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Investor sentiment, accounting information and stock price: Evidence from China

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ABSTRACT

This paper analyzes the mechanism behind the effects of investor sentiment and accounting information on stock price based on the residual income valuation model. Using data from China's A-share market, we construct the sentiment index and examine the sentiment effect from the perspective of the expected earnings growth and the required rate of return. Furthermore, we investigate the joint effect of sentiment and accounting information on stock price and highlight the asymmetric effect of investor sentiment and the moderating effect of information uncertainty. The empirical results show that investor sentiment can change both the expected earnings growth and the required rate of return, thus affecting the stock price. However, the sentiment effect during pessimistic period is evidently different from that when sentiment is relatively high, especially for the required rate of return. In addition, accounting information and investor sentiment can both explain the stock price. However, accounting information is more reliable for stocks with stable earnings, whereas investor sentiment has evident asymmetric effect on stock price and should receive more focus for stocks with high information uncertainties.

1. Introduction

Recently, China's A-share market has experienced a severe fluctuation.[1] The Shanghai Composite Index rose from 2100 in July 2014 to a peak of 5178 in June 2015, and then it dropped dramatically to approximately 3500 in less than one month, exhibiting an obvious speculative atmosphere. In addition, the growth of China's real economy is gradually slowing, and the IMF has lowered its expectation of China's economic growth in 2015 to <7%. Undoubtedly, both the investors' irrational behavior and economic fundamentals could impact the market value of financial assets. However, for investors, which should be focused on more when making investment decisions?

As noted by traditional finance theory, accounting information reflects the quality of assets and the profitability of the enterprise; thus, it can be used to forecast equity prices. Several studies in the literature, such as Ball and Brown (1968), analyze the relevance between the accounting information and the asset price. However, many studies in traditional finance are developed based on the market efficiency hypothesis as well as the rational expectation hypothesis and cannot explain many financial anomalies. Studies in the field of behavioral finance believe that investors may be irrational; thus, investors' psychological factors or cognitive bias could affect their investment decisions. Therefore, the stock price variation relies not only on the intrinsic value represented by accounting information but also on investors' irrational behavior, which can be measured by investor sentiment.

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[1] A-share market indicates the stock market trading RMB common stocks issued by companies in China.

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Investor sentiment, which derives from incorrect subjective beliefs or information unrelated with asset value, may lead to false market anticipation and fuel market volatility. In the past, certain dramatic movements in the financial market, such as the recent boom and slump in China's A-share market, have made investor sentiment and its pricing function more appealing.

Existing studies have shown that investor sentiment may systematically affect the stock market; however, few provide explanation for the mechanism behind the sentiment effect. Chen (2011) develops a framework to explain the sentiment effect and finds that investor sentiment can affect the value relevance of accounting information. It is intuitive that sentiment could affect the predicted earnings growth because investors usually have an optimistic attitude toward the future during the high sentiment period, and stock analysts tend to issue higher ratings for those hard-to-value stocks (Cornell et al., 2014). In addition, sentiment could affect the required rate of return in a more complicated manner. According to the pricing theory, the required rate of return equals the product of risk quantity and risk price, whereas optimistic investors may underestimate their risk exposure but require higher compensation for their risk-taking during periods of high sentiment. Because sentiment may impact both the expected earnings growth and the required rate of return, how do these two effects interact with each other and affect stock price jointly? Furthermore, if sentiment could also explain the future stock price in addition to the accounting information, which should receive more focus when making investment decisions, particularly for those stocks with high earnings volatility? We attempt to answer these questions by exploring the unmarked mechanism behind the effect of accounting information and investor sentiment.

This paper decomposes the effect of accounting information and investor sentiment on the basis of the theoretical framework proposed by Ohlson (1995) and Chen (2011). Using data on China's A-share listed companies from 2002 to 2011, we construct investor sentiment index based on the principle component method and examine the channels behind the sentiment effect on stock price from the perspective of the expected earnings growth and the required rate of return. Then, we investigate the combined impact of sentiment and accounting information on stock prices. Moreover, we highlight the asymmetric effect of investor sentiment and the difference of the mechanism provided by information uncertainty. Our study extends the valuation model from the perspective of behavioral finance and provides empirical evidence for the specific mechanism of the sentiment effect on future price in the emerging market. In addition, we give a clear explanation for asymmetric sentiment effect and demonstrate the moderating effect of information uncertainty on sentiment and accounting information. Our study provides certain recommendations for investors' behavior decisions and is meaningful for accounting policy and market regulation.

The remainder of our research is structured as follows. Section 2 reviews the related literature, and Section 3 introduces our sample, data, major variables and models. Section 4 presents the empirical results and analyses, and Section 5 provides our conclusions and implications.

2. Literature

Accounting information has long been recognized as an important factor of stock price. Ball and Brown (1968) analyze the relation between earnings variation and price changes empirically, and Beaver (1968) employs a mean value test to further verify its significance. Chan et al. (1996) find that the percentage of cash flow can affect the accounting surplus in the next year and thus has a significant effect on the future stock return. In addition, certain studies note that earnings management can also affect the stock valuation. Chaney and Lewis (1995) indicate that earnings management of information asymmetric enterprises may lead investors to overestimate the stock price; certain other studies also find that lower accounting quality may lift the cost of equity and increase the stock valuation error (Aboody et al., 2005; Barth et al., 2013; Francis et al., 2005). However, Core et al. (2008) find there is no evident relation between the accounting quality and the equity cost, and Rajgopal and Venkatachalam (2011) argue that the worsening accounting quality is closely correlated with high return volatility.

Wang et al. (2010) note that the effect of accounting information can arise from accounting measurement and investor behavior; this implies investor behavior can also affect the stock valuation in addition to the fundamental accounting information. De Long et al. (1990) indicate that the irrational behavior of noise traders may cause the so-called “noise trader risk”; thus, the stock price is jointly determined by the “rational” intrinsic value and “irrational” noise trader risk. The behavior of noise traders is always measured by investor sentiment (Lee et al., 1991), which derives from incorrect subjective beliefs or information unrelated with stock value and reflects investors' overall optimistic or pessimistic attitude toward the stock market (Brown and Cliff, 2004). Baker and Wurgler (2006) define investor sentiment as the propensity to speculate, which drives the demand for speculative investments. In addition, the researchers find that investor sentiment has a larger effect on stocks with highly subjective valuations or those difficult to arbitrage stocks.

Different approaches are applied to gather proxies for investor sentiment in existing studies, among which some use the implicit indicators. Lee et al. (1991) employ the discount rates of Close-end Funds to describe the investor sentiment, and certain market liquidity indicators, such as the average turnover rate, are applied by Baker and Stein (2004). In addition, Schmeling (2009) suggests that the CCI (Consumer Confidence Index) can also be used to measure market sentiment. Certain other studies quantify sentiment based on certain explicit indicators. For example, Brown and Cliff (2004) use the questionnaire information such as the investors' view of the market trend and reaction to news to directly measure sentiment. In addition, Baker and Wurgler (2006) select six measures suggested by prior studies and orthogonalize them on several macroeconomic variables to extract the irrational components. Thereafter, a composite sentiment score is constructed from the six residuals using principle component analysis. Because it considers multiple information sources related to investor sentiment, the method proposed by Baker and Wurgler (2006) is widely used in the existing empirical literature (Stambaugh et al., 2012).

Many studies note that investor sentiment may have an effect on stock price. Brown and Cliff (2004) indicate that high sentiment may alter the investors' expectation of future cash flows and thus affect prices. Certain other studies (Cornell et al., 2014; Hribar and

McInnis, 2012) believe that stock analysts are optimistic regarding corporations' future profitability when sentiment is high; thus, they tend to issue more buying signals for those hard-to-value stocks. Furthermore, Baker and Wurgler (2007) argue that sentiment could also affect stock price by altering the anticipated risk exposure of investors, and Shefrin (2008) constructs an SDF (Stochastic Discount Factor) based on the sentiment and link the required rate of return to investor sentiment. In addition, Baker and Wurgler (2006) discover certain cross-sectional differences of the sentiment effect; they find that investor sentiment provides more evident impact on stocks that are difficult to value or risky and costly to arbitrage. In addition, Stambaugh et al. (2012) detect an asymmetric effect of investor sentiment, i.e., the optimistic sentiment always leads to overpricing, which is greater than the underpricing resulting from pessimism.

Most prior studies solely document the phenomenon that investor sentiment could affect stock price combined with accounting information and indicate the heterogeneity of the sentiment effect. However, the existing literature rarely provides a theoretical basis for the mechanism behind the effect of sentiment and the accounting information and explain the cross-section difference of this mechanism. Based on the residual income valuation model, this paper decomposes the effect of sentiment theoretically into two channels and provides empirical evidence for the mechanism behind these effects. Furthermore, we investigate the joint effect of sentiment and accounting information and analyze the role of information uncertainty to explain the cross-sectional difference of the sentiment effect.

3. Methods

3.1. Sample and Data

Our empirical study is performed using annual data of the Shanghai and Shenzhen A-share market in China from 2002 to 2011. The sample period ends in 2011 because of the data loss resulting from the suspension of IPOs in China's A-share market from 2012 to 2014. For the data calculation quality, we limit our sample to non-financial firms and exclude those ST and PT stocks[2]; the resulting sample is composed of 1860 firms. The one-year deposit rate, our proxy for the risk-free rate, is collected from the website of the People's Bank of China, and other data can be obtained from the CSMAR database. Data processing is completed using Matlab (R2013a) and STATA 12.0.

3.2. Variables

3.2.1. Investor Sentiment Index

In this section, we use the method proposed by Baker and Wurgler (2006) to develop the investor sentiment index of China's stock market; thus, the sentiment can be indicated by the value of the sentiment index at the beginning of the current year (the end of the previous year). Among the six sentiment proxies in Baker and Wurgler (2006), we retain the closed-end fund discount, the market turnover rate and the average first-day returns on IPOs. However, considering that China still implements the IPO verification system at present and IPO suspension is sometimes used as an instrument of stock market regulation, the number of IPOs is not appropriate to measure the investor sentiment in China's stock market. Besides, China's listed companies rarely issue the long-term debt in their public financing and usually perform badly in the dividend sustainability and dividend policy transparency. Therefore, we replace the number of IPOs, the equity share in new issues and the dividend premium with the consumer confidence index, new A-share market accounts and the average first-day turnover rate on IPOs, which are widely used as proxies for investor sentiment in the existing literature. Then, we orthogonalize these measures on macroeconomic variables such as the industrial added value, the macroeconomic climate index, the consumer price index and the money supply M1 to eliminate the effect of macro economy and achieve the "irrational" component of these measures. Thus, the investor sentiment index can be constructed from the six residuals based on their first principal component.

3.2.2. Required Rate of Return and Expected Earnings Growth

Certain studies directly use the realized rate of return to indicate the required rate of return; however, Ogneva (2012) notes that the ex-post realized rate of return is not an appropriate proxy for the ex-ante required rate of return, particularly when a cash flow shock occurs. Because investor sentiment can affect both the expected cash flow and the expected risk exposure, in accordance with Chen (2011), we use the implied cost of capital to measure the ex-ante required rate of return.[3] To improve the reliability of our conclusion, our proxy is obtained using the average of four implied costs of capital calculated from PEG (Price-Earnings Ratio divided by the Earnings Growth Rate; Easton, 2004), GGM (Gordon Growth Model; Gordon and Gordon, 1997), CT (Claus and Thomas, 2001) and OJN (Ohlson and Juettner-Nauroth, 2005), which are more efficient in China's market (Sun et al., 2012).[4] Furthermore, the expected earnings growth in this paper is calculated using the difference between the average earnings per share forecasted by stock analysts and the realized earning per share divided by the absolute value of the realized earnings per share of the previous year.

[2] In China, if a listed company reports a net loss for two consecutive years, it will be labeled as "ST", which stands for "Special Treatment". If the listed firm sustains losses for three consecutive years, it will be labeled as "PT", which stands for "Particular Transfer".

[3] Pastor et al. (2008) indicate that the implied rate of return is more useful than the actual rate of return when considering the temporal risk-return tradeoff.

[4] Two kinds of approaches are used in the current literature to estimate the implied cost of capital, including the residual income models which are labeled as GLS, CT and GGM, as well as the earnings growth models denoted by AGR, PEG, MPEG, EP and OJN. Among these approaches, GLS is a model described in Gebhardt et al. (2001), CT indicates the model proposed by Claus and Thomas (2001), GGM is a model based on the Gordon Growth Model by Gordon and Gordon (1997), AGR (Expected Abnormal Growth in Accounting Earnings), PEG (Price-Earnings Ratio divided by the Earnings Growth Rate), MPEG (Modified PEG Ratio) and EP (Expected Earnings divided by Price) are based on the abnormal earnings capitalization model proposed by Easton (2004), OJN is a model suggested by Ohlson and Juettner-Nauroth (2005).

3.2.3. Stock Price, Risk-free Rate and Earnings Volatility

The stock price is indicated by the closing price at the end of the following April, to match the time when the accounting statement is published. Our risk-free rate is measured using a one-year deposit rate, and the earnings volatility is calculated using the standard error of earnings per share in the previous eight months standardized by its mean value.

3.2.4. Characteristic Variable of Corporations

In this paper, variables such as firm size, market β, book to market ratio, momentum factor, leverage and dividend payoff ratio are used to describe characteristics of corporations, in which size is indicated by the market value. Market β is derived from the daily market returns of the previous year based on CAPM, and the book to market ratio is the corporation's book value divided by its market value. In addition, the momentum factor is obtained using the monthly cumulative return from the previous January to the previous November, the leverage is the debt to assets ratio, and the dividend payoff ratio is dividends per share divided by earnings per share. The detailed descriptions of variables in this paper are reported in Table 1.

3.3. Models

3.3.1. Mechanism behind the effect of accounting information and sentiment

It has long been accepted that accounting information is useful to forecast the stock price. Ohlson (1995) introduces the residual income valuation model and develops a relation between the accounting information and equity value.

$$P_t = Y_t + \omega/\left(R_f - \omega\right)\overline{X}_t + \alpha V_t \tag{1}$$

where P_t is the stock price, Y_t is net asset value per share, $\overline{X}_t$ is the expected excess earnings per share, V_t indicates other market information, R_f is the risk-free rate, and ω is growth rate of $\overline{X}_t$.

Because the expected excess earnings is difficult to measure, we attempt to replace $\overline{X}_t$ with accounting earnings based on the method proposed by Chen (2011). In addition, Feltham and Ohlson (1999) argue that the risk adjusted discount factor is more appropriate than the risk-free rate in the empirical setting; therefore, we replace R_f with the implied cost of capital. Thus, Eq. (1) can be written as:

$$P_t = \left(\frac{RRR - RRR\omega}{RRR - \omega}\right)Y_t + \left(\frac{RRR\omega}{RRR - \omega}\right)X_t + \left(\frac{\omega - RRR\omega}{RRR - \omega}\right)d_t + \alpha V_t \tag{2}$$

where X_t indicates the earnings per share, d_t is the dividend per share, and RRR is the required rate of return.[5]

Regarding investor sentiment, prior studies argue that sentiment impacts both the expected earnings growth and the required rate of return. The effect of sentiment on investors' judgment regarding future earnings growth is very intuitive. When sentiment is high, investors usually become more optimistic, and stock analysts tend to issue buying signals more actively (Baker and Wurgler, 2007); thus, we conjecture that higher sentiment will lift investors' expected earnings growth ω. In addition, sentiment can affect the required rate of return through its effects on the expected risk exposure and the risk price. During a high sentiment period, investors tend to underestimate the potential risk exposure (Wright and Bower, 1992) but become more risk-averse and increase their required risk price (Isen et al., 1988; Andrade, 2005). The effect of sentiment on the required rate of return RRR depends on the relative magnitude of these two effects. Thus, investor sentiment can affect stock price through its effect on the coefficients in Eq. (2).

3.3.2. Sentiment and Channels Behind its Effect on Stock Price

Under the framework developed based on the residual income valuation model, investor sentiment can affect stock price through the expected earnings growth ω and the required rate of return RRR. Here, we construct an empirical model to test whether sentiment affects these two channels significantly. To take the asymmetric effect of investor sentiment into consideration, we introduce an optimistic period dummy that takes the value of one if the sentiment index is higher than the median, and zero otherwise. The interaction of sentiment index and the optimistic period dummy is included in our in model. In addition, because higher earnings volatility may increase the difficulty of stock valuation and Baker and Wurgler (2006, 2007) show that stocks that are difficult to value tend to be more sensitive to investor sentiment, the effect of sentiment may depend on the earnings volatility of stocks. Thus, we include the earnings volatility and its interaction term with sentiment as our dependent variables. The panel data models can be described as follows:

$$EEG_{i,t} = \gamma_0 + \gamma_1 VOL_{i,t} + \gamma_2 SENT_{t-1} + \gamma_3 SENT_{t-1} \times High_{t-1} + \gamma_4 SENT_{t-1} \times VOL_{i,t} + \eta CV_{i,t} + \varepsilon_{i,t} \tag{3}$$

$$RRR_{i,t} = \lambda_0 + \lambda_1 VOL_{i,t} + \lambda_2 SENT_{t-1} + \lambda_3 SENT_{t-1} \times High_{t-1} + \lambda_4 SENT_{t-1} \times VOL_{i,t} + \xi CV_{i,t} + \varepsilon_{i,t} \tag{4}$$

where $VOL_{i,t}$ is earnings volatility and $CV_{i,t}$ presents a set of control variables including firm size, book to market ratio, market β, leverage, dividend payoff ratio, momentum factor and risk-free rate.

[5] For details, see Chen (2011).

Table 1
Descriptions of variables.

Variables	Description
SENT	Investor sentiment index. We select six measures and orthogonalize them on four macroeconomic variables, and *SENT* is calculated using the first principal component of these residuals.
RRR	Required rate of return, which is calculated using the average implied cost of capital based on four methodologies such as PEG, GGM, CT and OJN.
EEG	Expected earnings growth, which is formed by the difference between the average earnings per share forecasted by stock analysts and the realized earning per share divided by the absolute value of realized earnings per share of the previous year.
PRC	Stock price at fiscal year t. *PRC* is indicated by the closing price at the end of the following April.
EPS	Earnings per share at fiscal year t.
R_f	Risk-free rate, which is measured by the one-year deposit rate
VOL	Earnings volatility, which is derived using the standard error of EPS in the past 8 months standardized by its mean value.
LMV	Firm size, measured by logarithmic market value.
BETA	Market β, which is derived from the daily market returns of the previous year based on CAPM.
BM	Book to market ratio.
MOM	Momentum factor, i.e., returns to buying winners and selling losers, which is calculated using the monthly cumulative return from last January to last November.
LEV	Leverage, measured by the debt to assets ratio at the end of last year.
DPR	Dividend payoff ratio, which equals to the dividends per share divided by earnings per share.

Eq. (3) can be used to test the effect of sentiment on the expected earnings growth. Because investors are more optimistic and analysts tend to issue more buying signals when sentiment is high, we expect higher investor sentiment will lift the expectation of earnings growth, i.e.$\gamma_2 > 0$. The effect of sentiment on the required rate of return can be examined through Eq. (4). To test the cross-sectional difference of sentiment effect, we retain *VOL* and its interaction with sentiment in Eq. (4). Similarly, the interaction of *SENT* and *High* is included to test the asymmetric effect of sentiment on the required rate of return. As previously analyzed, higher sentiment may lead to a lower "risk amount" but higher "risk price"; the sign of λ_1 depends on the relative magnitude of these two effects.

3.3.3. Empirical Model for the Effect of Accounting Information and Sentiment

The valuation model presented by Eq. (2) indicates that the stock price could be explained by accounting variables such as net asset value per share and earnings per share. In addition, if sentiment does impact the expected earnings growth and the required rate of return, it will affect stock price together with accounting information through the effect on coefficients in Eq. (2) $(RRR - RRR\omega)/(RRR - \omega)$ and $RRR\omega/(RRR - \omega)$. Thus, we can test the joint effect of accounting information and sentiment through Eq. (5).

$$\begin{aligned} PRC_{i,t} = {} & \tau_0 + \tau_1 SENT_{t-1} + \tau_2 SENT_{t-1} \times High_{t-1} + \tau_3 BV_{i,t} \\ & + \tau_4 BV_{i,t} \times SENT_{t-1} + \tau_5 EPS_{i,t} + \tau_6 EPS_{i,t} \times SENT_{t-1} + \varepsilon_{i,t} \end{aligned} \tag{5}$$

where $BV_{i,t}$ is the net asset value per share, and $EPS_{i,t}$ is the earnings per share.

As investor sentiment may affect the expected earnings growth and the required rate of return differently during optimistic and pessimistic periods, we conjecture that sentiment has an asymmetric effect on stock price. Thus, the interaction of *SENT* and *High* is also included in Eq. (5). To consider the effect resulting from information uncertainty, we divide our sample into four groups according to the earnings uncertainty, which is represented by the standard deviation of earnings per share in the past eight seasons. Then, we run the regression shown by Eq. (5) for each group; thus, the moderating effect of accounting uncertainty can be investigated by comparing the estimated results of each subsample.

4. Results

4.1. Descriptive Statistics

Table 2 summarizes the descriptive statistics for the main variables in this paper. As shown, observations of variables is evidently different because of the data missing and the different requirement for data calculation. *RRR* (the required rate of return) has a mean of 0.0989, which is slightly larger than its median 0.0805. Additionally, the mean of *EEG* (the expected earnings growth) is 3.4279, which is also larger than its median 1.0945. The 95th quantile of *EEG* is 23.6260, which is nearly 7 times its mean value, indicating an evidently right-skewed distribution (in reality, its skewness is 2.5703). In addition, the *EPS* of our sample companies has a mean of 0.2197, whereas the standard deviation is 0.2223. Regarding other characteristic variables, our sample companies have an average size of 14.8369, and the overall leverage is 0.4860.

Using sentiment proxies that have been orthogonalized by macroeconomic variables, we can form our sentiment index based on the first principal component. The resulting index is given by:

$$\begin{aligned} SENT_t = {} & -0.0231 \times CEFD_t + 0.0224 \times CCI_t + 0.6285 \times NNOA_t \\ & + 0.4735 \times TURN_t + 0.4923 \times RIPO_t + 0.2973 \times TIPO_t \end{aligned} \tag{6}$$

Table 2
Summary statistics.

	Obs	Mean	Std	Q_5	Q_{25}	Median	Q_{75}	Q_{95}
RRR	6017	0.0989	0.0628	0.0303	0.0513	0.0805	0.1297	0.2383
EEG	7835	3.4279	5.8373	0.1146	0.6237	1.0945	2.4752	23.6260
VOL	11,340	1.1371	1.1195	0.3304	0.4673	0.6421	1.2848	4.6136
BV	14,655	3.4610	2.4915	0.7600	2.0100	3.0340	4.3085	7.9600
EPS	14,593	0.2197	0.2223	−0.0161	0.0296	0.1655	0.3436	0.6911
DPR	8828	0.9116	0.5784	0.1667	0.4327	0.7775	1.3496	1.9608
LMV	13,191	14.8369	1.0596	13.3509	14.1149	14.7166	15.4167	16.7744
LEV	16,453	0.4860	0.1866	0.1499	0.3506	0.4960	0.6276	0.8054
BETA	14,283	1.0721	0.3069	0.6158	0.9432	1.0977	1.2285	1.4552
BM	14,401	0.3805	0.2168	0.0811	0.2080	0.3380	0.5193	0.8517
MOM	12,997	0.0074	0.0498	−0.0690	−0.0250	−0.0023	0.0427	0.0919

where $CEFD_t$ is the discount of Closed-end Fund, CCI_t is the consumer confidence index, $NNOA_t$ indicates the new A-share market accounts, $TURN_t$ is the A-share market turnover rate, and $RIPO_t$ and $TIPO_t$ indicate the average first-day return and the first-day turnover rate on IPO, respectively.

Each individual sentiment measure is entered with the expected sign in Eq. (6). The monthly sentiment index of China's A-share market from 2001 to 2013 is illustrated in Fig. 1,[6] which shows that the sentiment index was below zero from 2002 to 2005. This finding indicates that investors were generally pessimistic in this period. In addition, the sentiment index rose sharply from 2005 to 2007 but decreased dramatically in 2008, which is very consistent with the market condition before and after the financial crisis.

4.2. Effect of Sentiment on the Expected Earnings Growth

We examine the relation between sentiment and the expected earnings growth using a panel data model, and Table 3 reports the regression results. In column (1), the sentiment index, the earnings uncertainty and their interaction are included as explanatory variables. In addition, we include certain control variables such as risk-free rate, dividend payoff ratio and firm size in column (2). To better illustrate the moderating effect provided by earnings uncertainty, we sort our observations based on their historical earnings volatility and replace the original *VOL* measure with the ranking of 1 to 4 (1 is the smallest volatility, and 4 is the largest) in column (3). For columns (1) to (3), p-values of the Hausman test are all smaller than 1%, implying that the fixed effect model should be applied to estimate the coefficients.

As shown in Table 3, the coefficients of the sentiment index are positive and significant at the 1% level even after controlling the risk-free rate and other characteristic variables, indicating that sentiment can provide a positive effect on the expected earnings growth. This result is consistent with our prediction that higher sentiment leads to more optimistic expectations regarding future earnings growth. However, the coefficients on the interaction of sentiment and the optimistic period dummy variable are negative. This indicate that investor sentiment has a weaker impact on the predicted earnings growth during optimistic period. In addition, the coefficients on earnings volatility are also significantly positive across all columns, which implies that investors tend to have more optimistic predictions for stocks with higher information uncertainties. The estimated coefficients on the interaction of sentiment and earnings volatility are all negative, which is consistent with the finding of Baker and Wurgler (2006) that high information uncertainty may increase the difficulty of stock valuation; thus, those hard-to-value stocks are more sensitive to sentiment. Because of the strong speculative atmosphere in China's stock market, the prices of stocks with high earnings volatility rise very rapidly in the short-term such that investors will lower their expected earnings growth in the next period as a result of the modifying effect.

Regarding the control variables, the estimated coefficients on *DPR* and *LEV* are positive and significant at the 1% level, whereas the coefficients on *LMV*, *BETA* and *BM* are negative and significant at the 10% level. These results suggest that investors have higher expected earnings growth for firms with higher dividend payoffs and leverage. However, for those firms with larger size, higher market risk or higher book to market ratios, investors tend to have lower expectations.

4.3. Effect of Sentiment on the Required Rate of Return

Table 4 presents the regression results using the required rate of return as the dependent variable. Similar to the result in Table 3, we add firm characteristic variables as control variables in column (2). Additionally, in column (3), we replace the original *VOL* measure with the earnings volatility ranking indicated by 1 to 4 (1 is the smallest volatility and 4 is the largest). All parameters are estimated using the fixed effect model according to the results of the Hausman test.

As shown in Table 4, the *SENT* coefficients are not significant after controlling the impact of control variables, which indicates that sentiment has no significant effect on the required rate of return during low sentiment period. However, the coefficients of the $SENT * High$ are significantly positive across all columns, implying that higher sentiment can lift the required rate of return during

[6] The missing monthly data required is completed using the interpolation method.

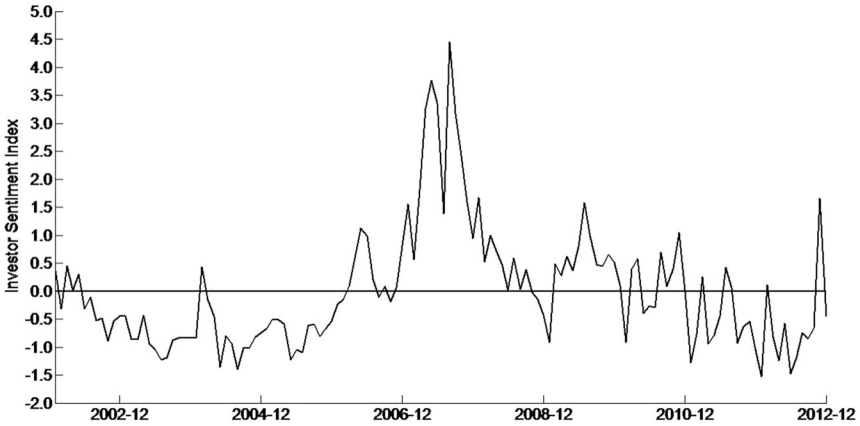

Fig. 1. Sentiment index of China's A-share market from 2001 to 2013. Note: We select six measures as sentiment proxies and orthogonalize them on four macroeconomic variables, our sentiment index is formed using the first principal component of these residuals. The missing monthly data required is completed using the interpolation method.

optimistic period. This suggests that a higher sentiment exhibits a greater effect on "risk price" than that on "risk amount" and thus lifts the required rate of return when investors are overall optimistic. Furthermore, we find no evidence of the direct effect and moderating effect of information uncertainty because the estimated coefficients on *VOL* and *SENT* ∗ *VOL* are not significant at the 10% level in column (2) and column (3). Regarding the control variables, the estimated coefficients *DPR* are significantly positive in the latter two columns; however, the *LMV* and *BM* coefficients are significantly negative. These results imply that investors will require higher return for firms with higher dividend payoff ratios. However, the investors' required rate of return is lower for those firms that have a larger size or book to market rations.

Table 3
Effect of sentiment on the expected earnings growth.

Variables	(1)	(2)	(3)
Constant	2.9757***	28.1205***	24.9818***
	(19.16)	(9.03)	(8.06)
VOL	1.6028***	1.4403***	1.7166***
	(13.00)	(11.79)	(16.92)
SENT	2.2723***	2.2081***	2.7051***
	(8.08)	(4.05)	(4.79)
SENT ∗ *High*	−2.7633***	−0.8591	−1.2713**
	(−8.05)	(−1.45)	(−2.09)
SENT ∗ *VOL*	−0.3554**	−0.3396**	−0.1692*
	(−2.25)	(−2.21)	(−1.73)
R_f		−97.3453***	−111.8016***
		(−3.31)	(−3.86)
DPR		0.5577***	0.5081***
		(3.54)	(3.32)
LMV		−1.6525***	−1.4992***
		(−8.48))	(−7.69)
BETA		−1.0974**	−1.1275*
		(−2.51)	(−2.59)
BM		−1.9087***	−1.7475***
		(−3.37)	(−3.09)
MOM		6.1925***	4.0727**
		(3.31)	(2.19)
LEV		3.7180***	2.9018***
		(3.82)	(3.06)
Trend		0.2326***	0.1200*
		(−3.62)	(1.85)
R^2	0.0827	0.1252	0.1385
Observations	6826	6812	6812
Hausman test	157.49	205.63	155.08
p-Value	0.0000	0.0000	0.0000

Corresponding *t*-statistics are reported in parentheses. The Hausman tests suggest that all parameters should be estimated using the fixed effect model.
*** Significance at 1% level.
** Significance at 5% level.
* Significance at 10% level.

Table 4
Effect of sentiment on the required rate of return.

Variables	(1)	(2)	(3)
Constant	0.0959***	0.8763***	0.8810***
	(52.68)	(24.44)	(24.53)
VOL	0.0042***	0.0001	−0.0012
	(2.89)	(0.06)	(−0.93)
$SENT_{t-1}$	−0.0538***	−0.0843***	−0.0842***
	(−13.53)	(−11.29)	(−10.84)
$SENT_{t-1} * High$	0.0325***	0.1219***	0.1222***
	(7.00)	(14.62)	(14.58)
$SENT_{t-1} * VOL$	−0.0016	−0.0009	−0.0004
	(−0.86)	(−0.63)	(−0.37)
R_f		−1.6663***	−1.6734***
		(−5.15)	(−5.18)
DPR		0.0070***	0.0071***
		(3.78)	(3.78)
LMV		−0.0544***	−0.0546***
		(−22.34)	(−22.41)
BETA		−0.0069	−0.0069
		(−1.29)	(−1.29)
BM		−0.0552***	−0.0552***
		(−7.68)	(−7.69)
MOM		0.0090	0.0108
		(0.47)	(0.56)
LEV		−0.0275***	−0.026
		(−2.67)	(−2.49)
Trend		0.0149***	0.0150***
		(15.68)	(15.72)
R^2	0.1711	0.3420	0.3421
Observations	5265	5254	5254
Hausman test	17.95	630.91	636.52
p-value	0.0030	0.0000	0.0000

Corresponding *t*-statistics are reported in parentheses. The Hausman tests suggest that all parameters should be estimated using the fixed effect model.
*** Significance at 1% level.
** Significance at 5% level.
*Significance at 10% level.

4.4. Joint Effect of Accounting Information and Sentiment

Because accounting information and investor sentiment could both affect stock price, we investigate their joint effect on stock price; Table 5 provides the results. To consider the moderating effect of information uncertainty, we rank our observations based on their earnings volatility and divide them into 4 groups. Columns (1) to (4) convey the results of each group, respectively (column 1 is the least volatile group, whereas column 4 is the most volatile group). Again, all parameters in columns (1), (2) and (4) are estimated using the fixed effect model suggested by the Hausman test. Table 5 shows that *SENT* coefficients are not significant in columns (1) but are significantly positive in column (2), (3) and (4); moreover, the coefficient in column (4) is evidently larger than that in column (3). These results indicate that information uncertainty provides more difficulties in stock valuation; thus, stocks with higher earnings volatility are more sensitive to investor sentiment. What should be noted is that the coefficients of $SENT * High$ are negative and have larger absolute values than those of *SENT*, implying that higher sentiment can lower stock price during high sentiment period. This is consistent with the results in Tables 3 and 4, as sentiment has a much weaker positive effect on the predicted earnings growth but stronger positive effect on the required rate of return during optimistic period compared with the pessimistic case. In addition, the estimated coefficients on accounting variables (both *BV* and *EPS*) are significantly positive; however, the coefficients generally decrease with the increase of earnings volatility except the case in column (3), indicating that the direct effects of accounting information gradually weaken with the increase of information volatility.

Regarding the interaction of accounting variables and investor sentiment, as shown in Table 5, the coefficients on $BV * SENT$ are positive in four groups but gradually decrease with the increase of earnings volatility. A similar trend can be found for $EPS * SENT$, and its coefficient estimated is not significant in the most volatile group, implying that the indirect effect of accounting information will decrease when information uncertainty is higher. These results suggest that accounting information is useful for stock valuation, particularly for those with stable earnings. However, for stocks with high earnings volatility, the effect of investor sentiment should receive more focus.

4.5. Robustness Test

We undertake certain sensitivity checks to test whether the effect of accounting information and the investor sentiment on stock price is robust. First, the expected earnings growth in the above analysis is measured by $(E(EPS_{t+1}) - EPS_t)/|EPS_t|$; however, its embedded economic meaning may be different for different signs of EPS_t. When EPS_t is positive, it measures the persistence of

Table 5
Joint effect of accounting information and sentiment on stock price.

Variables	(1)	(2)	(3)	(4)
Constant	7.1271***	9.3280***	7.3821***	8.9444***
	(8.08)	(12.24)	(15.07)	(11.61)
SENT	1.7847	4.2460***	5.5390***	8.0416***
	(1.08)	(4.21)	(10.06)	(11.55)
*SENT * High*	−6.8220***	−6.9119***	−7.0350***	−8.5650***
	(−8.21)	(−10.32)	(−11.28)	(−9.66)
BV	1.1051***	0.7130***	1.0225***	0.7604***
	(4.41)	(3.46)	(6.78)	(2.74)
*BV * SENT*	1.0219*	0.5865**	0.3193***	0.1779*
	(1.84)	(2.09)	(2.24)	(1.66)
EPS	15.5013***	9.6052***	14.5435***	8.2362***
	(7.37)	(6.70)	(10.65)	(4.67)
*EPS * SENT*	9.5952***	8.0978***	5.3987***	−0.1191
	(5.53)	(3.61)	(4.62)	(−0.08)
R^2	0.4997	0.4782	0.4548	0.3622
Observations	2686	2578	2135	1556
Hausman test	26.74	89.33	11.18	17.39
p-Value	0.0004	0.0000	0.1309	0.0001

Corresponding *t*-statistics are reported in parentheses. The Hausman tests suggest that all parameters in columns (1) , (2) and (4) should be estimated using the fixed effect model.
*** Significance at 1% level.
** Significance at 5% level.
* Significance at 10% level.

a firm's profitability. However, when EPS_t is negative, the larger measure indicates lower profitability persistence. As a robust check, we perform a similar analysis after excluding those observations with negative EPS_t, and the results are unaltered.

In addition, the variable $SENT_t$ is measured by the sentiment index at the beginning of the year, i.e., the end of the previous year. Because the sentiment may fluctuate wildly because of the strong speculative atmosphere in China's stock market, we conduct our analyses using the average sentiment of the previous year, and the findings still hold.

5. Conclusions and Implications

This paper analyzes the mechanism behind the effects of investor sentiment and accounting information on stock price on the basis of the theoretical framework developed by Ohlson (1995) and Chen (2011). Using data on China's A-share listed companies from 2002 to 2011, we develop the sentiment index based on the principal component analysis and examine the sentiment effect from the perspective of the expected earnings growth and the required rate of return. Furthermore, we investigate the joint effect of sentiment and accounting information on the future price and highlight the asymmetric effect of investor sentiment and the moderating effect of information uncertainty. Under the theoretical framework, investor sentiment can affect stock price through the expected earnings growth and required rate of return channels, and our empirical results show that an increase of sentiment will lead to higher predicted earnings growth, but the sentiment effect is much weaker during optimistic period. Also, higher sentiment will depress the required rate of return during pessimistic period but results to higher required rate of return when sentiment is relatively high. Furthermore, we find that both accounting information and sentiment can explain stock price; however, accounting information is more reliable for stocks with stable earnings, whereas investor sentiment has evident asymmetric effect on stock price and becomes more important in the valuation of stocks with high information uncertainties.

Our findings provide evidence that behavioral factors such as investor sentiment can explain stock price; thus, investors' psychological and cognitive biases may play important roles in the financial market, particularly the emerging markets. In addition, our results have certain implications for financial supervision and accounting policy creation. On the one hand, because higher sentiment may drive an increase in the stock price and fuel speculative bubbles in stocks, regulators should strengthen the education of individual investors and foster institutional investors and rating agencies with the purpose of guiding their rational investment. On the other hand, the regulation of accounting information of listed companies should be enhanced to improve the quality of accounting information; thus, we can weaken the effect of sentiment on stock price.

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