Volume 7 · Issue 4 · December 2024 ISSN 2810-9295(Online)

# Journal of Sustainable Business and Economics

Volume 7·Issue 4·December 2024 ISSN 2810-9295(Online)

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🙌 Journal of Sustainable Business and Economics Research



ISSN 2810-9295







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# Journal of Sustainable Business and Economics

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## Journal of Sustainable Business and Economics https://journals.bilpubgroup.com/index.php/jsbe

### ARTICLE

# How Investor Sentiment Influences Stock Price Informativeness of Firms' Future Earnings: Evidence From China's Stock Market

Junfeng Wang

The University of Glasgow

### ABSTRACT

This paper explores whether the level of stock price informativeness about listed companies' future earnings is influenced by investor sentiment. In prior studies, investor sentiment, which can be regarded as the mood of the market, is defined as a belief about unjustified firms' future cash flow, investment returns and risks in capital markets. At the same time, stock price informativeness indicates how much information about a firm's future earnings is reflected by stock prices. Higher price informativeness indicates a higher market efficiency level. Using linear regression analysis based on panel data from China's stock market and listed companies, this research documents how stock price informativeness can be reduced by investor sentiment during market pessimism. However, although the explanatory power of future earnings over stock returns is strengthened by positive sentiment, it is not certain that positive sentiment increases price informativeness since the asset price bubble exists with extreme market optimism. Furthermore, the effect of sentiment on price informativeness would be weakened by higher state-owned shareholding. These empirical results imply that sentiment, to a certain degree, causes the investors' ignorance during pessimism and exaggeration during optimism, even though these companies actually have considerable earning prospects. While during pessimism, which usually happens after a crisis, the profitability and reliability of these state-owned enterprises are again emphasised by investors.

Keywords: Sentiment; Informativeness; Stock market efficiency; State-owned shareholding

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#### ARTICLE INFO

Received: 29 October 2024 | Accepted: 18 November 2024 | Published Online: 30 December 2024 DOI: http://doi.org/10.26549/jsbe.v7i4.21157

#### CITATION

W, J.F., 2024. How Investor Sentiment Influences Stock Price Informativeness of Firms' Future Earnings: Evidence From China's Stock Market. Journal of Sustainable Business and Economics. 7(4): 1–32. DOI: http://doi.org/10.26549/jsbe.v7i4.21157

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### **1. Introduction**

Literature commonly agrees that the purpose of financial markets and systems is to lead to the efficient allocation of financial capital and this efficient allocation requires that financial markets as a whole can price financial assets correctly <sup>[1, 2]</sup>. As one of the components of the financial system, the stock market also needs to be able to price shares reasonably and correctly to achieve a rational allocation of financial capital, ensuring that financial resources will flow to competitive industries and enterprises. According to the Gordon growth model, the value of shares of a company depends on the ability to earn profits and pay dividends in the future. The better the company's profitability and earnings prospects, the higher the value of its stock and the higher the market price of the stock <sup>[3]</sup>. Thus, to some extent, the stock price implies information about the firm's profitability in the future, which is defined as the stock price informativeness about the firm's future earnings <sup>[4, 5, 6]</sup>.

Capital markets rely on the arbitrage mechanism to price financial assets accurately. According to the traditional finance theory, investors trade based on their judgments in the light of the available information<sup>[7]</sup>. Although the information available to investors is not entirely consistent and some investors are better informed than others. As trading continues and market pricing continues to be adjusted, stock prices will eventually fully reflect all the information about the value of the stock, including both public and private information. It is then impossible to achieve higher than average market returns on a risk-adjusted basis by using current information, given that stock prices only respond to new information, while the traders who lack information, investment skills or rationality will eventually be eliminated from the market because of persistent losses <sup>[1, 8, 9, 10, 11, 2]</sup>.

However, researchers in psychology have found that, contrary to the traditional finance and efficient market theory, individuals are not as rational as the rational man hypothesis but are susceptible to psychological and behavioural influences that can lead to systematic deviation of decisions from rational expectations <sup>[12]</sup>. This behavioural effect also exists in the stock market and investor sentiment is one of the most important factors that influences investment decisions and market efficiency, as it can easily spread widely in societies where there is an informational cascade <sup>[13]</sup>.

As argued in prior literature, sentiment predicts the direction of stock price movements, as pessimism about the stock market enhances downward pressure on stock prices, while optimism links to a rise in stock prices <sup>[14, 15, 16]</sup>. Sentiment also negatively relates to stock returns <sup>[17, 18, 19]</sup>, negatively relates to market volatility <sup>[20, 21, 22]</sup>, and both extreme high or low sentiment leads to extremely high trading volume <sup>[17, 14]</sup>. Most importantly, investor sentiment impedes the realisation of the arbitrage mechanism based on rational investors and their private information described in traditional financial theory. The inability to predict how sentiment will change and the significant influence of sentiment on markets makes arbitrage become abnormally risky, costly and less attractive to arbitragers, while noise traders may be compensated for taking on excessive risks made by themselves and even receive higher returns than sophisticated investors <sup>[17]</sup>.

Moreover, some stocks are hard to price because of the difficulty and subjectivity of determining their true values, making these stocks more speculative than others and more likely to be impacted by prevailing sentiment <sup>[23]</sup>. From the perspective of investor sentiment research, although stock prices and returns depend on a firm's value, these two variables also relate to noise traders and market sentiment. Therefore, the arbitrage I mechanism that ensures stock market efficiency could be out of order and the stock prices could deviate from their fundamental value.

Although the association of investor sentiment with the stock market, the reason behind the association and the role of sentiment as a market signal have been well discussed, few studies have directly illustrated how and to what extent investor sentiment affects the stock market's ability to anticipate firms' future earnings and to generate rational pricing, i.e., the stock price informativeness. As for the research on stock price informativeness, although many papers have demonstrated how market and accounting institutions, such as income smoothing <sup>[24]</sup>, state ownership <sup>[25, 26]</sup>, investor protection <sup>[27]</sup>, corporate disclosure policy <sup>[28]</sup>, transparency <sup>[29]</sup> and credit ratings <sup>[30]</sup>, can affect the market's ability to predict firms' future earnings, few studies have focused on the effect of behavioural factors.

Therefore, in order to provide new evidence to fill this research gap, the objective of this paper is to investigate whether investor sentiment has an impact on the informativeness of stock prices and the accuracy of market pricing. Considering the effect of sentiment on stock markets described by previous studies, that pessimism would generate a greater effect than optimism does, I hypothesise that investors steeped in pessimism tend to ignore the fundamentals of the company and its true earning potential. Thus, stock prices during periods of pessimism will be less informative about firms' future earnings than during other periods. Meanwhile, I also incorporate state ownership as an analysed factor in the study, since, on the one hand, it has already been proved that state-owned shareholding reduces the stock price informativeness <sup>[26, 31]</sup>, on the other hand, attributes, such as large asset scales, long earnings history and a high proportion of tangible assets may make state-owned firms less sensitive to market sentiment <sup>[23]</sup>. Therefore, I hypothesise that higher state ownership reduces the effect of sentiment on stock price informativeness.

In my empirical analysis, I employ the panel data showing stock returns, firms' annual financial results and market sentiment index in A shares of China's stock market from 2004 to 2020, covering 27,051 firm-year observations and 3,709 listed firms across 312 industrial categories. Regression analyses were performed according to the Main Board and the ChiNext (the two main trading boards with different price limits and listing regimes) separately, to ensure that the characteristics of the different boards do not affect the robustness of the findings.

Finally, in line with prior studies, I found that investor sentiment negatively predicts the stock returns. Regarding my hypotheses, market pessimism reduces the market anticipation accuracy on firms' future earnings. Furthermore, I found that, although state ownership proportion negatively relates to stock price informativeness, higher state-owned shareholding weakens the effect of sentiment on stock price informativeness. These findings are all in line with the prior literature about sentiment analysis mentioned above.

The remaining parts of the paper are structured as follows: Section 2 contains the literature review and my hypothesis development. Section 3 presents the methodology and the research design. Section 4 presents the empirical analysis, including descriptive statistics, empirical results and a battery of sensitivity tests to ensure the robustness of my findings. Finally, Section 5 illustrates the conclusions of the study.

# **2. Literature Review and Hypothesis Development**

### 2.1 Literature Review

### 2.1.1 Theoretical Background: Efficient Market Hypothesis

In general, the primary task of capital markets is to provide a proper price as a signal for reasonable allocation of financial stocks and resources. This requires asset prices to fully reflect all available information at any time while the buyer and seller can make rational decisions based on the 'fair price'<sup>[8]</sup>. In the beginning, the traditional financial theory believed that this was achievable. Investors will adjust their investment decisions and therefore the asset price according to publicly available information. This process will be carried out within a short term and, therefore, it is impossible to achieve higher returns than average market returns by using currently available information, for example, earning announcements, given that stock price only responds to new information <sup>[1]</sup>. Even though there are investors who are not well-informed and make irrational investment decisions, arbitragers will always trade against them and thus converge the asset prices to their fundamental value, bringing the market back to efficiency <sup>[1, 9]</sup>. Those whose judgments bring mispricing will keep losing money to arbitragers and finally quit the market.

Yet this perfect access to information and market arbitrage mechanism seems to remain only at the theoretical level. All arbitrage opportunities require capital and are risky <sup>[32]</sup>. Access to information and arbitrage are still subject to limitations in real markets, which makes their effectiveness in real markets highly questionable. As noted by Gilson and Kraakman, the cost of accessing and processing information still remains a challenge in understanding how markets behave efficiently <sup>[10]</sup>. Although many researchers have developed various models to show how the market can act as if everyone is well-informed despite the costs, they still cannot reach a consensus regarding how markets reach efficient information and prices.

The seminal work of Beaver also indicated the weakness of Fama's theory in providing a precise definition for efficient market and information availability<sup>[7]</sup>. He argued that a securities market is efficient with an information system that includes all signals, data and knowledge investors use to shape their beliefs and expectations about future security prices. The market is considered efficient and prices are said to 'fully reflect' the information system, only if security prices behave as though everyone has equal access to that information system. If superior information, information asymmetry, costly information extraction and heterogeneous belief exist in the market, it is hard to say that the capital market is efficient. The above discussion illustrates that stock prices and returns cannot timely and accurately reflect a company's value and profitability, due to the existence of limitations on market arbitrage mechanisms and investors' access to the same information.

### 2.1.2 Theoretical Background: Decision-Making and Behaviour Research

Studies about individual decision-making and

behavioural finance and economy have confirmed the above obstacles to the realisation of efficient markets. Usually, the investor relies on expected returns or discount rates as the benchmark of investment decisions. Under the background of an efficient market, investors hold homogeneous beliefs among investors and the expected returns can be directly calculated according to the market returns, risk-free interest rates and the stock-to-market correlation <sup>[11, 7]</sup>. However, in reality, investors may process the same information differently and the individual's background, analysis abilities and the content of the assessed information may lead them to different conclusions, investment decisions and heterogeneous expectations on the stock market <sup>[33]</sup>.

Even though investors have corresponding analysis abilities and the same access to market information, they may still make mistakes with the heuristics in cognitive instincts. When making decisions, individuals may unintentionally employ heuristics, the efficient shortcuts to save energy for mental activities but which usually lead to systematic errors and biases <sup>[12]</sup>. Daniel et al. found the signs of systematic biases in the stock market that investors may overestimate the precision of their private information signals and their overconfidence affects investment decisions, thus leading to overreaction and underreaction to given market signals and information, causing excess volatility in financial markets <sup>[34]</sup>. The above results suggest that investors are subject to a range of non-fundamental factors, misjudging the value of a stock and causing systematic price deviations from fundamental value.

### 2.1.3 Theoretical Background: How Sentiment Affects Stock Markets

The seminal work of DeLong et al. further describes how behavioural factors, mainly investor sentiment, affect stock prices, trading and market efficiency by testing a model including both rational arbitragers who are equipped with a Bayesian approach to evaluate stocks and returns and noise traders who are sentiment-driven <sup>[17]</sup>. Their analysis shows that investor sentiment significantly affects stock prices, returns and trading volume. The optimistic sentiment is followed by the increasing stock price but relatively lower return and extreme high or low sentiment will usually be followed by high trading volume. Most importantly, it is shown that sentiment-driven traders disrupt the function of the arbitrage mechanism, which is described as the key of the efficient market.

Furthermore, due to the unpredictable random belief of noise traders, stock prices often deviate from fundamental value to varying degrees and stock investment also becomes abnormally risky, reducing the attractiveness of arbitrage and the efficiency of the arbitrage mechanism. Moreover, unlike the description of efficient market theory, noise traders may be compensated for bearing the risk created by themselves, letting them stay in the market. The work of D'Avolio<sup>[35]</sup> and Wurgler and Zhuravskaya<sup>[36]</sup> also showed that it could be risky and costly for arbitraging by holding, trading and betting, especially for small stocks with uncertain values.

The incorporation of non-fundamental information into investment decisions and market sentiment is an important reason why sentiment-driven traders lead to asset prices deviating from their fundamental value. The research of Brown <sup>[37]</sup> has shown that non-fundamental information which is completely unrelated to the company and the market, such as sports game results <sup>[38]</sup>, weather conditions <sup>[39]</sup>, aviation disasters <sup>[40]</sup>, holidays <sup>[41]</sup>, and seasonal shortness of days <sup>[42]</sup>, is also incorporated into the noise trader's decision-making and market sentiment; while the sentiment signal would be strengthened during spreading and further influence other investors through information cascades <sup>[13]</sup>.

Such arguments have also been supported by research about how media can influence and guide the trend of investors' sentiment. Sentiment expressed directly by the news media can affect the market and prices <sup>[43]</sup>. Additionally, Tetlock found that high media pessimism robustly brings stress on market price movement even though the information carries no fundamental content about firms' and equities' value and low market returns lead to high media pessimism again <sup>[14]</sup>. The work of Mutz and Soss also

showed that media organisations can change public sentiment by perceiving community salience, setting news agendas and affecting opinion climates <sup>[44]</sup>. These approaches allow the media to change people's attention and sentiment with the same underlying facts. This effect is more pronounced than ever as social media is growing rapidly. Compared to traditional media such as newspapers, internet news and social media have a much greater power to guide market sentiment <sup>[22]</sup>.

This literature provides an important insight that the stock market does not function as efficiently as described in the theoretical hypothesis; investor sentiment has an impact on asset pricing and market efficiency, and this is the theoretical premise of my research.

### 2.1.4 Measures of Sentiment

Generally, sentiment indicates the public opinions and attitudes of the community to a certain issue <sup>[44]</sup>. In a financial context, it is defined as the belief about unjustified firms' future cash flow and investment risks in capital markets <sup>[23]</sup>, which can be divided into positive/bullish, neutral and negative/bearish <sup>[15]</sup>.

Multiple approaches have been developed to estimate sentiment. In general, the measures can be categorised into direct measures and indirect measures. The direct measures for sentiment use surveys by posing questions to investors randomly, collecting information about investors' emotions and expectations and forming the investors' sentiment index, for example, the investor sentiment survey data undertaken by the American Association of Individual Investors, the Consumer Sentiment Index by the University of Michigan and the FTSE 100 Investment Sentiment Scoreboard by Hargreaves Lansdown.

Furthermore, there are three non-direct measures of sentiment. The first is calculated as a measure of market sentiment by analysing the sentiment of a large number of texts on the Internet and calculating a synthesis of the investors' views extracted from them on the form of the rise and fall of the stock market at the time, such as the Fear and Greed Index by CNN and the China investors' index by Peking

University. The second measure is a combination of several market-related indicators that are calculated to construct a corresponding market sentiment index, for example, Baker and Wurgler constructed a measure of stock market sentiment based on the common variation of the closed-end fund discount, NYSE share turnover, the number of IPOs, the average first-day returns on IPOs and equity share in new issues and dividend premium <sup>[19]</sup>. Chen, Chong and Duan followed this approach and used daily data to construct a similar sentiment index for the Hong Kong stock market <sup>[16]</sup>. The last type of sentiment uses the significant correlation between some continuous variables or single events and sentiment, such as the weather, sports match results and daylight hours mentioned above, and uses this to infer investor sentiment, since these variables and events have been proven to have an impact on market sentiment [38, 39, 40, 41, 42]

#### 2.1.5 Current Empirical Studies

Following the theoretical framework of DeLong et al. and the approaches to measure sentiment noted above, many researchers have offered empirical evidence of sentiment's effects on the market <sup>[17]</sup>. Investor sentiment positively relates to stock prices and is negatively correlated with following returns in the short term <sup>[14, 18, 19, 45]</sup>. Low current market sentiment usually implies that future stock returns will be higher as low sentiment-induced trading has brought stock prices lower than their fundamentals <sup>[18]</sup>.

Overreaction by investors is the key factor in this situation, in addition to the limited arbitrage and herding behaviour. Investors' overreaction or underreaction to market signals causes the incorrect valuation of stocks because of psychological biases, such as overconfidence <sup>[23, 18]</sup>. This explanation is consistent with Tversky and Kahneman, who found that individuals tend to over-exploit limited information when deciding under uncertainty <sup>[46]</sup>. More specifically, investors overreact to noise information with high strength but low statistical weight and underreact to information with low strength but high statistical weight, such as a firm's earning announcements <sup>[47]</sup>.

Sentiment-driven traders' overreaction and underreaction to market signals also generate excessive long-lived price fluctuations, which are more volatile than what would be justified by dividend volatility alone <sup>[48]</sup>, while relatively extreme sentiment usually indicates high market volatility <sup>[22, 17, 37]</sup>. However, unlike the conclusion regarding the effect of sentiment on stock prices, this view is counter to some studies. Brown and Cliff argued that although sentiment levels and changes are closely related to prevailing market returns, sentiment is not a strong predictor of near-term future stock returns and market volatility <sup>[49]</sup>; they believed that institutional sentiment has a higher effect than the individuals in the market. Wang et al. illustrated that most of our sentiment measures are caused by returns and volatility rather than vice versa <sup>[50]</sup>. Moreover, Audrino et al. showed that the effect of sentiment is generally small and has only short-term effects on volatility<sup>[21]</sup>.

In addition to the general influence of sentiment on the market, the empirical evidence also shows that sentiment has a significant asymmetrical impact on price, return and volatility. Sentiment has a greater effect on stock prices in stock market downturns than in stock market expansions <sup>[15]</sup>. Negative sentiment or media content carrying a pessimistic mood usually outperforms that of positive indices when predicting price movements, leading to higher market fluctuations <sup>[22, 45, 51, 15]</sup>. These investigations and results are consistent with the loss aversion theory proposed by Tversky and Kahneman<sup>[52]</sup>. Investors are more sensitive to good news when they are optimistic and more sensitive to bad news when they are pessimistic <sup>[53]</sup>. Based on these observations, I infer that market sentiment's impact on stock price informativeness is different between optimism and pessimism and I will make subsequent hypotheses based on this assumption.

The same sentiment also has an asymmetric impact on firms of different types. Overall, sentiment has a greater impact on small stocks, growing stocks, young stocks, high volatility stocks, unprofitable stocks and non-dividend-paying stocks <sup>[23, 15, 18, 53]</sup>.

Without a sufficient history of earnings and a high degree of uncertainty about the future, the true value of such stocks is difficult to define, while stocks of companies with a long history of earnings, tangible assets and stable dividends are less sensitive to sentiment. The more optimistic the market sentiment, the more likely small stocks are to be overvalued, while bond-like stocks are likely to be undervalued <sup>[23]</sup>. This observation is the base of my second hypothesis. Since state-owned firms generally belong to traditional industries with large asset scales, I infer that sentiment's impact on price informativeness of state-owned firms' stocks should be less than on other stocks.

### 2.1.6 Sentiment's Impacts on China's Stock Market

Although the impact of sentiment on stock markets is similar in general, it may still show some differences depending on the markets, while the research are mainly concentrating on the advanced markets situation. As the second largest stock market and an emerging market, there are institutional differences between the China stock market and the U.S. and European stock markets, which can be used for sentiment studies. On the one hand, China's information disclosure system is not as developed as that of the advanced markets while investors may blindly rely on relevant information and the majority opinion to make decisions <sup>[70, 63]</sup>, and on the other hand, there are more limitations on short-selling mechanisms <sup>[69]</sup>, IPOs <sup>[71]</sup>, and the price limits <sup>[65]</sup> in the China stock market, while these constraints have been proved that interrupt markets from improving information environment and allowing arbitrage, and therefore increasing the noise trader risk <sup>[19]</sup>. These special market characteristics and the institutional changes that have taken place in the Chinese market over time are likely to provide us with new insights into how sentiment affects stock prices and investor judgment.

Based on the above theoretical foundations, measurement approaches and empirical evidence, we can generally infer that, in addition to public and private information about firm fundamentals, noise information about firms' value and investors' over- or under-reaction to fundamental information can also affect stock prices, returns and volatility through investor sentiment. These non-fundamental contents or irrational reactions contained by sentiment can lead to deviation of stock prices from company fundamentals, resulting in excessively high or low returns and market volatility that cannot be explained by fundamental information. Thus, based on the prior literature, the objective of my research is related to the work of Li et al. <sup>[54]</sup>, focusing on how investor sentiment influences stock return and pricing, to what extent that sentiment affects the explanatory power of firms' future earnings over the stock return, and how state-owned shareholding affect this interaction in China stock market.

Meanwhile, the limitations and shortcomings of the literature also bring me advice on my methodology and measurement. For example, Wang et al. pointed out that sentiment could be caused by market return <sup>[50]</sup>, which is ignored by many prior studies, and Chen, Chong and Duan illustrated that using daily data to construct the sentiment measure leads to excessive volatility and noise in their research <sup>[16]</sup>. Therefore, I employ lagged stock return as the control variable and yearly panel data for measure of sentiment, to avoid endogeneity and noise problems in my analysis.

# 2.1.7 Gaps and Limitations in the Current Literature

Current studies have conveyed multiple aspects of the market that could be affected by investor sentiment. However, there are also limitations and gaps in the literature. First, some of the regression analyses addressing the impact of investor sentiment are considered to be insufficiently rigorous. For example, studies that deny the impact of investor sentiment argue that investor sentiment is caused by prior stock returns and volatility <sup>[50]</sup>, and therefore is just the investors' feeling, rather than a cause of market changes. Meanwhile, many studies illustrating the sentiment effect have not considered previous stock returns and volatility as the control variables, and thus, their models may have endogeneity problems. Second, most of the studies did not use the same data and measurement standards.

Although Baker and Wurgler constructed a methodology for calculating the investor sentiment index <sup>[19]</sup>, some studies still use their approaches to calculate the corresponding investor sentiment, which may also lead to inconsistencies in their findings. In addition, differences in the duration and frequency of observation of studies may lead to opposing conclusions. Chen, Chong and Duan mention that using high-frequency data could lead to excessive volatility and noise of sentiment measures <sup>[16]</sup>. Finally, the empirical literature mainly focuses on the effects brought about by sentiment to different market signals, it but seldomly studies how market sentiment influences the asset pricing process and results of the stock market. This question relates to the extent to which market sentiment affects the efficiency and accuracy of market pricing and the results may provide policymakers implications about how to implement reforms to improve the efficiency of stock markets in allocating financial resources.

#### 2.2 Hypothesis Development

The hypotheses of this paper mainly stem from the discrepancy between theory and reality as well as from the conclusions of studies that partially reread each other.

Theoretically, the value of shares is determined by the cash return that a company pays to its shareholders. This in turn is directly related to the profit that the company can realise, and therefore the company's profit determines the pricing of shares and the rate of return. When the firm's earning prospect is constant, the higher the bid, the lower the rate of return realised. According to the Gordon Growth Model, the share price is:

$$P = \frac{Div}{R-G}$$
, while  $R = \frac{Div}{P} + G$ 

R equals rate of return, G equals to the growth rate of dividend, and Div is the dividend in the first period <sup>[3]</sup>. Because dividend is decided by firm's

earning ability, the return of stock is also determined by firm's current and future earnings.

In an efficient market, current stock returns reflect a firm's profitability, which is partly determined by unexpected profits realised by the firm in the current period and partly by investors' expectations of the firm's future earnings prospects. Furthermore, news and shocks that may affect the firm's future earnings prospects, but not its current profits, will cause investors to reevaluate their expectations of the firm's future profits <sup>[4, 5]</sup>. Since investors evaluate the stock prices based on firms' earning information, the price informativeness level, which means how much information stock prices contain about future earnings, determines the effectiveness of asset pricing in the stock market. When more information about firms' future earnings is included in the current stock return, the higher informativeness and informational efficiency of the stock price, which leads to a more efficient allocation of resources <sup>[2]</sup>.

Stock prices contain a wide range of information that is not entirely public, including both public and private information derived from insider or personal analysis. By analysing the explanatory power of the traditional asset pricing model, Roll argued that the low R2 statistic for common asset pricing models is due to strong firm-specific return variation unrelated to public information <sup>[58]</sup>. He considered that this implies both private information and else occasional frenzy unrelated to concrete information.

The sentiment analysis researches support the latter conjecture, which proposes that the sentiment and noise trader frenzy will twist the price of shares, drive it away from the fundamentals, and lead to excess market fluctuations or turmoil. When sentiment is positive, investors are more sensitive to good earning news, while negative sentiment will bring higher sensitivity to bad earning news. There is an asymmetric effect of different market sentiments on stock returns, market pessimism would exert a greater impact on stock returns than optimism and drive prices downward. Investors also react more violently to negative news, including both fundamental and noisy information <sup>[15, 14, 22, 53, 72]</sup>.

However, for the assertion by Roll <sup>[58]</sup>, Durney et al. believed that greater firm-specific stock return variation is brought by the incorporation of private information and arbitrage instead of the investors' synchronous frenzy causing deviation of prices from stocks' fundamentals, and therefore, is associated with more informative stock prices and more efficient market <sup>[2]</sup>. This argument is consistent with Wurgler, arguing that synchronicity of stock return is negatively correlated with the quality of capital allocation <sup>[74]</sup> and Durney et al., who argue that industries and firms for which firm-specific stock price variation is larger use more external financing and allocate capital more efficiently <sup>[73]</sup>; it also partially supported by Morck et al. [56], illustrating that property right protection is linked with the firm-specific variation compared to the systematic variation in the developed markets. However, the association between variations in emerging markets and the noise trader risk is still considerable.

Considering the above arguments and that negative sentiment has a stronger impact on the market than positive sentiment, investors pay more attention to good earning news during optimism and are more sensitive to bad news and non-statistical news during pessimism <sup>[53, 47]</sup>, I infer and test the following hypothesis:

*Hypothesis 1*: Positive sentiment increases the explanatory power of future earnings on its stock return, while negative sentiment reduces the explanatory power of future earnings on stock returns.

The underlying theory of the first hypothesis is that asymmetry influences sentiment on investors' cognition, making investors hold more expectations of profitable firms during optimism, while underestimating firms' earning prospects during pessimism. However, it is also proved that characteristics of the market, such as openness degree, would influence the impact of cultural factors effect on stock price informativeness and efficiency <sup>[59]</sup>. In order to corroborate my first hypothesis regarding the effect of country and market characteristics, I test how state-owned shareholding influences the sentiment's impact on stock price informativeness. Unlike many former socialist countries, China still retains a large part of its state-owned enterprises (SOEs) and on that basis has carried out a series of reforms to improve the operational efficiency and competitiveness of state-owned enterprises. Those reforms include the separation of ownership and operating rights (1978-1992) and mixed ownership reform (2003-). The first of these allows SOEs to make their own operating decisions according to the market situation and the latter allows private capital to own and trade the share of the SOEs, gradually loosening the control of the state and transforming Chinese SOEs from what was originally the arm of the state to a profit-driven economic entity <sup>[55, 75]</sup>.

Generally, contrary to the pessimistic opinions, the reforms concentrating on SOEs and financial markets have made significant progress by increasing the quality of information and corporate transparency, and therefore, leading to higher state-owned firms' share price informativeness <sup>[31]</sup>. For example, the Split Share Structure Reform (2005-2006) that converted non-tradable shares owned by the state into tradable shares strengthened the corporate governance incentives of state shareholders to reduce the information asymmetry in Chinese listed firms and massively increased the earning information contained by the price of listed SOEs<sup>[25]</sup>. Although these reforms make solid improvements in SOEs' management, competitiveness, and stock price informativeness, it is argued that the price informativeness of SOEs is still relatively lower than the informativeness of privately owned firms' stock prices.

Carpenter et al. attributed this to the unpredictability at the policy level, as the SOEs are more affected by national policies and government decisions than the private sector <sup>[31]</sup>. Goodell et al. also found the price synchronicity of SOEs is about 9.0% to 15.4% larger than that of non-SOEs, indicating that SOEs have less informative stock prices <sup>[26]</sup>. However, it is also proved that the effect of investor sentiment is weaker on bond-like stocks, which mainly belong to traditional industries with a history of long and stable earnings, dividends and large amounts of tangible assets. Such companies may instead be undervalued when market sentiment is optimistic (see, for example, <sup>[23, 15, 18, 54]</sup>. Most of the Chinese state-owned enterprises (SOEs) are involved in traditional industries, such as energy, transport and public utilities and their stocks have bond-like characteristics <sup>[55]</sup>. In line with the above research and arguments, I propose and test the second hypothesis:

*Hypothesis 2*: An increase in state ownership will reduce stock price informativeness, while the influence of sentiment on the relation between current stock returns and firm future earnings is expected to be weaker (stronger) with higher (lower) firms' state-owned shareholding.

### 3. Methodology

The model used to test the hypothesis was originally designed by Collins et al. to test the lack of timeliness of earning reports and the weak contemporaneous return-earnings association<sup>[4]</sup>. It was later modified by Lundholm and Meyers to measure how disclosure quality affects the association between stock return and current and future earnings of the firm <sup>[6]</sup>. The rationale and also the advantage of this method is to introduce the moderation effect to test whether the examined variables affect the explanatory power of a company's future earnings over current stock returns, thus directly demonstrating whether the variables affect the market's ability to predict a company's future earnings and, accordingly, its ability to accurately price the stocks base on firms' profitability.

However, this method has potential limitations. Namely, when the examined variables enhance the explanatory power of earnings over the current stock returns, it is still not clear that this enhancement increases the stock price informativeness and market efficiency since the enhancement could be explained in different ways. For example, the empirical results show that positive market sentiment enhances the relation between current stock returns and firms' future earnings, while this enhancement may be due to the investors' excessive expectation of profitable firms in a bullish market and may eventually lead to an asset bubble and market crisis instead of higher pricing accuracy and market efficiency.

An alternative method to measure the price information content is stock price synchronicity, which is illustrated by Morck et al. <sup>[56],</sup> Piotroski and Roulstone<sup>[57]</sup> and Goodell et al.<sup>[26]</sup>. Price synchronicity measures the degree to which individual stock prices move together with the market and industry indexes and it is used as an inverse measure of stock price informativeness. However, as mentioned by Roll [58], stock price idiosyncratic or synchronic variance is generated by both noise and new information, while the price synchronicity caused by the latter does not necessarily imply lower price informativeness, and thus, it is considered a problematic measure [31, 59]. Besides, compared with the methodology of Lundholm and Meyers <sup>[6]</sup>, the approach to price synchronicity cannot visualise how the tested variables affect the ability of the market to evaluate the profitability of a firm, which is key to the discussion of how the tested variables affect the effectiveness of market pricing.

The idea of the model by Lundholm and Meyers is that investors in the market are thought to price stocks by considering the unexpected portion of current earnings,  $UE(E_{i,t})$  and expectations of future earnings,  $E(E_{i,t+1,+3})$  together; thus leading the investment to a corresponding return <sup>[6]</sup>.

$$R_{i,t} = a_0 + b_1 U E(E_{i,t}) + b_2 E(E_{i,t+1,+3}) + e_{i,t}$$

The modified version of the model uses earnings in the last year as the proxy of the expected portion of the current earnings and uses realised current earnings minus the past earnings to get the unexpected part of the current earnings, while realised future earnings serve as the proxy of expected future earnings at the current period. It expresses the current return as a function of future, current and past earnings and noise information as follows:

$$R_{i,t} = a_0 + b_1 E_{i,t-1} + b_2 E_{i,t} + b_3 E_{i,t+1,+3} + b_4 R_{i,t+1,+3} + e_{i,t}$$
(1)

The left hand is the dependent variable,  $R_{i,t}$ , indicating the annual stock return of firm i for period t, measured over 12 months from 8 months before the fiscal year t end to 4 months after the fiscal year t end and showed at the end of period t, since the listed companies in China are required to illustrate the annual financial report before April 30<sup>th</sup>. On the righthand are explanatory factors:  $E_{i,t-1}$  denotes the firm i's earnings for the last fiscal year illustrated by the annual report (at the end of period t-1, when 4 months later the fiscal year t-1),  $E_{i,t}$  is the earning for current fiscal year (illustrated at the end of period t), and  $E_{i_{1}i_{1}+3}$  indicates the sum of future earnings of the firm i for the three years following the current fiscal year t (illustrated at the end of period t+1, t+2, and t+3). Because adding more periods only brings little explanatory power, the future earnings only cover 3 periods <sup>[4]</sup>. All the current and future earnings are scaled by the market value of equity four months after the t - 1 fiscal year-end (at the end of period t-1 and also the starting point of  $R_{i,t}$  measurement).  $R_{i,t+1,+3}$ denotes the sum of stock return for the three years following year t, starting four months after the year t fiscal year-end and serving as the control variable.

The reason behind it is that realised earnings after the current period t are not equal to the expected future earnings at period t. Using the realised future earnings as the proxy of currently expected future earnings introduces the measurement error generated by ignoring shock events that would happen in future periods but are not anticipated in the current period. Such events would affect earnings in the future and lower the accuracy of current anticipation. Since unexpected shock to future earnings should affect investors' expectations in future and also generate future returns,  $R_{i,t+1,+3}$  can be used as the instrumental variable measuring the future shock events and as the control variable to the regression equation, ensuring that irrelevant components positively related to future returns are removed from future earnings and therefore control for this measurement error. Therefore,  $E_{i,t+1+3}$  and  $R_{i,t+1+3}$  together measure the market's current expectation on future earnings<sup>[6]</sup>.  $e_{i,t}$  is the error term including the noise information.

In line with Lundholm and Myers <sup>[6]</sup> and Collins et al. <sup>[4]</sup>, the coefficient of  $E_{i,t-1}$ ,  $b_1$ , captures how

market response to prior earning as the benchmark of current earning anticipation or the already anticipated portion of current earnings and is expected to be negative. The coefficient of  $E_{i_1}$ ,  $b_2$ , represents the market response to the unexpected portion of current earnings compared to the prior earnings and is predicted to be positive. The coefficient of  $E_{i,t+1+3}$ ,  $b_{3}$ , which is predicted to be positive, captures the market response to information about future earnings that is anticipated but not reflected in current and past earnings. Lastly, future returns,  $R_{i,t+1+3}$ , reflect the currently unexpected shock events which do affect a firm's fundamentals and brings a surprise component to the future earnings. When the effect of shock events happening in the following three years is positive overall, it would increase the return in the future,  $R_{i,t+1,+3}$ , and the current return,  $R_{i,t}$ would tend to be undervalued, otherwise, the current return would tend to be overvalued. Therefore, the coefficient of  $R_{i,t+1,+3}$ ,  $b_4$ , is expected to be negative.

The reason for the final adoption of the Lundholm and Myers<sup>[6]</sup> methodology in this paper is that, unlike the Five Factors Model illustrated by Fama and French<sup>[60]</sup> and the SYN method, this method introduces firms' future earnings as the explanatory variable, and allows the addition of interaction factors to test the effect of multiple variables on the explanatory power of earnings over stock returns, thus, directly demonstrating how these factors influence stock price informativeness. This attribute is highly consistent with my topic. However, the shortcoming of this method is that researchers cannot obtain future earnings data or investors' expectations directly, making this approach unable to be used for predicting stock returns.

This approach has also been extensively used by prior studies to test the impact of various factors on the market's ability to anticipate the firms' future earnings and the efficiency of the market's incorporation of the companies' future profits into the stock price.

Various studies have shown that while markets can set stock prices and returns based on the fundamentals and profitability of firms, this ability is often influenced by other factors, some are institutional and others are behavioural. For example, Tucker and Zarowin showed that income smoothing can raise the stock price informativeness <sup>[24]</sup>. The change in the current share price of higher smoothing firms contains more information about their future earnings than the change in the share price of lower smoothing firms. Haw et al. <sup>[27]</sup> and Dasgupta et al. <sup>[29]</sup> showed that a more transparent market environment with better financial disclosure, earnings quality and information dissemination with media is significantly associated with the stock price that is more informative about firms' future earnings. Additionally, unexpected shocks in the future should be less surprising when they actually happen.

Chou also prevented credit ratings from conveying information about the firm's future earnings to the capital markets <sup>[30]</sup>. The current stock returns of rated firms reflect more future earnings than the stock returns of non-rated firms and the informativeness level would be higher if the firm obtained a better rating. As for the behavioural factors, Tsalavoutas and Tsoligkas illustrated that uncertainty avoidance, as an important aspect of national culture, influences stock price informativeness negatively <sup>[59]</sup>. Where people show higher ambiguity and uncertainty avoidance, the information about future earnings included by stock price tends to be less. Luckily, this effect can be neutralised by market openness.

Consistent with former studies, to test my hypothesis, I extended the equation by adding the sentiment variable in Eq. (1), as a main effect and as an interaction with future earnings and future returns. Eq. (2) is as follows:

$$R_{i,t} = a_0 + b_1 E_{i,t-1} + b_2 E_{i,t} + b_3 E_{i,t+1,+3} + b_4 R_{i,t+1,+3} + b_5 S_t + b_6 S_t * E_{i,t+1,+3} + b_7 S_t * R_{i,t+1,+3} + Controls_{i,t} +$$
  
Indstry FE + Year FE +  $e_{i,t}$  (2)

Among the added variables,  $S_t$  indicates the value of investors' sentiment index during the period t, measured by the average number of monthly sentiment index in period t ( $S_t$  describes the market sentiment throughout the whole period t, while  $R_{i,t}$  indicates the realised stock return at the end of period t). Since  $E_{i,t+1,+3}$  and  $R_{i,t+1,+3}$  together measure the expected future earnings, to test the hypothesis,  $S_t$  should also interact with both  $E_{i,t+1,+3}$  and  $R_{i,t+1,+3}$ . In line with the consensus arguing that sentiment negatively forecasts aggregate market return on average <sup>[17, 37, 23, 48, 18]</sup>, the coefficient of  $S_t$ ,  $b_5$ , is expected to be negative.  $S_t * E_{i,t+1,+3}$  is the interaction between sentiment and the sum of future earnings.

The coefficient of these factors,  $b_6$ , describes the incremental impact that sentiment,  $S_t$ , has on the explanatory power of  $E_{i,t+1,+3}$  over  $R_{i,t}$ . In line with the first hypothesis,  $b_6$  is expected to be positive, indicating that more extreme sentiment is associated with a lower market ability to anticipate and consider the firms' earning prospects during stock value estimation.  $R_{i,t+1,+3}$  is used as the instrumental factor describing the portion of future shocking unexpected events and indirectly affects the current stock return. Although sentiment may affect investors' expectations about future events and reactions to unexpected shock, this influence is not covered by my research question and hypothesis. Therefore, I have no prediction on the coefficient of this variable.

To test my second hypothesis, I extended Eq. (2) by introducing  $SOE_{i,t}$  as the proxy of state-owned shareholding proportion, as the main effect, the interaction with:

$$E_{i,t+1,+3}$$
,  $R_{i,t+1,+3}$ ,  $S_t * E_{i,t+1,+3}$ , and  $S_t * R_{i,t+1,+3}$ .

The modified equation is as follows:

$$\begin{split} R_{i,t} &= a_0 + b_1 E_{i,t-1} + b_2 E_{i,t} + b_3 E_{i,t+1,+3} + b_4 R_{i,t+1,+3} + \\ & b_5 S_t + b_6 S_t * E_{i,t+1,+3} + b_7 S_t * R_{i,t+1,+3} + b_8 SOE_{i,t} \\ & + b_9 SOE_{i,t} * E_{i,t+1,+3} + b_{10} SOE_{i,t} * R_{i,t+1,+3} + b_{11} SOE_{i,t} * \\ & S_t * E_{i,t+1,+3} + b_{12} SOE_{i,t} * S_t * R_{i,t+1,+3} + Controls_{i,t} + \\ & \text{Indstry FE + Year FE} + e_{i,t} \end{split}$$

(3)

Where  $SOE_{i,t}$  is the percentage of stateowned shares among the total shares,  $SOE_{i,t} * E_{i,t+1,+3}$  measures how state-owned shareholding impacts the association between current return and future earnings,  $SOE_{i,t} * S_t * E_{i,t+1,+3}$  indicates how state ownership affects sentiment's impact on relation between  $E_{i,t+1,+3}$  and  $R_{i,t}$  (i.e. stock price informativeness). Consistent with Goodell et al. <sup>[26]</sup> and Carpenter et al. <sup>[31]</sup>, state-owned shares reduce the price informativeness of the stock price. Therefore, I predict that  $b_9$ , the coefficient of  $SOE_{i,t} * E_{i,t+1,+3}$ , to be negative. In line with the second hypothesis, which predicted the effect of sentiment would be reduced as the firm has more state-owned shareholding, I expect  $b_{11}$ , the coefficient of  $SOE_{i,t} * S_t * E_{i,t+1,+3}$ , to be negative.

Finally, I employed panel data analysis with OLS regressions and introduced year and industry fixed effects in both regression equation (1) and (2), in order to make sure that the result was not driven by industrial characteristics or any particular sub-period during the sample period.

I also introduced a series of control variables, including total equity market value at the end of each period t (the measurement period is the same as  $R_{i,l}$ ),  $MV_{i,t}$ , firms' last period price to earnings ratio,  $PE_{i,t-1}$ , price to book value ratio,  $PB_{i,t-1}$ , Tobin's Q, *Tobin's*  $Q_{i,t-1}$ , return on equity ratio,  $SOE_{i,t-1}$ , book value of total equity,  $TE_{i,t-1}$ , and finally, stock return for the last period,  $R_{i,t-1}$ .

### 4. Sample Selection and Data

I selected all listed A-shares of the Shanghai Stock Exchange (SHSE), and Shenzhen Stock Exchange (SZSE) in the China stock market as the sample. The China stock market was chosen for the sample because its characteristics fit well with the issues discussed in this paper. Firstly, the China stock market has become the second largest in the world, accounting for 10% of the global equity market, and has reached a level of price informativeness comparable to that of the United States market. This means that the ability of the China stock market to reflect information about companies' future profits has improved dramatically, which provides an important prerequisite for my discussion <sup>[31]</sup>. In addition, China's stock market consists mainly of domestic individual investors, of which the share of individual investor trading volume exceeds 80% in 2021, which makes China's stock market sensitive to domestic investor sentiment, while reducing the interference of foreign investor factors <sup>[31, 62, 63]</sup>.

I started my sample period in 2004 since the investor sentiment index started in mid-2003. As the 2024 financial reports of sample companies had not yet been released during the study, I ended the sample period by 2020 as the 'current period', to be able to calculate the sum of future earnings for the following three years (from 2021 to 2023). The sample period contains three Chinese stock market crises, in 2008, 2015 and 2020, respectively, all witnessing massive stock market turmoil. In addition to being divided by exchange, the Chinese stock market is also divided by trading boards containing different types of listed companies and listing requirements. Among them, the Main Board has a more stringent profit records requirement for IPO companies and contains many large listed companies and state-owned listed companies. ChiNext board has a lower profit records requirement for IPO firms, mainly serving firms with innovative businesses and higher growth rates. In addition to different requirements for IPO and types of listed firms, the trading boards adopt different price limits, while the main board allows 20% of daily share price fluctuation (+/- 10%), ChiNext allows 40% of daily share price fluctuation (+/-20%) after 2020. Moreover, the ChiNext Board changed the listing regime from the previous approval-based system to a registration-based system in 2020, while the Main Boar did not complete this reform until 2023.

To measure the market sentiment, I used the standard Investor Sentiment Index (ISI) as the proxy of investor sentiment in China, which was created by Wei et al. <sup>[64]</sup> according to the sentiment instructor formula proposed by Baker and Wurgler, to describe the market sentiment during the sample period <sup>[19]</sup>. The negative and lower ISI number indicates the more pessimistic market sentiment, while the positive and higher number indicates the more optimistic sentiment and 0 indicates the neutral level. In line with the annual return and earning data, I calculated the annual average of this monthly

indicator (ISI) to measure the annual investor sentiment over the sample period (over 12 months, the starting and ending points are the same as the measured period of return).

For the state-owned shareholding proportion, I used the number of state-owned shares compared to the total number of shares disclosed in the annual reports of companies listed on the main board of the A-share market as an indicator of the proportion of state-owned shares. For the remaining key variables, firms' earnings and stock returns, I used the figures illustrated by annual financial reports and stock price, to calculate the firm's profits scaled by each firm's last market value of equity and the stock return at the end of each period. As the Science and Technology Innovation Board (STAR) and Beijing Stock Exchange (BSE) have only just been established in recent years, there is insufficient data available and therefore they are not included in the discussion.

Finally, I retrieved all the data on the key variables, control variables and fixed effects from the China Stock Market and Accounting Research database (CSMAR). After excluding firms with observation gaps larger than 3 periods, my final sample covered 27,051 firm-year observations, corresponding to 3,709 listed firms across 312 industrial categories.

# 5. Empirical Results

### **5.1 Descriptive Statistics**

**Table 1** illustrates the description of the statistics for all earnings, stock returns, sentiment index, state-owned shareholding and firm-specific control variables used in the model. According to the results, the last earnings, current earnings and future earnings are all left-skewed, given that the mean value of these variables is lower than the median number and all of the mean and median numbers of earnings are higher than 0, indicating that the majority of listed companies on A share are able to maintain or realise profits while few companies face relatively significant losses. Meanwhile, the last, current and future returns are all right-skewed, having mean values higher than the median value, while the mean values of the last and current returns are positive and median values are negative. This indicates that the returns of most stocks are concentrated in the lower range and even have negative returns in the long term but a few stocks have very high returns. These attributes of firms' earnings and stock returns are in line with the prior literature <sup>[27, 59]</sup>.

As for the two influencing factors, the sentiment index is right-skewed, with a mean value above the median, and the median value is negative, showing that more than half the time investor sentiment is pessimistic or cautious about the market during the sample period. However, there are certain periods when sentiment is extremely positive and these extremes of positive sentiment pull up the overall average since the absolute value of the max sentiment index is 57.6% higher than the minimum value. These periods maybe when the market is experiencing significant gains or when there is significant positive news. The state-owned shareholding proportion is also right-skewed, showing that the majority of companies listed on the China stock market are private; state-owned enterprises, on the other hand, generally have a mix of state and private capital holdings. However, as can be seen from the maximum value of state ownership, there are still a small number of companies that are almost exclusively owned by state capital.

To describe and compare the characteristics of shares listed in different boards, I further separated the description of the statistics into Main Board and ChiNext Board. Table 2 presents the firm-level descriptive statistics for all main board-listed firms. As more than four-fifths of A-share listed companies are listed and traded on the Main Board, the characteristics of profits and stock returns of Main Board listed companies are the same as those of A-shares, firms' earnings are left-skewed and stock returns are right-skewed. In addition, the level of state ownership, the size of the market capitalisation of companies, the valuation level and the growth rates of various aspects of the listed companies on the Main Board are similarly in line with those of the A-shares as a whole.

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Table 1. Firm-level descriptive statistics for all listed A shares.						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ν	mean	Std	min	median	max
CompanyNumber	41,262	1,667	1,056	1	1,677	3,709
Year	41,262	2,014	4.663	2,004	2,014	2,020
StockCode	41,262	303,338	278,321	1	300,277	603,999
$R_t$	41,250	0.201	0.846	-0.905	-0.0324	21.23
$E_{t-1}$	37,963	0.0156	0.159	-9.159	0.0213	5.659
$E_t$	37,963	0.0212	0.139	-4.897	0.0233	6.001
$E_{t+1,+3}$	37,963	0.120	0.422	-4.984	0.0810	18.56
$R_{t+1,+3}$	41,250	0.524	1.232	-2.326	0.209	18.54
$S_t$	41,262	0.0187	1.110	-2.045	-0.0100	3.223
$S_t * E_{t+1,+3}$	37,963	-0.0267	0.452	-21.38	-0.00131	19.45
$S_t * R_{t+1,+3}$	41,262	-0.525	1.763	-35.90	-0.0686	49.40
$SOE_t$	41,262	0.0864	0.184	0	0	0.971
$SOE_{t} * E_{t+1,+3}$	37,963	0.0132	0.0917	-2.282	0	7.155
$SOE_{t} * R_{t+1,+3}$	41,262	0.0844	0.396	-0.965	0	11.86
$SOE_{t} * S_{t} * E_{t+1,+3}$	37,963	-0.00766	0.118	-7.796	0	3.426
$SOE_{t} * S_{t} * R_{t+1,+3}$	41,262	-0.111	0.682	-22.41	0	19.21
$log MV_t$	39,973	22.42	1.124	18.15	22.29	28.70
$PE_{t-1}$	33,775	120.6	1,889	0	41.53	331,674
$PB_{t-1}$	37,292	5.446	70.00	0	2.904	9,382
Tobin's $Q_{t-1}$	37,744	2.804	80.03	0.621	1.588	14,787
$gROE_{t-1}$	29,598	0.493	23.07	-1,512	-0.308	1,816
$gTE_{t-1}$	37,286	0.0516	0.400	-19.82	0.0135	28.60
$R_{t-1}$	37,552	0.202	0.860	-0.905	-0.0417	18.44
IndustryFE	41,262	60.43	48.85	1	59	312
YearFE	41,262	2,014	4.663	2,004	2,014	2,020

 Table 1. Firm-level descriptive statistics for all listed A shares

Table 2. Descriptive statistics for all Main Board listed shares.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ν	mean	Std	min	Median	max
CompanyNumber	35,586	1,296	801.4	1	1,413	2,981
Year	35,586	2,013	4.765	2,004	2,014	2,020
StockCode	35,586	303,824	299,695	1	600,011	603,999
$R_t$	35,574	0.206	0.858	-0.905	-0.031	21.230
$E_{t-1}$	33,074	0.017	0.166	-9.159	0.022	5.659
$E_t$	33,074	0.023	0.147	-4.897	0.024	6.001
$E_{t+1,+3}$	33,074	0.131	0.446	-4.984	0.086	18.560
$R_{t+1,+3}$	35,574	0.540	1.236	-2.114	0.222	18.540
$S_t$	35,586	-0.004	1.145	-2.045	-0.010	3.223
$S_t * E_{t+1,+3}$	33,074	-0.028	0.480	-21.380	-0.001	19.450
$S_t * R_{t+1,+3}$	35,586	-0.555	1.845	-35.900	-0.074	49.400
$SOE_t$	35,586	0.098	0.193	0.000	0.000	0.971
$SOE_{t} * E_{t+1,+3}$	33,074	0.015	0.098	-2.282	0.000	7.155

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						Table 2 continued
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ν	mean	Std	min	Median	max
$SOE_{t} * R_{t+1,+3}$	35,586	0.097	0.424	-0.965	0.000	11.860
$SOE_{t} * S_{t} * E_{t+1,+3}$	33,074	-0.009	0.127	-7.796	0.000	3.426
$SOE_{t} * S_{t} * R_{t+1,+3}$	35,586	-0.128	0.732	-22.410	0.000	19.210
$log MV_t$	34,486	22.450	1.161	18.150	22.320	28.700
$PE_{t-1}$	29,261	121.500	2,010	0.000	39.050	331,674
$PB_{t-1}$	32,439	5.522	75.030	0.000	2.770	9,382
Tobin's $Q_{t-1}$	32,886	2.861	85.730	0.621	1.531	14,787
$gROE_{t-1}$	25,642	0.464	21.690	-1,512	-0.289	1,359
$gTE_{t-1}$	32,432	0.044	0.383	-19.820	0.014	28.600
$R_{t-1}$	32,604	0.206	0.869	-0.905	-0.040	18.440
IndustryFE	35,586	66.300	48.290	1.000	75.000	312
YearFE	35,586	2,013	4.765	2,004	2,014	2,020

Table 3 illustrates the ChiNext Board listed firm's attributes. Although the firms' earnings and stock return features are similar to the A-share and the Main Board, listed companies on the ChiNext are significantly different from those on the Main Board in terms of the state-owned percentage and the characteristics described by the other control variables. The average state ownership on the ChiNext is 1.3%, much lower than the 9.81% for companies listed on the Main Board. Secondly, the average market capitalisation of Main Board companies is approximated to be 5,622 million, while the average market capitalisation of GEM companies is approximated to be 4,557 million, which is almost 18.94% lower than the average value of Main Board. What's more, the overall valuation of ChiNext listed companies is also lower, while the average price-to-earnings ratio and priceto-book ratio were both lower than the Main Board by approximately 5.68% and 10.59%, respectively. Considering that the ChiNext allows higher intraday price fluctuation and a lower price limit brings a better market arbitrage mechanism and incorporates more information into prices [65, 66, 67, 68, 32], I presume stock prices on GEM will be more informative and less susceptible to market sentiment than on the Main Board.

### 5.2 Hypothesis 1: Investor Sentiment Affects Stock Price Informativeness

**Table 4** illustrates the empirical results of Equations (1) and (2), mainly testing how realised the sum of future earnings for 3 periods is associated with the current return, and how sentiment affects this association. In line with the prior literature, column (1) shows that there is a significant positive correlation between the future earnings of the company and current stock returns, showing that stock returns and prices reflect the profitability of the company to some extent <sup>[6, 27, 59]</sup>. The coefficient of  $E_{i,t+1+3}$  is significant and positive, reflecting that the market shows positive feedback on information about anticipated future earnings. The second column of Table 4 shows the empirical implementation of Equation (2), added sentiment factors, moderation effect and firm-level controls. The presented results confirm my hypothesis 1. As expected, the coefficient of  $S_t * E_{i,t+1,+3}$  is positive and significant, indicating that during market optimism (sentiment index > 0), information about future earnings tends to be highly valued and incorporated into stock prices, companies with stronger future profitability have greater stock price increases and higher stock returns. While during market pessimism (sentiment index < 0), the positive correlation

between a company's future earnings and stock returns is weakened, even though some firms have relatively strong profitability and realized future earnings, pessimistic investor sentiment can also put downward pressure on its stock price, leading to lower or even negative stock return.

Thus, stock price informativeness is reduced. The coefficient of  $S_t$  is negative and significant, proving that over-optimistic market sentiment over a period can cause overvalued stock prices and lower returns realised in the end, while over-pessimistic market sentiment can lead to higher returns at the end of the period. These two conclusions are consistent

with prior literature which argues that market sentiment negatively relates to stock return, and the impact of sentiment on stock prices and returns are greater when market sentiment is low, and investors are more susceptible to noise unrelated to the fundamental value of a company than when they are optimistic <sup>[17, 37, 14, 20, 15, 18, 19]</sup>. Brown and Cliff <sup>[49]</sup> and Wang et al. <sup>[50]</sup> mentioned that lagged returns may affect the relationship between sentiment and current returns, my regression also includes lagged return,  $R_{i,t-1}$ , as a control, finding that sentiment's influence on stock return remain significant and negative.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ν	mean	Std	min	Median	max
CompanyNumber	5,676	289.600	196.100	1	261	728
Year	5,676	2,016	2.962	2,009	2,017	2,020
StockCode	5,676	300,291	197.800	300,001	300,262	300,739
$R_t$	5,676	0.169	0.766	-0.818	-0.042	17.630
$E_{t-1}$	4,889	0.007	0.090	-3.010	0.016	0.201
$E_t$	4,889	0.009	0.068	-1.682	0.018	0.571
$E_{t+1,+3}$	4,889	0.046	0.182	-2.506	0.053	4.070
$R_{t+1,+3}$	5,676	0.419	1.203	-2.326	0.128	18.080
$S_t$	5,676	0.164	0.845	-1.383	0.133	1.653
$S_t * E_{t+1,+3}$	4,889	-0.017	0.160	-3.145	-0.001	2.595
$S_t * R_{t+1,+3}$	5,676	-0.336	1.102	-23.620	-0.046	4.959
$SOE_t$	5,676	0.013	0.068	0.000	0.000	0.722
$SOE_{t} * E_{t+1,+3}$	4,889	0.001	0.007	-0.161	0.000	0.255
$SOE_{t} * R_{t+1,+3}$	5,676	0.007	0.079	-0.601	0.000	1.889
$SOE_t * S_t * E_{t+1,+3}$	4,889	-0.001	0.006	-0.266	0.000	0.137
$SOE_t * S_t * R_{t+1,+3}$	5,676	-0.005	0.055	-1.201	0.000	0.609
$log MV_t$	5,487	22.240	0.829	20.260	22.150	26.610
$PE_{t-1}$	4,514	114.600	710.400	5.366	55.430	43,068
$PB_{t-1}$	4,853	4.937	5.176	0.777	3.880	241.300
Tobin's $Q_{t-1}$	4,858	2.421	1.525	0.897	1.998	26.430
$gROE_{t-1}$	3,956	0.686	30.530	-49.150	-0.414	1,816
$gTE_{t-1}$	4,854	0.106	0.493	-2.638	0.0130	8.021
$R_{t-1}$	4,948	0.175	0.792	-0.818	-0.050	17.630
IndustryFE	5,676	23.630	34.000	2.000	15.000	278
YearFE	5,676	2,016	2.962	2,009	2,017	2,020

Table 3. Descriptive statistics for all ChiNext Board listed shares
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Table 4. Relation between sentiment and price informativeness.				
	(1)	(2)		
VARIABLES	$R_{t}$	<i>R</i> ,		
E <sub>t-1</sub>	-0.448***	-2.091***		
	(-17.67)	(-30.34)		
$E_t$	0.121***	0.557***		
	(1.00)	(9.72)		
$E_{t+1,+3}$	0.487***	0.384***		
	(35.61)	(30.82)		
$R_{t+1,+3}$	-0.147***	-0.081***		
	(-33.96)	(-19.38)		
$S_t$		-0.124***		
		(-15.66)		
$S_t * E_{t+1,+3}$		0.019**		
		(2.38)		
$S_t * R_{t+1,+3}$		-0.013***		
		(-3.50)		
logMV,		0.096***		
		(31.03)		
$PE_{t-1}$		0.000**		
		(2.38)		
$PB_{t-1}$		0.000		
		(0.41)		
Tobin's $Q_{t-1}$		-0.001		
		(-1.31)		
$gROE_{t-1}$		-0.000		
		(-0.05)		
$gTE_{t-1}$		-0.027***		
		(-2.94)		
$R_{t-1}$		-0.082***		
		(-16.61)		
Constant	0.215***	-2.178***		
	(47.00)	(-7.53)		
Observations	37,952	27,051		
R-squared	0.059	0.583		
IndustryFE	YES	YES		
YearFE	YES	YES		
F	594.4	125.7		

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

### **5.3 Hypothesis 2: State Ownership Reduces Price Informativeness and Influence of Sentiment on Stock Price Informativeness**

Column (3) of **table 5** shows the empirical results of the implementation of Equation (3), introducing state-owned shareholding variable and interaction terms. The results show that the coefficient of  $S_t$  and  $S_t * E_{i,t+1,+3}$  still remains positive and significant after introducing  $SOE_{i,t}$ ,  $SOE_{i,t} *$  $E_{i,t+1,+3}$ , and  $SOE_{i,t} * R_{i,t+1,+3}$ , suggesting that market sentiment still significantly affects stock returns and price informative content in stock markets with the presence of state capital. Further, the results show that the coefficient of  $SOE_{i,t} * E_{i,t+1,+3}$  and  $SOE_{i,t} *$   $S_t * E_{i,t+1,+3}$  are all negative and significant, which is in line with my hypothesis 2 and prior studies. These indicate that, on the one hand, in line with Goodell et al. <sup>[26]</sup> and Carpenter et al. <sup>[31]</sup>, a higher proportion of state-owned shares reduces the stock price informativeness; on the other hand, stock prices of companies with higher state ownership are less vulnerable to market sentiment. However, compared to the opinion arguing that state ownership directly affects the price information volume, I believe that state ownership may indirectly affect price informativeness through the attributes of bondlike stocks. Based on this speculation, I designed the second robustness test.

	(1)	(2)	(3)	
VARIABLES	$R_t$	$R_t$	$R_t$	
$E_{t-1}$	-0.448***	-2.091***	-2.141***	
	(-17.67)	(-30.34)	(-30.66)	
$E_t$	0.121***	0.557***	0.581***	
	(1.00)	(9.72)	(10.14)	
$E_{t+1,+3}$	0.487***	0.384***	0.397***	
	(35.61)	(30.82)	(30.38)	
$R_{t+1,+3}$	-0.147***	-0.081***	-0.083***	
	(-33.96)	(-19.38)	(-18.89)	
$S_t$	0.215***	-0.124***	-0.145***	
	(47.00)	(-15.66)	(-17.10)	
$S_t * E_{t+1,+3}$		0.019**	0.031***	
		(2.38)	(3.57)	
$S_t * R_{t+1,+3}$		-0.013***	-0.015***	
		(-3.50)	(-3.75)	
$SOE_t$			-0.185***	
			(-7.82)	
$SOE_{t} * E_{t+1,+3}$			-0.217***	
			(-4.61)	
$SOE_{t} * R_{t+1,+3}$			0.008	
			(0.37)	
$SOE_t * S_t * E_{t+1,+3}$			-0.174***	
			(-4.08)	
$SOE_{t} * S_{t} * R_{t+1+3}$			0.013	
			(0.97)	
$log MV_t$		0.096***	0.101***	
		(31.03)	(32.32)	
$PE_{t-1}$		0.000**	0.000**	

 Table 5. Relation between sentiment and price informativeness under SOE.

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			Table 5 continued
	(1)	(2)	(3)
VARIABLES	$R_t$	$R_{t}$	$R_t$
		(2.38)	(2.51)
$PB_{t-1}$		0.000	0.000
		(0.41)	(0.62)
Tobin's $Q_{t-1}$		-0.001	-0.001*
		(-1.31)	(-1.66)
$gROE_{t-1}$		-0.000	-0.000
		(-0.05)	(-0.14)
$gTE_{t-1}$		-0.027***	-0.027***
		(-2.94)	(-2.99)
$R_{t-1}$		-0.082***	-0.084***
		(-16.61)	(-17.04)
Constant		-2.178***	-2.314***
		(-7.53)	(-8.01)
Observations	37,952	27,051	27,051
R-squared	0.059	0.583	0.586
IndustryFE	YES	YES	YES
YearFE	YES	YES	YES
F	594.4	125.7	124.7

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

### **5.4 Robustness Tests**

To test the sensitivity of my findings, I carried out the robustness tests from three perspectives to examine different results. The first robustness test addresses Hypothesis 1 and the conclusions about the effect of sentiment on price informativeness. I replaced the measure of market sentiment in equation (3) from ISI to China Investor Confidence Composite Sentiment Index (CICSI), which is also an index measuring investor sentiment in China's stock market based on another model constructed by Yi and Mao (2009). Although both indicators are based on Baker and Wurgler's calculation methodology<sup>[19]</sup>, in contrast to the ISI, which is a more biased indicator of market activity, Yi and Mao (2009) also take into account sentiment analysis of the content of news media reports and uses questionnaires to collect data on investor perceptions of the current market, which are also included in the CICSI. Furtherly, I add the Entrepreneurial Confidence Index, CCI, and the Consumer Confidence Index,  $CCI_{\nu}$  into the equation (3) as controls, which are also behavioural factors and may affect investor sentiment. Due to missing CICSI data, the new regression analyses only cover the years 2004 to 2013.

Table 6 illustrates the empirical results for the adjusted equation. Despite the decrease in the significance level, the results still indicate that investor sentiment reduces price informative content when the market is pessimistic and that market sentiment and returns are still significantly negatively correlated. In addition, the results of this regression also show that the proportion of state ownership cuts price informativeness but at this point, the effect of state ownership on the association between sentiment and price information is not significant. I speculate that this could be due to the reduced observation period of the sample. While the sample observation period of the original regression analysis contains market turmoil in 2008, 2015, and 2020, the new regression analysis includes only the market turmoil in 2008.

For hypothesis 2 and the corresponding

regression results, to test whether the weakening effect of the state-owned shareholding on the sentiment's impact on price informativeness is caused by other characteristics of the stateowned firms, I added tangible assets ratio, TAR<sub>i</sub>, dividend payout rate,  $DPR_{it}$ , and the size of the total assets,  $logTA_{it}$  in equation (3) as the new control variables. Table 7 shows the robustness test results. After adding attributes of the bond-like stock traditional industry as controls, the coefficients and significance levels of the core variables are generally consistent with those presented in Table 5. Most importantly, the coefficient of  $SOE_{i,t} * S_t * E_{i,t+1,+3}$ remains negative and significant. Therefore, my conclusion is unchanged: an increase in state-owned shares will reduce the effect of sentiment on price informativeness.

The third robustness test focuses on the impact of different trading rules on the Main Board and the GEM in the Chinese stock market, I regress equation (3) on the data of the Main Board and ChiNext Board separately. **Table 8** presents the results of the Main Board data regression. From the regression results, the direction and significance of the main explanatory variables' effect on stock returns are unchanged and my conclusion remains the same.

Regarding regression results based on equation (3) on ChiNext data, referring to Table 9, the main variable coefficients and significance are dramatically different from the previous findings. Although  $E_{i,t+1}$ and  $E_{it}$  still have a significantly positive relation with return, the variables about sentiment and SOE are all insignificant except  $SOE_{i,t} * E_{i,t+1,+3}$ , leading to uncertainty in ChiNext with respect to earlier conclusions. This result partly shows that a more relaxed price limit and the registration-based system are more conducive to more informative stock prices, creating higher market efficiency. However, this view can only be considered as a guess instead of an accurate conclusion since, compared to the Main Board, the ChiNext existence is much shorter (created in 2009), and it has been reformed frequently (currently, about 5 times), and the most important reforms of the price limit and registration systems were completed in 2020.

 Table 6. Relation between investor sentiment and price informativeness: Robustness Test 1.

 (1)

	(1)
VARIABLES	$R_{t}$
<i>E</i> <sub><i>t</i>-1</sub>	-2.531***
	(-19.15)
$E_t$	0.729***
	(7.30)
$E_{\iota^{+1},+3}$	4.778***
	(5.67)
$R_{t+1,+3}$	-0.051***
	(-7.39)
$S_t$	-134.146***
	(-6.09)
$S_t * E_{t+1,+3}$	0.051*
	(1.33)
$S_t * R_{t+1,+3}$	0.044***
	(6.15)
SOE,	-0.086***
	(-2.81)

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		Table 6 continued
	(1)	
VARIABLES	$R_t$	
$\overline{SOE_t * E_{t+1,+3}}$	-0.291***	
	(-3.37)	
$SOE_t * R_{t+1,+3}$	-0.053*	
	(-1.95)	
$SOE_t * S_t * E_{t+1,+3}$	0.050	
	(0.64)	
$SOE_t * S_t * R_{t+1,+3}$	-0.054***	
	(-3.21)	
$logMV_t$	0.046***	
	(9.23)	
$PE_{t-1}$	0.000*	
	(1.80)	
$PB_{t-1}$	0.002	
	(1.42)	
Tobin's $Q_{t-1}$	-0.004	
	(-1.47)	
$gROE_{t-1}$	0.001***	
	(2.74)	
$gTE_{t-1}$	-0.058***	
	(-3.79)	
$ECI_t$	4.226***	
	(6.07)	
$ECI_t * E_{t+1,+3}$	0.003	
	(1.12)	
$CCI_t$	30.794***	
	(6.07)	
$CCI_t * E_{t+1,+3}$	-0.046***	
	(-7.52)	
<i>R</i> <sub>t-1</sub>	-0.069***	
	(-10.23)	
Constant	-3,735.858***	
	(-6.08)	
Observations	11,591	
R-squared	0.661	
IndustryFE	YES	
YearFE	YES	
F	75.41	

	(1)
VARIABLES	R,
$E_{t-1}$	-2.239***
	(-22.91)
$E_t$	1.388***
	(14.45)
$E_{t^{+1},+3}$	0.332***
	(23.18)
$R_{t+1,+3}$	-0.071***
	(-16.13)
$S_t$	-0.147***
	(-17.33)
$S_t * E_{t+1,+3}$	0.034***
	(3.96)
$S_t * R_{t+1,+3}$	-0.021***
	(-5.14)
$SOE_t$	-0.147***
	(-6.25)
$SOE_{t} * E_{t+1,+3}$	-0.119**
	(-2.56)
$SOE_{t} * R_{t+1,+3}$	0.017
	(0.78)
$SOE_t * S_t * E_{t+1,+3}$	-0.161***
	(-3.71)
$SOE_{t} * S_{t} * R_{t+1,+3}$	0.027*
	(1.96)
$logMV_t$	0.310***
	(60.17)
$PE_{t-1}$	0.000
	(0.81)
$PB_{t-1}$	-0.000
	(-0.22)
Tobin's $Q_{t-1}$	-0.006***
	(-6.28)
$gROE_{t-1}$	0.000
	(1.14)
$gTE_{t-1}$	-0.033***
	(-3.77)
$DPR_t$	0.003
	(0.70)
$TAR_{t}$	0.143***
•	(4.20)
logTA,	-0.196***
- ·	(-51.26)

 Table 7. How state-owned proportion affects price informativeness and effect of sentiment on price informativeness: Robustness test 2.

		Table 7 continued
	(1)	
VARIABLES	$R_t$	
$R_{t-1}$	-0.123***	
	(-24.96)	
Constant	-2.320***	
	(-8.28)	
Observations	25,163	
R-squared	0.624	
IndustryFE	YES	
YearFE	YES	
F	136.0	

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

Board.			
(1)			
VARIABLES	R,		
$E_{\iota-1}$	-1.957***		
	(-27.92)		
$E_t$	0.504***		
	(8.61)		
$E_{t+1,+3}$	0.375***		
	(28.49)		
$R_{t+1,+3}$	-0.091***		
	(-18.88)		
$S_t$	-0.146***		
	(-17.07)		
$S_t * E_{t+1,+3}$	0.024***		
	(2.81)		
$S_t * R_{t+1,+3}$	-0.010**		
	(-2.29)		
$SOE_t$	-0.185***		
	(-7.96)		
$SOE_t * E_{t+1,+3}$	-0.171***		
	(-3.72)		
$SOE_t * R_{t+1,+3}$	0.017		
	(0.77)		
$SOE_t * S_t * E_{t+1,+3}$	-0.163***		
	(-3.94)		
$SOE_t * S_t * R_{t+1,+3}$	0.007		
	(0.51)		
$log MV_t$	0.092***		
	(28.60)		
$PE_{t-1}$	0.000*		

 Table 8. Relation between sentiment, price informativeness and state-owned shareholding: Robustness test 3 based on the Main

 Roard

		Table 8 continued
	(1)	
VARIABLES	$R_t$	
	(1.72)	
$PB_{t-1}$	0.000	
	(0.39)	
Tobin's $Q_{t-1}$	-0.001	
	(-1.26)	
$gROE_{t-1}$	0.000	
	(0.07)	
$gTE_{t-1}$	-0.031***	
	(-3.11)	
$R_{t-1}$	-0.086***	
	(-16.54)	
Constant	-2.061***	
	(-7.33)	
Observations	23,303	
R-squared	0.615	
IndustryFE	YES	
YearFE	YES	
F	122.0	

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

	(1)	
VARIABLES	$R_{t}$	
$E_{t-1}$	-5.488***	
	(-7.23)	
$E_t$	0.868***	
	(4.30)	
$E_{t+1,+3}$	0.707***	
	(12.70)	
$R_{t+1,+3}$	-0.071***	
	(-6.63)	
$S_t$	-0.003	
	(-0.05)	
$S_t * E_{t+1,+3}$	-0.024	
~	(-0.35)	
$S_t * R_{t+1,+3}$	-0.030**	
	(-2.44)	
SOE,	-0.221	
	(-1.19)	
$SOE_{t} * E_{t+1,+3}$	-2.718*	
	(-1.72)	
$SOE_{t} * R_{t+1+3}$	0.037	

Table 9. Relation between sentiment, price informativeness and state-owned: Robustness test 3 based on the ChiNext Board.

		Table 9 continued
	(1)	
VARIABLES	$R_{t}$	
	(0.20)	
$SOE_t * S_t * E_{t+1,+3}$	-1.637	
	(-0.71)	
$SOE_t * S_t * R_{t+1,+3}$	-0.024	
	(-0.09)	
$log MV_t$	0.281***	
	(22.37)	
$PE_{t-1}$	0.000***	
	(4.55)	
$PB_{t-1}$	-0.025***	
	(-5.37)	
Tobin's $Q_{t-1}$	-0.022**	
	(-2.13)	
$gROE_{t-1}$	-0.000	
	(-0.31)	
$gTE_{t-1}$	-0.018	
	(-0.83)	
<i>R</i> <sub>t-1</sub>	-0.054***	
	(-3.53)	
Constant	-5.884***	
	(-14.36)	
Observations	3,748	
R-squared	0.493	
IndustryFE	YES	
YearFE	YES	
F	44.52	

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

### 6. Conclusion

In this study, I analysed how sentiment influences future earnings' explanatory power over stock returns, also named stock price informativeness, and how the influence of sentiment on price informativeness is affected by the firms' state ownership proportion. By investigating investor sentiment, stock returns, listed firms' earnings and state ownership situations, I found that investor sentiment has an asymmetric impact on the informativeness of stock prices and market pricing efficiency. During market optimistic periods, sentiment enhances the explanatory power of firms' future earnings over stock returns and stocks with higher firms' realised earnings in the future tend to witness higher returns. During market depression, the negative sentiment weakens the relation between future earnings and current returns, reducing stock price informativeness about firms' profitability.

This result implies that under negative sentiment, investors tend to ignore or underestimate the true earning ability and prospect of firms, leading to relatively lower stock returns, and thus, stock price informativeness is reduced. While under positive sentiment, investors seem to be better able to correlate future company earnings with stock returns, allowing companies that realise more profits in the future to have higher stock returns in the current period. However, although positive sentiment enhances the relation between return and future earnings, I still cannot conclude that compared to when the market was sentimentally neutral (S=0) stock price informativeness or market efficiency is improved during market optimism.

It is proved that during market bullishness, investors tend to overestimate the profitability of firms in the future, leading to increasing share prices and stock returns <sup>[17, 37]</sup>. Consequently, rising share prices, accompanied by growing market optimism, may eventually reach an asset bubble at a time of extreme market fervour, leading to subsequent price collapses and stock market crises. Both standard ISI and CICSI (two measurements of sentiment in China stock market) have reached interval maximum value in 2007 and 2015, a half to one year before the market crisis. This result is in line with the prior literature arguing that sentiment's effect on stock returns is asymmetric, and investors tend to be influenced more by negative sentiment and noise information during pessimism<sup>[15, 53, 54]</sup>.

When considering state ownership, I found that, although state ownership reduces price information efficiency, it also reduces sentiment's effect on price informativeness. The price informativeness of firms with a higher state-owned proportion tends to be affected less by sentiment, with no regard to whether this is during market optimism or pessimism. Furthermore, this effect is a direct result of the percentage of state ownership, not only because of the traditional industrial attributes or bond-like stock characteristics. It implies that the shares of firms with favourable earnings prospects but high state-owned shareholding are usually relatively out of favour with investors when markets are bullish, however, when markets are bearish, the profitability of these companies has been re-emphasised and valued accordingly. These findings are in line with Baker and Wurgler <sup>[23]</sup>, illustrating that stocks of firms with higher tangible assets and traditional business are less influenced by sentiment, while the SOEs in the sample also belong to this category. Meanwhile, the findings are also in line with the research studying SOEs in China, which argues that the policy burdens of state-owned enterprises call into question their profitability, but their national security nature and government support mean that state-owned enterprises do not go bankrupt easily, explaining why SOEs are treated differently during bullish and bearish markets <sup>[55, 26, 31]</sup>.

Finally, this article still has a lot of room for improvement. Firstly, although the positive sentiment enhances the relationship between future earnings and current stock returns, I still cannot conclude that positive sentiment increases price informativeness and market efficiency due to the existence of asset bubbles. This may indicate the limitations of the methodology I have used in determining the impact of positive sentiment on stock price informativeness, and the relation between sentiment and price informativeness during market optimism still needs to be further analysed. In addition, as ChiNext has been reformed very frequently since its creation, involving various aspects of the listing system, disclosure system and price limit, and the price limit and registration reforms have taken place in recent years (in 2020), the conclusion that ChiNext registration-based system and wider price limits improve price information is likely to lack robustness. Meanwhile, since the research is based only on data from the China stock market and listed companies, the validity of its conclusions in other markets has yet to be verified.

Based on the conclusions and limitations of this paper, my paper recommends that future studies analyse the impact of market sentiment and state ownership on stock market effectiveness based on cross-regional data and compare findings across countries. Research on the China stock market could focus on new market boards (such as the Science and Technology Innovation Board and Beijing Stock Exchange) and reforms and could discuss whether the reform measures have improved market rationality and pricing efficiency.

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# Appendices

VARIABLES **DEFINITIONS** Dependent variable Annual stock return for each firm at the end of current period t, measured from four R, months later the fiscal year onward Main independent variables Firm's net profit during the last period t-1, scaled by the market value of equity  $E_{t-1}$ measured at the period t-1 Firm's net profit during the current period t, scaled by the market value of equity  $E_{t-1}$ measured at the period t-1 The sum of future net profits of firm i for the 3 years following the current year,  $E_{t+1,+3}$ scaled by the market value of equity measured at the period t-1  $R_{t+1,+3}$ The sum of stock return in three periods following Investor sentiment index during each period, measured by standard Investor  $S_t$ Sentiment Index (ISI) SOE, State-owned shareholding of each firm, measured by percentage Control variables Firm's market value of total equity at the end of period t, measured by natural  $log MV_t$ logarithm  $PE_{t-1}$ Stock's price-to-earnings ratio at the end of period t-1  $PB_{t-1}$ Stock's price-to-book value ratio at the end of period t-1 Tobin's  $Q_{t-1}$ Firm's Tobin's Q value at the end of period t-1  $gROE_{t-1}$ Firm's growth rate of return on equity ratio at the end of period t-1  $gTE_{t-1}$ Firm's growth rate of total equity at the end of period t-1 Stock annual return at the end of period t-1  $R_{t-1}$ 

### **Appendix 1. Definition of variables**

Firm-specific Information in Stock Prices Guide Capital Allocation?

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	$\boldsymbol{R}_t$	$E_{t-1}$	$E_t$	<i>E</i> <sub><i>t</i>+1,+3</sub>	<i>R</i> <sub><i>t</i>+1,+3</sub>	$S_t$	$S_t * E_{t+1,+3}$
$R_t$	1.000						
$E_{t-1}$	-0.032***	1.000					
$E_t$	0.061***	0.421***	1.000				
$E_{t+1,+3}$	0.153***	0.293***	0.454***	1.000			
$R_{t+1,+3}$	-0.136***	-0.022***	-0.021***	0.141***	1.000		
$S_t$	-0.156***	-0.014***	0.008	-0.058***	-0.391***	1.000	
$S_t * E_{t+1,+3}$	-0.098***	0.036***	0.000	-0.200***	-0.175***	0.296***	1.000
$S_t * R_{t+1,+3}$	0.058***	0.033***	0.045***	-0.060***	-0.633***	0.541***	0.293***
$SOE_t$	0.078***	0.007	0.019***	0.038***	0.173***	-0.129***	-0.065***
$SOE_t * E_{t+1,+3}$	0.124***	0.043***	0.119***	0.383***	0.136***	-0.076***	-0.291***
$SOE_{t} * R_{t+1,+3}$	-0.056***	-0.025***	-0.024***	0.069***	0.559***	-0.257***	-0.167***
$SOE_{t} * S_{t} * E_{t+1,+3}$	-0.106***	0.005	-0.023***	-0.230***	-0.200***	0.209***	0.499***
$SOE_{t} * S_{t} * R_{t+1,+3}$	0.030***	0.022***	0.025***	-0.064***	-0.455***	0.336***	0.197***
$log MV_t$	0.159***	0.170***	0.228***	0.161***	-0.358***	0.230***	0.083***
$PE_{t-1}$	-0.009	-0.020***	-0.011**	-0.007	-0.011*	0.011**	0.006
$PB_{t-1}$	-0.004	-0.013**	-0.017***	-0.006	-0.014***	0.015***	0.001
Tobin's $Q_{t-1}$	-0.005	-0.006	-0.001	-0.001	-0.002	0.006	0.007
$gROE_{t-1}$	0.008	0.003	0.013**	0.008	0.004	-0.004	0.002
$gTE_{t-1}$	-0.026***	0.038***	0.039***	-0.004	-0.001	0.000	0.000
$R_{t-1}$	-0.035***	0.024***	0.036***	-0.010**	-0.131***	0.502***	0.114***
	$S_t * R_{t+1,+3}$	SOE <sub>t</sub>	$SOE_{t} * E_{t+1,+3}$	$SOE_{t} * R_{t+1,+3}$	$SOE_{t} * S_{t} * E_{t+1,+3}$	$SOE_{t} * S_{t} * R_{t+1,+3}$	logMV <sub>t</sub>
$S_t * R_{t+1,+3}$	1.000						
$SOE_t$	-0.204***	1.000					
$SOE_{t} * E_{t+1,+3}$	-0.158***	0.328***	1.000				
$SOE_{t} * R_{t+1,+3}$	-0.567***	0.490***	0.279***	1.000			
$SOE_{t} * S_{t} * E_{t+1,+3}$	0.289***	-0.165***	-0.620***	-0.357***	1.000		
$SOE_{t} * S_{t} * R_{t+1,+3}$	0.711***	-0.399***	-0.255***	-0.839***	0.407***	1.000	
$log MV_t$	0.301***	-0.029***	0.049***	-0.230***	0.050***	0.200***	1.000
$PE_{t-1}$	-0.001	-0.003	-0.006	-0.001	0.004	0.001	-0.005
$PB_{t-1}$	0.005	-0.012**	-0.005	-0.007	0.004	0.007	-0.013**
Tobin's $Q_{t-1}$	0.010*	-0.007	-0.002	-0.003	0.003	0.004	-0.005
$gROE_{t-1}$	-0.001	0.002	0.000	0.004	0.001	-0.001	0.010*
$gTE_{t-1}$	-0.007	-0.009*	-0.002	-0.019***	0.000	0.001	0.022***
$R_{t-1}$	0.205***	0.087***	0.005	-0.051***	0.084***	0.134***	0.125***
	$PE_{t-1}$	$PB_{t-1}$	Tobin's $Q_{t-1}$	$gROE_{t-1}$	$gTE_{t-1}$	<i>R</i> <sub>t-1</sub>	
$PE_{t-1}$	1						
$PB_{t-1}$	0.031***	1.000					
Tobin's $Q_{t-1}$	0.021***	0.210***	1.000				
$gROE_{t-1}$	0.005	-0.019***	-0.001	1.000			
$gTE_{t-1}$	0.002	-0.027***	-0.009*	0.003	1.000		
$R_{t-1}$	0.019***	0.025***	0.006	0.006	0.011**	1.000	

# Appendix 2. Correlation between different variables



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### ARTICLE

# Introduction to The Use of Environmental Protection Concepts in Interior Design

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### ABSTRACT

With the high consumption mode of industrial civilisation spreading all over the world since the middle of the 20th century, the pollution caused by industrial production has been not only related to environmental pollution, but also to the health of human beings themselves, affecting the conditions of survival of human beings and restricting the production and development of society. The global environment and resources are facing a severe test. As a result, the idea of environmental protection has been put forward. The concept of environmental protection has developed rapidly, from the initial single emphasis on reducing pollution, to the current reduction of energy consumption and resource conservation, this overall environmental protection concept is also applied in interior design, including the choice of materials, cleaning and maintenance, the use of energy saving. As long as it is matched properly, it can not only reduce the cost and achieve aesthetics, but also achieve the purpose of energy saving and environmental protection. *Keywords:* interior design; environmental protection concept; use

### 1. Introduction

Before the highly industrialised Europe and America conquered the world, the concept of environmental protection' was almost never mentioned. Europe and the United States of America, high energy consumption, bringing large-scale exploitation and consumption of resources, to the exploitation of resources and trafficking in resources as the mainstay of production and life model has become an example of civilisation development model, the developing countries are also to Europe

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ARTICLE INFO

Received: 10 December 2024 | Accepted: 26 December 2024 | Published Online: 30 December 2024 DOI: http://doi.org/10.26549/jsbe.v7i4.22154

CITATION

C, Y.X., 2024. Introduction to The Use of Environmental Protection Concepts in Interior Design. Journal of Sustainable Business and Economics. 7(4): 33–38. DOI: http://doi.org/10.26549/jsbe.v7i4.22154

#### COPYRIGHT

Copyright © 2024 by the author(s). Published by Bilingual Publishing Group. This is an open access article under the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License (https://creativecommons.org/licenses/by-nc/4.0/). and the United States of America life closer. It was only after the environment for human survival had become unusually severe and produced unusually serious consequences that environmental protection was taken seriously and advocated.

# **2.** The concept of holistic environmental protection

### **2.1 Background of the emergence of environ**mental protection

Prior to the high degree of industrialisation, the world was still very rich in resources, and industrial raw materials such as minerals and timber had not yet been over-exploited; people's living standards were relatively low, and many regions were still developing slowly in a low-energy-consuming social pattern.

Against the backdrop of the world's widespread adoption of energy-intensive production modes, the entire earth's atmosphere has been damaged, the intensity of ultraviolet rays has been significantly increased, and the highly intensive emission of greenhouse gases has also led to a devastating disruption of the weak balance between negative oxygen ions and carbon dioxide in the atmosphere, and the phenomenon of excessively high temperatures has begun to appear on a global scale, accelerating the process of desertification in many regions. The ecological balance of nature has been disrupted, and the widespread melting of icebergs at the North and South Poles has caused the global sea level to rise, with many cities living by the sea facing the possibility of being completely submerged. The environment for human existence has become exceptionally severe, and after people realised the seriousness of the problem, environmental protection was naturally put on the agenda.

# **2.2** Evolution of the concept of environmental protection

The concept of environmental protection was initially mentioned only in industrial production. For

example, coal power plants, cement plants, chemical plants and paper mills. These enterprises, which cause very serious air and environmental pollution, have acquired relevant equipment to reduce emissions after the introduction of environmental protection standards.

Later, environmental protection penetrated into urban planning. That is, the more polluting factories were laid out in advance to minimise their impact on the lives of residents. The requirements were significantly higher and required the co-operation of a large number of departments. Nowadays, environmental protection is also reflected in interior design. However, it should be noted that a city or a country, without the first two environmental requirements to meet the standards of protection, alone in the interior design of environmental protection, it is difficult to play a certain role. Only the first two requirements are up to standard, the residents of the pursuit of personal living space environmental protection is meaningful.

# **2.3** The emergence of new environmental protection concepts

The new environmental protection concept does not only impose exact limits on environmental pollution, but also strongly emphasises the reduction of energy consumption, that is, energy conservation. The old environmental protection concept of reducing emissions and pollution only provides a pavement for energy conservation. The ultimate goal of environmental protection is to prolong mankind's consumption of the earth's limited resources, to save more resources for future generations, and to have a better living environment for mankind. In other words, energy conservation is a must and the only means to achieve the goal quickly. With such a large population base in China, if the vast majority of residents can implement new environmental protection concepts, reduce energy consumption and environmental pollution, the total amount of resources saved will also be very considerable. Therefore, it is crucial to realise new environmental concepts in interior design.

# 2.4 New environmental concepts related to interior design - holistic environmental concepts

The holistic environmental concept is based on a whole chain of environmental concepts.

Firstly, the environment in which the structure or building is situated must meet certain standards; secondly, the structure must have a comprehensive waste disposal and recycling system, wastewater must be properly treated, and the water system must be in a virtuous cycle; and thirdly, the structure must have been constructed taking into account the geographic location of the building. For example, the effect of the sun and monsoon on the building, as well as temperature variations are important considerations.

and monsoon winds on the building, as well as temperature variations, are all important considerations. A good structure makes good use of light, not only to avoid high indoor temperatures caused by light, but also to make the interior very well lit, with minimal use of lighting fixtures. In interior design, pay attention to the impact of small environment to people. Therefore, designers should pay attention to the design of the small indoor environment. In the specific design process, the designer not only needs to consider the spatial factors of the environment, but also to fully consider the flexibility of the space, so that people can have a good experience. At the same time, the designer should also be the use of materials for full consideration, in the choice of materials, to the natural elements and its full integration, which not only can promote the application of environmental protection concept in interior design, but also can effectively reduce the waste of resources. In the use of resources, the relevant designers should also follow certain environmental protection concepts, to save energy, to renewable resources instead of non-renewable resources. In addition, in the specific design process, should also pay attention to the treatment of solid waste, reduce the pollution generated by solid waste.

Many luxury villas are designed with large

floor-to-ceiling windows because the use of floorto-ceiling windows can achieve the purpose of good lighting, ventilation and a wide field of vision, which is very much in line with the needs of modern people's lives, but only a few areas and lots are suitable for large floor-to-ceiling windows. Although the large floor-to-ceiling windows can provide more adequate light, but to waste energy unnecessarily heating and cooling (because the thermal conductivity of the glass is very strong, so that the temperature difference between indoor and outdoor can not be pulled apart). If you do interior design for such a house, it is extremely difficult to be environmentally friendly.

Environmental protection can not only start from saving energy, but also through the development of new energy sources to achieve the purpose of resource utilisation and environmental protection. For example, make full use of renewable resources. Renewable resources include: wind energy, solar energy, natural gas and so on. These resources are renewable, clean and non-polluting. When designing the exterior of the building and the ventilation system, the relevant staff can design the interior based on the consideration of wind energy, so that the interior can be better ventilated.

Finally, a building's exterior and interior decorative materials can also try to avoid wasting energy. Nowadays, many clients are able to accept the original colours of the materials. In such a case, the judicious use of a mix of natural materials can serve to beautify the building, reduce the waste of resources, and make the maintenance of the building provide convenience.

It must be emphasised that needless embellishment of light fittings not only wastes a lot of electricity, but also hinders the maintenance of the building. Therefore, the use of decorative materials that require electricity should be reduced as much as possible; in some public buildings, such as railway stations, airports and other places, although they also use a large number of lamps and lanterns, but if they can be designed to make rational use of the lamps and lanterns, maximise the lighting and decorative effect of the lamps and lanterns, and to be able to turn off some of the lamps and lanterns at certain specific times of the day, but also be able to

If we can make rational use of the function of the lighting to maximise the lighting and decorative effects, and can turn off some of the lighting at certain times while still maintaining the basic illumination, we will be able to maximise energy savings.

3..The overall environmental protection concept in the interior design of the specific performance of the overall environmental protection concept requires a global perspective on the relationship between design and environmental protection. Aesthetics is bound to consume a certain amount of resources, and will inevitably be out of the scope of practicality; and environmental protection requires the ability to maximise the effectiveness of materials and save resources. This seems to be contradictory, but ultimately to achieve harmony through design is to find a balance.

### 3.1 Aesthetics in the big picture

Aesthetics is a subjective sensibility that changes with the times and technology, and it is more important to consider the matching of different materials in the design. Different performance and characteristics of the material, with each other, complement each other's strengths and weaknesses. Mixed materials are the star of the materials used in the current decoration, and also the future development trend.

When carrying out interior design, designers usually use wood panels to carry out the design, in the division of the material, it can be classified into two categories, one is solid wood panels, one is man-made panels. But at this stage of the specific design process, designers usually use to artificial board, because to fully consider the environmental factors. If the board is classified according to the moulding, then it can usually be divided into solid board, plywood, fibreboard, decorative panels, fire prevention boards, density boards, etc., of which the most commonly used is density board. Alternatively, density board can be divided in detail. If it is divided by density, then it can be classified as high density board, medium density board, low density board. Each of these three categories has its own characteristics.

Mixed materials not only offer more functionality, but also a greater variety of colours and styles. Colour is the first thing that must be considered and it creates different sensations to people. The choice of colour of materials is very important in modern architecture and it is an important element in the composition of the man-made environment.

Since the middle of the 19th century, psychologists began to focus on the effects of colour psychology verified by experiments. Psychologists have found that different colours produce different psychological changes in people. Red causes people to become exuberant and excited, while blue causes people to become quiet. They also found that colours also have an effect on people's brain waves, for example, red gives people a sense of warning, while blue is relatively more relaxed.

Faced with this phenomenon, designers can also use colours in interior design, where designers most commonly use cool and warm colours. In the study of warm colours, it can be found that red, yellow, etc. will make people feel warm, so it is called warm colours. Purple, blue and green colours make people feel cold and are therefore known as cool colours. In daily life, the indoor use is usually incandescent lamps, if they are switched on, then people will not have a warm feeling, more so in winter. If some warm colours are added to the interior, then this feeling will be relieved relatively. In general, if the interior space is narrower and you want the interior space to be visually enlarged, then you need to use cool colours to adjust the visual effect, because warm colours have a sense of forward movement. Therefore, if you use warm colours for decoration you may make the space appear visually smaller. Darker tones and larger patterns are desirable for spacious interiors, and small rooms should consciously use a sense of colour distance to expand the space.

The purity and brightness of colours can also have a big visual effect. In general, dark colours will give people a heavy feeling, bright colours will make people feel relaxed. Therefore, when designing, the brightness and purity of colours should be used wisely.

# **3.2** Environmental protection in the whole picture

The rational use of decorative materials is the first condition for interior decoration to meet the requirements of environmental protection.

With the development of decorative materials technology, the wide application of wallpaper replaces the previous difficult to change the style of interior decoration and decoration of the problem. Wallpaper replacement relative to change the colour of wall paint to be easier, and less air pollution. Currently there are ordinary wallpaper, plastic wallpaper, paper-based fabric wallpaper and many other types of wallpaper.

For example, the choice of flooring materials, according to the size of foot traffic to choose different materials. Larger foot traffic in the living room and walkway, try to use tiles and other more resistant materials, although the aesthetics is relatively low, but also difficult to replace, but the cost is lower, more stable. Bathrooms and kitchens use a lot of water, so also use tile as a decorative material. Bedroom and study of these relatively small flow of people, more use of wood flooring and other endurance is relatively low, but more beautiful materials. Wooden flooring is a lightweight, resilient, low thermal conductivity, simple construction material, and easy to construct.

Simple decoration is a trend, the resources used in decoration and furniture will be more reasonable. Now there are many small houses decorated with luxury, in fact, this is a waste of resources. The pursuit of high-grade, the use of a large number of complex decoration materials, will make the space looks more crowded, the material residual toxic gases in a small space can not be quickly evaporated, may be hazardous to health. You can create a comfortable and warm living environment through decoration and furniture placement.

# 4. New environmental protection concept of interior design decoration material selection

The overall environmental protection concept puts extra emphasis on saving energy, of course, in saving energy at the same time to reduce the cost, not just the pursuit of environmental protection and make the renovation of the cost is too much, which is contrary to the original intention of environmental protection, after all, saving money is also in saving resources.

Many customers are now keen on natural materials such as wood and stone. Timber and stone processing history is relatively long, the technology is also quite skilled, pollution is basically the lowest of all materials, is indeed a more ideal material. However, in today's more industrially developed world, natural materials are rather more expensive. Therefore, there is no need to use too much natural materials in most buildings. In addition to being expensive, natural materials are relatively difficult to recycle and dispose of.

Polymer materials are a more desirable choice for home decoration. Polycarbonate (hereinafter referred to as PC) is one of the best. PC material has excellent transparency and impact resistance, good mechanical strength, thermal performance and electrical resistance, small creep, product size stability, and can be alloyed with many kinds of polymer materials to make its performance more perfect. Good prospects and excellent performance, as well as low prices, all make PC materials become the first choice for future home decoration. Mass production of PC materials, in the cost than natural materials have an advantage, and can pull the related industrial development.

At present, the domestic building design has strengthened the importance of fire protection. If the home decoration still use too much wood, glass and other poor fire performance of the material, obviously does not meet the requirements of the combination of PC materials and fire-retardant materials, can achieve a more ideal fire performance. Therefore, PC materials are often used in large public buildings.

## 5. Conclusion

At present, there are still a lot of wasted materials and wasted energy in interior design. To save energy, then in the specific process, the relevant staff need to do the following two aspects.

First, when designing, the concept of environmental protection should be integrated into it, so that the interior design can be more environmentally friendly. Secondly, when carrying out interior design, designers should also fully integrate the relevant elements of nature into the design, so that people can better get close to nature.

Therefore, in the specific design, designers should not only consider the practicality of the design, but also spend a lot of energy to study the costeffectiveness of different materials. Protecting the environment and paying attention to ecology is the responsibility of every designer.

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Journal of Sustainable Business and Economics https://journals.bilpubgroup.com/index.php/jsbe

### ARTICLE

# Research on the Integration of Batik Technology as Intangible Cultural Heritage and Cultural Tourism——Example of Miao People in Guizhou, China

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### ABSTRACT

Miao batik in Guizhou region of China has a long history, and the batik process is also a kind of inheritance of intangible cultural heritage, which contains the longing and pursuit of the minority people for a better life, and it is an indispensable treasure of the national folk culture, which is deeply loved by the people for its unique form showing its own unique value. At the same time, batik has become an important tourism resource to attract consumption because of its exquisite pattern modelling, iconic colour effect and deep cultural connotation.

Keywords: Miao batik; Craft symbols; Cultural heritage; Culture and tourism integration

### **1. Introduction**

Batik is a traditional textile and dyeing technique of ethnic minorities in ancient China, which is known as one of the three major textile and dyeing techniques in ancient China together with 'stranded val' and 'pinch val'. Miao and Buyi ethnic groups are good at batik, which is a technique of drawing patterns on cloth with liquid wax, then removing the wax after dyeing. The patterns are first drawn on the cloth with liquid wax, and then the wax is removed after dyeing. Because of the natural cracking of the wax, the surface of the cloth often shows a special 'ice pattern', which has a special flavour. Batik has rich patterns, light colours and unique styles, and is often used to make clothing and all kinds of daily necessities, which gives people a sense of simplicity, elegance and pleasing to the eyes, and is very characteristic of the nation. Batik has a history

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ARTICLE INFO

Received: 10 December 2024 | Accepted: 20 December 2024 | Published Online: 30 December 2024 DOI: http://doi.org/10.26549/jsbe.v7i4.22669

#### CITATION

P, L.L., 2024. Research on the Integration of Batik Technology as Intangible Cultural Heritage and Cultural Tourism——Example of Miao People in Guizhou, China. Journal of Sustainable Business and Economics. 7(4): 39–43. DOI: http://doi.org/10.26549/jsbe.v7i4.22669

#### COPYRIGHT

Copyright © 2024 by the author(s). Published by Bilingual Publishing Group. This is an open access article under the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License (https://creativecommons.org/licenses/by-nc/4.0/). of more than 2,000 years, starting from the Qin and Han Dynasties in China. In the wheel of history, the inheritors have created a rich and colourful batik technique and developed it into an indispensable and valuable treasure of the Chinese nation. From the perspective of cultural ecology, the creation and development of any kind of art or culture cannot be separated from its special living environment, and the unique social and ecological environment of Guizhou Province has enabled the continuation of the batik technique in the region, making it an indispensable element in the daily life of the local ethnic minorities.

### 2. Production process of batik

The production process of batik can be roughly divided into three steps: linen, waxing and dyeing. The materials used in these three steps are all taken from nature and are made by hand by the Miao people.

(1) Firstly, we go to the mountains to find 'hemp', extract the plant fibre and make it into cloth, then bleach and wash the cloth with straw ash, then use boiled taro to make a paste and smear it on the opposite side of the cloth, then put it on the stone plate after drying in the sun and use the horn of an ox to smooth and polish it.

(2) Firstly, lay the white base cloth on a wooden board, then put the yellow wax into a metal container and dissolve it over a low fire, then use a wax knife dipped in the wax juice to draw patterns on the base cloth. The way of holding the wax knife is different from the way we normally write. The wax knife is held with the handle tilted significantly forward at an angle of more than 45 degrees, and the blade tilted backward almost under the wrist, resulting in a forward tilt of the tip of the brush and a backward point of the nib. When painting, for those long straight lines, the wax cutter can only move vertically with the wrist, horizontal and other movements can only be used to trim some short horizontal lines and to draw circles, if the horizontal straight lines are long, then the method must be changed at this point, and in order to keep the process of making the wax cloth fool-proof, it is common to change the position or rotate the wax cloth in order to change it horizontally or vertically before proceeding with the painting. The whole process must be done with concentration and patience. Throughout the painting, the wax juice must be kept at the right temperature, usually at fifty degrees centigrade. This process of using wax is called wax spotting, and the requirement of this step is to be very skilful and not to make any mistakes in the process of painting.

(3) Dyeing involves immersing the wax-coated cloth in large ceramic jars containing blue indigo dye extracted from plants, usually for five to six days per piece. After the first soaking and taking it out to dry, the cloth becomes light blue, and after drying it and soaking it several times, a deep

After the first soaking, the cloth turns light blue. After the first soaking, wax flowers are dyed on the light blue colour, so that after dyeing, two patterns of light and dark colour appear. When dipping and dyeing, some 'wax seals' are damaged and cracked due to folding, which is called 'ice pattern', making the batik pattern more rich in layers, with natural and chic flavour, of course, when people master this law, they can design and control this 'ice pattern', according to the overall aesthetics of the needs of controlling this unique flavour. 'Ice pattern'.

(4) Then the cloth is boiled with water to remove the wax, and after rinsing, the cloth will show the blue and white distinct patterns in a process called wax removal.

Each piece of finished batik is the result of the hard work of Miao women, which contains the concept of Miao people living in harmony with nature for thousands of years. They depict a variety of exquisite patterns on the wax cloth, including bird patterns, fish patterns, dragon patterns, phoenix patterns, butterfly patterns and other animal patterns, as well as pear patterns, pomegranate patterns, and other plant patterns, no matter whether it is the pattern or the raw material are all taken from the nature, and Miao women then carry out purely handmade processing in order to make the pattern. Both patterns and raw materials are taken from nature, and the Miao women then process them by hand in order to get a beautifully made batik cloth. Batik of the Miao is a concept that embodies the idea of harmony between human beings and nature, and it is a desirable way for human beings to get along with nature.

# **3.** Combination of batik and modern technology

Through investigation and research, the reason is that purely handmade batik is too expensive, long time, low production, not enough visibility, then thought of using modern methods for processing and promotion.

(1) Nowadays, the scope of self media is very wide, all aspects of the life of common people are involved, many companies use media to promote their products, in fact, this reason can also be applied to batik, modern people's living standards compared to the previous has improved greatly, more in pursuit of the quality of life, for the products of the ancient technology but more like, just batik technology in the developed areas are rarely known, we can choose to promote through the self media to promote the batik. Developed areas are rarely known, we can choose to expand the impact through the promotion of self-media, such as the current jitterbug short video, WeChat public number and so on promotion.

(2) Use modern industrial technology to improve the industry, batik use of cloth is a linen plant fibre production, dyes are also extracted from the natural plant indigo pulp, sometimes because of seasonal reasons can not be produced in large quantities, we can use modern greenhouse technology planting, printing part can be carried out by machine, with modern assembly line, so that large quantities can be produced, but also to Reduce the price, conducive to the promotion. It is worth noting that some places have begun to use these techniques, but it is only a simple printing operation of the pattern on the batik, which is far from achieving the effect of promoting batik. The products of these industries often face the problem of discolouration, the designed clothes take back and wear a few times and start to lose colour, the colour becomes faded, while the handmade batik, the traditional material is the more vivid the more it is washed, so the process should try to avoid dyeing with chemical materials, the traditional linen can better absorb the colour, in order to achieve the effect of the more it is washed, the more it is vivid.

(3) Guizhou is now a county with high speed, so it is completely capable of setting up batik factories in some famous places or Miao villages, making batik as a local income-generating industry and integrating the idle labour force at home, which can not only improve the output but also solve the employment problem of some people.

(4) Batik is not sold partly because of the problem of style, Miao village after all, less contact with modern society, batik fabric clothing style is also relatively obsolete, you can ask professional designers in accordance with the preferences of modern young people to design styles, innovation in the old.

## 4. 'Internet + Batik', and the integration of cultural tourism

With the arrival of the new media era, 'Internet +' has become a hotspot, exploring 'Internet + Batik' in the new media, network platforms on the dissemination of China's intangible cultural heritage and modern science and technology to carry out the organic fusion of batik culture is the focus of the current innovative development of batik culture. For example, various kinds of films and documentaries are combined with batik culture; at the same time, through interconnection, 'Batik Culture Taobao' shop is established to make batik culture, and put it on various short video platforms to expand the scope of dissemination.

Batik is China's intangible cultural heritage and a part of Chinese culture, it is not only an art form, but also a kind of cultural inheritance and spiritual pursuit. In the era of rapid development of the Internet, batik culture, as a member of China's intangible cultural heritage, should also keep abreast of the times, and the inheritors should actively use the new media platform to let more people understand batik and love batik, and to promote batik culture in the 'Modern + Batik Culture Taobao' shop. 'Modern+Batik', "Campus+Batik", "Internet+Batik" and other innovations, to contribute to the promotion of the dissemination, inheritance and development of batik culture, so that China's intangible cultural heritage in the journey of the new era Shining.

(1) Culture and tourism revitalisation type and protection type integration: display batik museums

As a must-visit attraction in the cultural tourism of ethnic villages, batik museums, as productive protection bases, make batik culture preserved and inherited by combining revitalisation and protection through the display of showrooms. At present, the batik museums in Guizhou Province include Guizhou Provincial Museum, Anshun Batik Museum and so on. Besides, Guizhou Province has also established ethnic culture tourism villages so that tourists can directly understand batik culture.

(2) Experiential Integration of Culture and Tourism: Batik Handmade Workshop Experience

At present, in Guizhou ethnic village scenic spots such as Xijiang Thousand Houses Miaozhai, Danzhai Wanda Town, Yagi Gou Batik Experience Workshop, Anshun Batik Experience Museum, Anshun Tunbao Scenic Spot Oriental Batik Experience Museum, and other areas, the batik technique is made to present the batik products' production process of painting, washing and dyeing to tourists through the form of culture and tourism fusion handicraft experience. Visitors can outline the pattern, point the wax flower, dye with the batik heritage master, make their beloved batik works, and personally feel the infinite charm of batik art.

(3) Creative and Extended Integration of Culture and Tourism: Batik Tourism Handicrafts and Folklore

The combination of batik and tourism is mainly through the form of tourism products. It is the core element in the tourism industry and the basis of all tourism activities, such as B&Bs, costumes, coasters and wall hangings with batik elements as IP. The integration of batik culture and tourism products promotes the development of tourism in ethnic areas on the one hand; on the other hand, it satisfies the visual experience of tourists through the presentation of batik tourism products, so that the period of more in-depth understanding of the rich batik culture.

(4) Virtual Landscape Roaming

Adhering to the tenet of 'inheriting batik technique, creating cultural tourism, promoting industrial development and shaping batik brand', the theme attractions of batik handicraft industry are established in minority areas of Guizhou, and the batik non-heritage handicraft cultural brand is created through large-scale batik industry clusters and mutual co-operation among multiple industries. In the process of travelling from the source to the destination, tourists can enter the experience interface of minority villages and batik non-heritage tourism products through virtual reality technology to understand the connotation of the original national culture, such as the pattern symbolism, colour matching and legend stories of batik. Through the informative and real visual 3D information, the tourists have a certain degree of understanding of batik culture and the beautiful feeling of immersion before entering the scenic spot.

(5) Virtual Character Experience

The production process of batik is programmed, and the processes from painting, washing, dyeing to cutting, sticking and sewing are closely integrated. It can be designed according to the different scenes of the non-heritage virtual tourism products, so that tourists can enter the exploration board of the knowledge of batik technique, the practice board of batik technique, the design board of batik creation, the cultural protection board of batik technique, etc., so as to make them immersed and wholeheartedly integrated into the unique handcraft of batik and be a protector, experiencer and disseminator of the intangible cultural heritage.

(6) Virtual Product Experience

Cultural tourism products can enhance the travelling experience of tourists on the one hand, and lay the groundwork for the sale of cultural commodities on the other. The virtual tourists landscape roaming route is dotted with a bright pearl - intangible cultural heritage virtual tourism products, tourists can experience the derivatives of batik according to their personal interests and hobbies, such as virtually wearing batik costumes, satchels, batik tea table tea tasting, etc., through the rich audio, video, text, animation, text pictures in the experience process to feel the connotation charm of batik, handmade techniques, etc., and get to know batik knowledge in depth through the microblog public account, WeChat public account, and Jitterbug number of batik craftsmen.

## 5. Conclusion

As an intangible cultural heritage, batik handicraft should extend and expand the artistic and cultural charm of batik, so as to make the protection and dissemination of the gradually disappearing handicraft and migration history more convenient and complete. Both the traditional batik handicraft and the products of cultural and tourism fusion bring vitality to the original ethnic cultural tourism in Guizhou. In the process of development of culture and tourism fusion industry, batik handicrafts, through its exquisite skills, representative legends and stories, carry cultural skills through culture and tourism products, so that tourists can feel its cultural heritage through the original national cultural tourism, enhance the inherent inheritance power of the national excellent traditional culture, better inheritance and development, so that the national skills blossom all over the world, and let the cultural memories flow for a long time.

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Journal of Sustainable Business and Economics https://journals.bilpubgroup.com/index.php/jsbe

### ARTICLE

# Research on Human Resource Innovative Performance Management and the Impact of Digital Economy——Taking an Enterprise in Henan as an Example

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### ABSTRACT

With the rapid development of the digital economy, enterprise human resources innovative performance management faces new challenges. This paper takes the background of digital economy as the premise, takes an enterprise in Henan as an example, and discusses in depth the impact of digital economy on the innovative performance management of enterprise human resources. In response to the challenges in the digital context, solution measures such as intelligent training, data-driven performance evaluation, and innovative reward and punishment system are proposed, with a view to providing strong reference and guidance for relevant personnel.

Keywords: Digital economy; Enterprise human resources; Innovative performance management; Management strategy

### 1. Introduction

The rise of digital economy has brought unprecedented opportunities and challenges to enterprise management. Although the wide application of digital technology brings efficiency and convenience to enterprises, it still faces many problems in innovative performance management of human resources. The lag of traditional performance management methods, the lack of digital skills and the insufficiency of innovative incentive mechanisms have become bottlenecks restricting the development of enterprises. This paper conducts an in-depth study on innovative performance management, aiming to solve the HRM problems in the era of digital economy through innovative means, and to realise the sustainable innovation and competitive advantage of enterprises.

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ARTICLE INFO

Received: 10 December 2024 | Accepted: 20 December 2024 | Published Online: 30 December 2024 DOI: http://doi.org/10.26549/jsbe.v7i4.22795

#### CITATION

C, Z.W., R.G.S., 2024. Research on Human Resource Innovative Performance Management and the Impact of Digital Economy——Taking an Enterprise in Henan as an Example. Journal of Sustainable Business and Economics. 7(4): 44–49. DOI: http://doi.org/10.26549/jsbe.v7i4.22795

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### 2. Advantages of the use of digital economy in the innovative performance management of human resources in enterprises

With the rapid rise of the digital economy, enterprises have explored brand new possibilities in the field of human resources innovative performance management. The digital economy brings unprecedented opportunities and advantages for enterprises, and plays a crucial role in enhancing the effectiveness of human resource management, stimulating the potential of employees, and realising innovative performance management. Against this backdrop of change, we can clearly see a series of outstanding advantages presented by the widespread application of the digital economy in enterprise human resource management. The following will delve into the three major advantages of the digital economy in the innovative performance management of enterprise human resources:

### 2.1 data-driven decision-making

The core of the digital economy is data, and in human resource management, a large amount of data is involved in employee performance, training, recruitment and other aspects. Through digital means, companies are able to collect, analyse and utilise this data in real time to gain a more accurate understanding of employee performance and needs. This data-driven decision-making enables companies to develop more specific and actionable HR strategies, and accurately adjust employee allocation, training programmes and incentives to improve overall performance.

### 2.2 Intelligent Recruitment and Talent Management

The digital economy provides enterprises with more intelligent recruitment and talent management tools, and through artificial intelligence, big data analysis and other technologies, enterprises can more quickly and accurately find the right talent for them. Intelligent recruitment systems can automatically match job requirements with candidates' skills and experience, improving the efficiency of recruitment and shortening the recruitment cycle. At the same time, the digital economy also provides enterprises with more comprehensive talent management tools. Through the establishment of employee information databases and performance management systems, enterprises are able to better understand the ability, potential and development direction of their employees, and formulate training programmes and promotion paths in a targeted manner. This not only helps to stimulate the enthusiasm of employees, but also enables enterprises to better retain outstanding talent.

# **2.3** Flexible work patterns and employee experience

The digital economy has driven changes in work patterns and made flexible working possible. Through digital tools and cloud computing technology, employees can more freely choose their workplace and work hours to achieve work-life balance. This flexibility not only helps to increase employee job satisfaction, but also contributes to improved employee performance. The digital economy also provides companies with more means to focus on the employee experience. Through employee satisfaction surveys and real-time feedback, companies can understand employee needs and feedback in a more timely manner, adjust their human resource management strategies, and enhance the employee work experience. This management style of focusing on employee experience helps to improve employee loyalty and commitment, which in turn has a positive impact on overall performance.

### **3.** The problems existing in the enterprise human resources innovation performance management in the context of the digital economy

# **3.1** There is an extreme lack of scientific and technological talents in enterprises

With the booming development of the digital

economy, the demand for scientific and technological talents in enterprises has increased dramatically. However, the current enterprises generally face the problem of shortage of scientific and technological talents. Digital transformation requires talents with the ability to master and apply advanced technologies, including expertise in data analysis, artificial intelligence, and big data management. Enterprises face difficulties in recruiting, cultivating and retaining these talents, which leads to a serious shortage of scientific and technological talents and restricts the speed of digital transformation.

# **3.2** The content of the performance management system is not flexible and innovative enough

Traditional performance management systems appear relatively rigid and outdated in the digital economy. The traditional annual performance evaluation is often too formal and stereotypical, and it is difficult to adapt to the rapidly changing market and business environment. In the digital economy, organisations need more flexible, real-time performance management systems that can respond to market changes and employee performance in a timely manner. The current performance management system may lack adaptability to new technologies and work styles, resulting in the actual contribution of employees not being fully reflected, and it is also difficult to stimulate employee innovation and initiative.

# **3.3 Traditional performance appraisal lacks objective data support**

Traditional performance appraisal usually relies on subjective evaluation and managers' intuitive judgement, and lacks sufficient objective data support. This model is susceptible to factors such as subjective bias, personal emotions and team politics, leading to unfair and inaccurate assessment results. In the era of digital economy, enterprises should pay more attention to data-driven decision-making, while traditional performance assessment methods cannot effectively use big data, analytical tools and other technologies to comprehensively and objectively reflect the actual performance and contribution of employees. This problem limits the ability of enterprises to develop scientific and reasonable talent incentive and development programmes.

# **3.4 Innovative performance reward and pun-ishment mechanisms are inflexible**

Traditional performance reward and punishment mechanisms are usually too standardised and rigid, making it difficult to respond flexibly to the contributions and performance of different employees. In the rapid development of the digital economy, employees' work content and contribution methods are diversified, and the traditional reward and punishment system is difficult to meet such diversified needs. For contributions to innovative work and teamwork, the traditional reward and punishment mechanism may not provide sufficient incentives, leading to the loss of excellent employees and the loss of innovative motivation.

### 3.5 Employee digital skills shortcomings affect performance improvement

With the rapid development of the digital economy, companies are demanding more and more digital skills from their employees. However, many employees may lack the necessary digital skills, including but not limited to data analytics, AI applications, cloud computing, and other aspects. This skills shortfall not only affects employee performance in a digital work environment, but also negatively impacts the overall digital transformation of the organisation. Employees' digital skills shortcomings may lead to low productivity, lagging project schedules, and may even miss out on business opportunities brought about by the digital economy era.

### 4. Enterprise human resources innovation performance management in the use of digital economy effective measures

# 4.1 Nurturing talents and consolidating the foundation of enterprise science and technology innovation

First of all, in order to attract talents and consolidate the foundation of enterprise science and technology innovation, enterprises can establish a close cooperation relationship between industry, academia and research. By establishing strategic partnerships with universities and research institutes, enterprises can directly participate in scientific research projects and attract excellent research talents. At the same time, innovative projects and challenges are carried out to stimulate the innovation potential of internal employees. This can include organising internal innovation competitions and providing business incubation programmes to develop employees' innovative thinking and practical skills. In addition, set up a specialised R&D team responsible for research and innovation in the company's core technologies. This team can be made up of senior scientific and technological talents within the enterprise, or it can attract external professionals to join in and jointly promote the enterprise's scientific and technological innovation. Secondly, the enterprise can stimulate the innovation enthusiasm of the staff through internal innovation competition and form a batch of innovation projects. Finally, the enterprise can set up a special R & D team to attract the industry's senior science and technology experts to join, and jointly committed to the company's core technology research and innovation. Through this series of implementation steps, the enterprise will successfully introduce highlevel talent, consolidate the foundation of scientific and technological innovation, and achieve a series of innovative results in a short period of time in order to enhance the competitiveness of the enterprise.

# **4.2 Improve the content of the human re**sources innovation performance management system

Firstly, formulate clear performance management objectives. Establish the core performance management objectives of enterprises in the context of the digital economy, and make clear the desired level of performance and the specific requirements for performance. This includes aspects such as the improvement of digital skills and the strengthening of innovation ability, ensuring that the performance management objectives are consistent with the requirements of the digital economy. Second, establish a performance management indicator system. Develop a system that includes key indicators covering digital skills, innovation contribution, teamwork and other aspects. Ensure that the indicator system is comprehensive and operable in order to effectively quantify the performance of employees. Finally, adopt intelligent tools to assist management. Introduce a digital performance management platform that combines artificial intelligence technology to analyse and mine performance data. Such a tool can provide real-time performance data to provide management with faster and more accurate decision support. Taking an enterprise as an example, it has set performance management goals for the digital economy era, emphasising the enhancement of digital skills and innovation capabilities. The enterprise has established a new set of performance management index system, including digital literacy test, contribution to innovation projects and other multifaceted indicators. To aid management, the enterprise introduced an intelligent performance management platform to identify employees' highlights and room for improvement in a timely manner through data analysis. Through the implementation of this strategy, the enterprise has achieved remarkable results. The clarity of the performance management objectives prompted employees to better understand the company's expectations, and the establishment of an indicator system made performance evaluation more objective and comprehensive. The application of intelligent tools improves management efficiency and makes decision-making more timely and accurate. On the whole, enterprises have achieved significant improvement in human resources innovation performance management in the digital economy environment.

# 4.3 Implementing a data-driven performance appraisal system

First of all, in order to implement a datadriven performance evaluation system, enterprises can establish a comprehensive performance data collection and analysis mechanism. Through the introduction of advanced information technology, such as human resources management systems and big data analysis tools, enterprises can collect employee performance data in real time, including work results, project completion, personal contribution and other information. Second. clear performance indicators and evaluation systems are developed to ensure the accuracy and comparability of data. This involves working closely with departments and positions to clarify business objectives and translate them into quantifiable performance indicators. This helps to ensure objectivity in evaluation and makes digitised performance assessment more meaningful. Finally, to better facilitate data-driven performance assessments, organisations can introduce realtime feedback mechanisms. By setting up regular performance appraisal meetings or utilising digital platforms, employees can view their performance data at any time and keep abreast of their performance. This helps employees stay productive and motivated at work. Taking an enterprise as an example, it has established a comprehensive data collection and analysis mechanism by introducing an advanced performance management system. Clear performance indicators have been formulated, and relevant business objectives have been set and quantified in conjunction with each department. In order to strengthen real-time feedback, the enterprise also built a digital platform internally so that employees can view their personal performance data at any time. Through this series of measures, the enterprise has achieved the digitalisation of performance management, providing employees with a more transparent and real-time performance evaluation experience, and further stimulating employee motivation.

# 4.4 Optimise the reward and punishment system of innovative performance management

First of all, in order to optimise the reward and punishment system of innovative performance management, enterprises can establish a clear performance evaluation standard and indicator system. Through full communication with each department and team, the key elements of innovation performance are clarified and quantified into measurable indicators. Second, develop a flexible reward mechanism to motivate employees to achieve better performance in innovation. This could include creating innovation bonuses, providing additional benefits or special recognition to reward top performers in a timely manner. Again, establish a fair and transparent rating process to ensure the impartiality of the reward and punishment system. Through digital tools, such as performance management systems, the entire reward and punishment process can be made more transparent and traceable, avoiding the influence of subjective factors on the results. Taking an enterprise as an example, firstly, the enterprise has established clear innovation performance evaluation criteria through extensive research and discussion, and clarified the key elements in innovation work. Second, the enterprise designed a flexible reward mechanism that not only includes cash bonuses, but also provides additional benefits such as resource support for innovation projects and employee skills training. Finally, through the digital performance management system, the company has established a transparent process for evaluating rewards and punishments, so that employees can clearly understand their own performance evaluation, rewards and punishments. This series of measures makes employees more actively participate in innovation work, get more incentives and rewards, and at the same time improves the overall level of innovation performance and promotes the development of corporate innovation culture.

### 4.5 Developing intelligent training programmes to enhance digital skills literac

In order to formulate intelligent training plans and enhance digital skills literacy, enterprises can conduct a comprehensive digital skills needs assessment. By investigating and analysing the specific needs of each department and position for digital skills, enterprises can make clear the skills that employees need to improve in different areas and provide basic data for the development of training plans. At the same time, it combines advanced online learning platforms and digital training resources to develop personalised learning paths. According to the employees' career development direction and digital skills needs, the training plan is tailored to ensure that the training content is closely related to the actual work of the employees. In addition, an intelligent learning management system is introduced to track and evaluate the entire training process. Through data analysis, enterprises can identify bottlenecks and problems in the learning process, and make timely adjustments and optimise training plans. Taking an enterprise as an example, the enterprise first conducted a full digital skills needs assessment, clarifying the specific needs of employees in various departments in data analysis, artificial intelligence and other aspects. Secondly, the enterprise introduced a first-class online learning platform and designed a personalised digital skills enhancement plan for each employee in combination with the employee's career planning. Finally, the enterprise adopted an intelligent learning management system to provide real-time monitoring and feedback on the employee learning process. After implementing this strategy, the enterprise found that employees' digital skills literacy was significantly improved, and their work efficiency was enhanced, while they were more flexible and adaptable in the digital transformation. This not only enhances the comprehensive competitiveness of employees, but also provides strong support for the development of enterprises in the era of digital economy.

### 5. Conclusion

In summary, with the introduction and popularity of the digital economy, the innovative performance management of enterprise human resources also needs to be optimised accordingly, and a more flexible and adaptable management system needs to be constructed. We need to actively explore the innovation and application of digital performance evaluation, intelligent training and other measures to strengthen the data-driven decision-making mechanism, so as to promote the better development of employee potential. Among other things, digital training pathways can meet the needs of employees to continuously upgrade their digital skills and improve the digital literacy of the overall team. In addition, optimising the reward and punishment system for innovative performance management is also a key part of the process, and we need to strengthen the mechanism for rewarding innovation and punishing sluggishness in order to better stimulate employee creativity. Through this series of efforts, we can lay the foundation for the overall development of the enterprise and promote the continuous innovation of human resource management in the era of digital economy.

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