	$absFE_{it+1}$	$absFE_{it+1}$	$FE_{it+1}$	$FE_{it+1}$
$Sticky_{it}$	$-0.950^{***}$ (-3.419)	$-0.456^{**}$ (-2.359)	$-3.445^{***}$ (-11.592)	$-1.538^{***}$ (-7.780)
$lnsize_{it}$		$0.958^{**}$ (2.000)		$-0.737$ (-1.610)
$Loss_{it}$		$17.353^{***}$ (9.602)		$10.649^{***}$ (6.090)
$Roa_{it}$		$-0.664^{**}$ (-2.500)		$-1.794^{***}$ (-7.569)
$Lev_{it}$		$5.848^{**}$ (2.569)		$-3.295$ (-1.483)
$MB_{it}$		$-0.078$ (-0.766)		$-0.129$ (-1.251)
$lhold_{it}$		$-0.014$ (-0.786)		$0.007$ (0.425)
$ABACC_{it}$		$6.090^*$ (1.763)		$0.433$ (0.230)
$Analyst_{it}$		$-1.073$ (-1.418)		$1.609^{**}$ (2.308)
$Big4_{it}$		$-2.228^{**}$ (-2.452)		$0.066$ (0.068)
$Surprise_{it}$		$-0.012$ (-1.153)		$0.013$ (1.035)
$Oplev_{it}$		$11.210^{***}$ (5.454)		$8.419^{***}$ (4.265)
$DTE_{it}$		$0.263$ (0.032)		$1.176$ (0.148)
$Fl_{it}$		$-0.606$ (-1.122)		$-0.975^*$ (-1.730)
$Earnvol_{it}$		$-0.005$ (-1.199)		$0.015^{***}$ (4.571)
$Retvol_{it}$		$-0.009$ (-0.579)		$-0.049^{***}$ (-2.601)
$Vsale_{it}$		$-0.013^{**}$ (-2.156)		$-0.001$ (-0.165)
$Seasonvol_{it}$		$74.454^{***}$ (3.240)		$-19.379$ (-0.884)
$CFvol_{it}$		$19.192$ (0.747)		$86.625^{***}$ (3.409)
Year	No-control	Control	No-control	Control
Industry	No-control	Control	No-control	Control
Constant	$14.674^{***}$ (56.523)	$1.315$ (0.120)	$3.054^{***}$ (10.806)	$11.464$ (1.096)
Observations	15,976	12,579	15,976	12,579
R-squared	0.001	0.116	0.011	0.182

Robust t-statistics in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ .



**Table 7 The intermediary mechanism test of earnings response coefficient.**

Variables	(1) re1 $R_{it}$	(2) re2 $R_{it}$	(3) re3 $R_{it}$	(4) re4 $R_{it}$	(5) re5 $R_{it}$	(6) re6 $R_{it}$
$X_{it-1}$	-0.804*** (-6.903)	-0.746*** (-5.777)	-0.751*** (-4.552)	-0.710*** (-5.116)	-0.814*** (-3.828)	-0.599*** (-3.478)
$X_{it}$	1.729*** (9.100)	1.611*** (6.678)	1.973*** (6.031)	1.386*** (5.386)	1.661*** (4.548)	1.416*** (3.153)
$X_{it+1}$	0.442*** (6.490)	0.283*** (3.519)	0.616*** (6.631)	0.506*** (4.483)	0.432*** (2.996)	0.523*** (3.308)
$R_{it+1}$	-0.107*** (-11.867)	-0.076*** (-5.883)	-0.115*** (-9.486)	-0.100*** (-6.774)	-0.070*** (-3.229)	-0.105*** (-5.231)
$Sticky_{it}$	0.005 (1.158)	-0.004 (-0.627)	0.011* (1.922)	-0.001 (-0.338)	0.001 (0.262)	-0.003 (-0.673)
$Sticky_{it} \times X_{it-1}$	-0.149** (-1.971)	-0.187** (-2.246)	-0.057 (-0.464)	-0.079 (-1.355)	0.006 (0.058)	-0.088 (-1.318)
$Sticky_{it} \times X_{it}$	0.276*** (4.149)	0.344*** (3.504)	0.173** (2.116)	0.192** (2.399)	0.195* (1.880)	0.179 (1.592)
$Sticky_{it} \times X_{it+1}$	0.051** (2.562)	0.022 (0.360)	0.086*** (3.965)	-0.009 (-0.221)	-0.128* (-1.873)	0.026 (0.522)
$Sticky_{it} \times R_{it+1}$	-0.000 (-0.048)	0.002 (0.207)	-0.002 (-0.255)	0.006 (1.319)	0.007 (1.067)	0.005 (0.777)
$absFE_{it}$				-0.000 (-1.366)	-0.000 (-0.556)	-0.001 (-1.530)
$absFE_{it} \times X_{it-1}$				-0.003 (-1.627)	0.006 (1.301)	-0.002 (-0.462)
$absFE_{it} \times X_{it}$				-0.001* (-1.692)	-0.007*** (-2.980)	-0.000 (-0.590)
$absFE_{it} \times X_{it+1}$				-0.003** (-2.155)	-0.007*** (-3.326)	-0.002 (-1.167)
$absFE_{it} \times R_{it+1}$				0.000 (1.012)	0.001 (0.716)	0.000 (0.798)
$lnsize_{it}$	-0.005 (-0.874)	0.003 (0.312)	-0.026*** (-3.253)	0.008 (0.792)	0.017* (1.790)	-0.019 (-1.219)
$MB_{it}$	0.010*** (3.256)	0.017** (2.028)	0.007** (2.476)	0.022*** (3.078)	0.036*** (3.786)	0.017** (2.232)
$Retvol_{it}$	0.009*** (11.304)	0.009*** (6.093)	0.008*** (12.217)	0.009*** (9.160)	0.010*** (6.310)	0.008*** (7.510)
$Roa_{it}$	-0.000 (-0.093)	-0.001 (-0.679)	-0.001 (-0.694)	-0.002 (-0.707)	-0.002 (-0.612)	-0.002 (-0.508)
$Lev_{it}$	0.001*** (5.145)	0.000 (0.556)	0.002*** (5.459)	0.001** (1.992)	-0.000 (-0.422)	0.002*** (2.832)
$Earnvol_{it}$	0.000 (0.653)	-0.005 (-0.761)	0.000 (1.386)	-0.003 (-0.741)	-0.004 (-0.490)	-0.001 (-0.191)
$Analyst_{it}$	-0.021*** (-4.431)	-0.022*** (-2.763)	-0.015** (-2.451)	-0.032*** (-3.995)	-0.032*** (-2.971)	-0.032*** (-2.882)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Constant	-1.075*** (-7.512)	-1.260*** (-4.652)	-0.631*** (-3.513)	0.428* (1.872)	0.177 (0.686)	0.968*** (2.869)
Observations	15,070	6681	8389	7109	3388	3721
R-squared	0.565	0.636	0.528	0.544	0.618	0.508

Robust t-statistics in parentheses. \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

value of the coefficient decreases to 0.195 (5 columns), and the coefficient of  $absFE_{it} \times X_{it}$  is negative at the significance level of 1% (-0.007, 5 columns). It can be seen that in the sample of state-owned enterprises, earnings forecast accuracy is part of the intermediary mechanism of cost stickiness reducing the earnings response coefficient. In the sample of non-state-owned enterprises, the coefficient of  $Sticky_{it} \times X_{it}$  is significantly positive at the level of 5%, and the absolute value of the coefficient is 0.173 (3 columns). After adding the variable series of analyst forecast errors  $absFE_{it}$ , the coefficient of  $Sticky_{it} \times X_{it}$  is no longer significant. It can be seen that in the sample of non-state-owned enterprises, earnings forecast accuracy is the partial intermediary mechanism of cost stickiness reducing the earnings response coefficient. The regression coefficient based on the Table 7 also shows that analyst forecast accuracy is the partial intermediary mechanism of cost stickiness reducing the future earnings response coefficient, which is not listed here. All the above regression results don't have significant collinearity in the VIF test.

**The intermediary mechanism of cost stickiness increasing stock price synchronicity: earnings forecast accuracy.** In order to test the accuracy of earnings forecasts is part of the intermediary mechanism of cost stickiness increasing stock price synchronicity, we use stock price synchronicity to regress analyst forecast errors  $absFE_{it}$ , observe the change of significance and absolute value of correlation coefficient, and analyze the role of

earnings forecast errors in cost stickiness increasing stock price synchronicity. As can be seen from Table 8, when  $Syn1_{it+1}$  is the explained variable, the coefficient of  $Sticky_{it}$  is significantly negative, and the absolute value of the coefficient is 0.003 (1 column). After adding the variable of analyst forecast errors  $absFE_{it}$ , although the absolute value of the coefficient of  $Sticky_{it}$  do not change, the coefficient significance decreases from 1 to 5% (2 columns), and the coefficient of  $absFE_{it}$  is positive at the significance level of 10% (0.096, 2 columns). It can be seen that the analyst's forecast errors are part of the intermediary mechanism of cost stickiness increasing stock price synchronicity. When  $Syn2_{it+1}$  is the explained variable, the coefficient of  $Sticky_{it}$  is significantly negative, and the absolute value of the coefficient is 0.004 (3 columns). After adding the variable of analyst's forecast errors  $absFE_{it}$ , the coefficient significance of  $Sticky_{it}$  decreases from 1 to 5%, the absolute value of the coefficient also decreases to 0.003 (4 columns), and the coefficient of  $absFE_{it}$  is positive at the significance level of 5% (0.112, 4 columns). These also shows that the earnings forecast errors are part of the intermediary mechanism of cost stickiness increasing stock price synchronicity. Cost stickiness reduces the accuracy of earnings forecasts, hinders the efficiency of company level information integrating into stock prices, and increases stock price synchronicity. Therefore, reducing cost stickiness can improve earnings forecast accuracy, and then are conducive to the integration of firm level information into stock prices, which can effectively improve the information efficiency of capital market.

**Table 8 The intermediary mechanism test of stock price synchronicity.**

Variables	(1) re1 <i>Syn1<sub>it+1</sub></i>	(2) re2 <i>Syn1<sub>it+1</sub></i>	(3) re3 <i>Syn2<sub>it+1</sub></i>	(4) re4 <i>Syn2<sub>it+1</sub></i>
<i>Sticky<sub>it</sub></i>	-0.003*** (-2.716)	-0.003** (-1.968)	-0.004*** (-2.940)	-0.003** (-2.110)
<i>absFE<sub>it</sub></i>		0.096* (1.721)		0.112** (1.992)
<i>Lnsiz<sub>it</sub></i>	0.033*** (17.433)	0.035*** (17.045)	0.032*** (17.260)	0.034*** (17.104)
<i>Roa<sub>it</sub></i>	-0.078* (-1.746)	-0.138*** (-2.750)	-0.052 (-1.184)	-0.110** (-2.259)
<i>Lev<sub>it</sub></i>	-0.116*** (-11.867)	-0.122*** (-11.151)	-0.122*** (-12.588)	-0.128*** (-11.928)
<i>SelManexprat<sub>it</sub></i>	0.015 (1.147)	0.034*** (2.612)	0.016 (1.169)	0.036*** (2.819)
<i>Loss<sub>it</sub></i>	-0.017*** (-3.012)	-0.013** (-2.182)	-0.019*** (-3.358)	-0.015** (-2.432)
<i>Seasonvol<sub>it</sub></i>	-0.073*** (-4.504)	-0.039** (-2.227)	-0.087*** (-5.409)	-0.052*** (-3.017)
<i>Ihold<sub>it</sub></i>	-0.080*** (-10.741)	-0.075*** (-9.318)	-0.087*** (-11.741)	-0.082*** (-10.379)
<i>Dividend<sub>it</sub></i>	-0.008* (-1.820)	-0.007 (-1.415)	-0.008* (-1.723)	-0.006 (-1.304)
<i>MB<sub>it</sub></i>	-0.001 (-1.293)	-0.001 (-0.810)	-0.001 (-1.268)	-0.000 (-0.741)
<i>Retvol<sub>it</sub></i>	-0.116*** (-3.395)	-0.149*** (-4.100)	-0.070** (-2.165)	-0.096*** (-3.011)
<i>Dturn<sub>it</sub></i>	-0.012*** (-11.718)	-0.013*** (-10.944)	-0.009*** (-9.002)	-0.010*** (-8.528)
<i>Analyst<sub>it</sub></i>	0.007*** (3.857)	0.009*** (4.046)	0.006*** (3.480)	0.008*** (3.645)
<i>Big4<sub>it</sub></i>	-0.003 (-0.394)	-0.005 (-0.779)	-0.003 (-0.417)	-0.005 (-0.832)
<i>ABACC<sub>it</sub></i>	-0.016** (-2.098)	-0.014* (-1.791)	-0.017** (-2.202)	-0.015* (-1.899)
<i>State<sub>it</sub></i>	0.030*** (9.305)	0.027*** (7.841)	0.029*** (8.932)	0.025*** (7.410)
Year	Control	Control	Control	Control
Industry	Control	Control	Control	Control
Constant	0.025 (0.568)	-0.022 (-0.460)	0.048 (1.127)	-0.002 (-0.045)
Observations	14,044	12,140	14,044	12,140
R-squared	0.291	0.295	0.287	0.292

Robust t-statistics in parentheses. \*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1.

**Conclusion**

This paper selects the data of Chinese capital market to study the relationship between cost stickiness, earnings forecast accuracy and stock price information content, which expands and continues the research results of Weiss (2010) to some extent. We find that cost stickiness reduces the accuracy of earnings forecasts, and then significantly affects the earnings response coefficient of stock prices. Cost stickiness not only reduces the current earnings response coefficient of stock prices, but also reduces the future earnings response coefficient. This shows that in the process of capital market valuation, cost stickiness is recognized by investors to a certain extent, reducing the dependence of investors' current earnings and the accuracy of future earnings forecasts, which is a factor that can not be ignored. Based on the actual situation in China, this paper compares the impact of different property rights. We find that different property rights make the relationship between cost stickiness and future earnings response coefficient (FERC) significantly different. For non-state-owned enterprises, cost stickiness significantly reduces the future earnings response coefficient of stock prices, but for state-owned enterprises, the impact of cost stickiness on the future earnings response coefficient is not significant. This shows that investors treat state-owned enterprises and non-state-owned enterprises differently when making investment decisions in stock trading. Owing to more regulation, the future development of state-owned enterprises is more likely to be disturbed by political factors, and there is a problem of soft budget constraints, which makes the correlation between the future earnings of state-owned enterprises and the value of stocks reduced. Finally, we find that cost stickiness can reduce the degree of incorporation of corporate information into stock prices, thereby reducing the synchronization of stock prices. In conclusion, this study shows that cost stickiness has a significant impact on investors' investment decision-making process and the information content of stock prices, which will affect the efficiency of resource allocation in capital market.

Cost stickiness reduces the information content in stock price by reducing the accuracy of earnings forecasts, which is not conducive to the information efficiency of capital market. If we can reduce the negative impact of cost stickiness on the accuracy of earnings forecasts, we can mitigate the damage of cost stickiness on the information efficiency of capital market. Raising analysts' and investors' awareness of corporate spending (e.g.: cost stickiness) can improve the accuracy of their earnings forecasts, not just when activity levels deteriorate. We suggest that listed companies voluntarily disclose relevant information about the company's cost stickiness, such as machinery and equipment information, personnel contract relationships, etc., or publicly disclose their own cost stickiness measurement values. Securities regulators should reasonably require listed companies with high-cost stickiness to give reasons. Securities companies should also carry out publicity and education on cost stickiness, and educate investors to pay attention to understanding cost stickiness and improve the accuracy of earnings forecasts, so as to improve the information efficiency of stock prices in the whole market.

**Data availability**

We selected all manufacturing companies from 2009 to 2021 as our samples (National Economical Industry Classification C1311-C4390). The data are obtained from CSMAR (China Stock Market & Accounting Research Database) and iFinD database.

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**Note**

1 State owned listed companies are often supported by government departments and other resources (Lin and Li, 2008), which makes the basic information of the company less integrated into stock prices.

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### Author contributions

ZS: the acquisition, analysis, or interpretation of data for the work; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. JL: substantial contributions to the conception or design of the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published.

### Competing interests

The authors declare no competing interests.

### Ethical approval

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**Correspondence** and requests for materials should be addressed to Zhoutianyang Sun.

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