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Individual stock crowded trades, individual stock investor sentiment and excess returns ☆

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ABSTRACT

Recent behavioral asset pricing models and the popular press suggest that investors may follow similar strategies resulting in crowded equity positions to push prices further away from fundamentals. This paper develops a new approach to measure individual stock crowded trades, and further investigates the joint effects of individual stock crowded trades and individual stock investor sentiment on excess returns. Specifically, our results show that the combined effect of individual stock crowded trades and individual stock investor sentiment on excess returns is positive and significant, which reveals the importance of "anomaly factors" in asset pricing. Furthermore, our results suggest that increasing individual stock buyer-initiated crowded trades will increase excess returns simultaneously; however, increasing individual stock seller-initiated crowded trades will decrease excess returns simultaneously. Collectively, our results highlight the importance of individual stock crowded trades and individual stock investor sentiment on the formation of stock prices.

1. Introduction

One of the fundamental goals of asset pricing theory is to understand the source of stock prices. Recent studies in behavioral finance indicate that both investor sentiment and investor behavior have significant impacts on stock returns. Typically, Shiller (2011, 2014) highlights that researches in light of actual human behavior should take account of how people really think and act. In this paper, we use individual stock investor sentiment to describe how people think of a particular stock, and use individual stock crowded trades to portray how people really act on a particular stock in stock market, and entertain the consequence of both individual stock investor sentiment and individual stock crowded trades on excess returns.

On the one hand, an extensive theoretical literature implies that investor sentiment has a significant impact on stock prices. For example, Baker and Wurgler (2006) demonstrate that investor sentiment has larger effects for small stocks, young stocks, high-volatility stocks, unprofitable stocks, non-dividend-paying stocks, extreme growth stocks, and distressed stocks. Kumar and Lee (2006) find that retail investor sentiment explains return comovements for stocks with high retail concentration. On the other hand, a large number of literatures reveal how crowded-trade problem affects stock prices. For example, Stein (2009) analyzes the consequences of both crowding and leverage in a setting to reveal the importance of crowded-trade problems on

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stock prices. Although there are several recent studies those deal with the relation between investor sentiment (crowded trades) and stock prices, however, these papers never incorporate the two factors into one model to reveal their combined effects on stock prices.

Where this paper differs from much of the previous literatures is in analyzing the consequences of both individual stock crowded trades and individual stock investor sentiment. Specifically, we first verify the individual stock investor sentiment effect, and we further separate the individual stock crowded trades into individual stock buyer-initiated crowded trades and individual stock seller-initiated crowded trades to certify the individual stock crowded-trade effect, individual stock buyer-initiated crowded-trade effect, and individual stock seller-initiated crowded-trade effect.

In this paper, we select the 183 current components of the CSI 300 Index to study the relation among investor sentiment, investor behavior and asset prices, where we can obtain the generalizable results for the average returns of 183 stocks co-move with market returns. In our tests, panel data regressive analysis reveals that individual stock crowded trades and individual stock investor sentiment are important determinants of excess returns. In particular, both individual stock crowded trades and individual stock investor sentiment have positive and prominent impacts on excess returns with or without the Fama-French three factors of China Stock Markets. In subsequent tests, we find that individual stock buyer-initiated crowded trades, individual stock seller-initiated crowded trades, and individual stock investor sentiment have significant effects on excess returns including or excluding the Fama-French three factors of China Stock Markets. Specifically, increasing individual stock buyer-initiated crowded trades (individual stock investor sentiment) will increase excess return simultaneously; however, increasing individual stock seller-initiated crowded trades will decrease excess return simultaneously. Furthermore, we conduct a number of additional robustness tests to verify the sensitivity of our results.

Our main contributions relative to the related empirical papers reflect in the following aspects. First, this paper measures the stock-level crowded trades, and further divides it into individual stock buyer-initiated crowded trades and individual stock seller-initiated crowded trades to measure the buyer-seller power of individual stocks. Second, this paper centers on the combined effect of individual stock investor sentiment and individual stock crowded trades on excess returns, which reveals that the combined effect of individual stock investor sentiment and individual stock crowded trades has a significant impact on stock returns. Finally, we separate individual stock crowded trades into individual stock buyer-initiated crowded trades and individual stock seller-initiated crowded trades, and further demonstrate the joint effect of individual stock buyer-initiated crowded trades, individual stock seller-initiated crowded trades, and individual stock investor sentiment on excess returns is significant and important.

The rest of the paper is organized as follows. Section 2 reviews the literature in this area to highlight our contributions. Section 3 presents our definitions of individual stock investor sentiment index and individual stock crowded-trade indexes, and further describes the data that we use in our empirical analysis. Section 4 presents the joint effects of individual stock crowded trades and individual stock investor sentiment on excess returns. Section 5 outlines the combined effect of individual stock buyer-initiated crowded trades, individual stock seller-initiated crowded trades, and individual stock investor sentiment on excess returns. Section 6 conducts a number of additional robustness tests to verify the sensitivity of our results. Finally, Section 7 concludes.

2. Literature review

With respect to the literature on this topic and its pertinence to the purpose of this study, the relevant research can be broadly classified into two strands. Behavioral finance explains stock returns from two perspectives: investor sentiment and crowded trades.

One possible explanation for stock returns is that investor sentiment affects asset prices (see, e.g., Antoniou, Doukas, & Subrahmanyam, 2015; Baker & Wurgler, 2006, 2007; Berger & Turtle, 2012; Fong & Toh, 2014; Greenwood & Shleifer, 2014; Kim, Ryu, & Seo, 2014; Lee, Jiang, & Indro, 2002; Qian, 2014). Baker and Wurgler (2006, 2007) use the closed-end fund discount, NYSE share turnover, the number and average first day returns on IPOs, the equity share in new issues, and the dividend premium to form market-wide investor sentiment, and further certify its importance on the cross-section of stock returns. Later work shows that market-wide sentiment can explain a series of anomalies in financial market. As Stambaugh, Yu, and Yuan (2012, 2014, 2015) investigate the role of market-wide sentiment in a set of anomalies in cross sectional stock returns. Moreover, Stambaugh and Yuan (2015) combine two new mispricing factors based on anomalies with market and size factors to produce a four-factor model, and demonstrate that this four-factor model's ability to accommodate a wide range of anomalies exceeds that of the five-factor model of Fama and French (2015). However, these literatures mainly analyze the role of market-wide investor sentiment on asset prices. Besides the market-wide sentiment, Kumar and Lee (2006) use buy and sell imbalance to capture retail investor sentiment, and further reveal that changes in portfolio-level retail sentiment may induce comovement in stock returns. However, the above literature ignores the roles of individual stock investor sentiment.

Furthermore, some papers propose the dynamics of stock-level sentiment theoretically (Cen, Lu, & Yang, 2013), and some papers prove the significant effect of individual stock investor sentiment empirically (see, e.g., Frazzini & Lamont, 2008; Lee, 2013). Frazzini and Lamont (2008) use mutual fund flows to measure individual investor sentiment for different stocks, and demonstrate that stocks that are overweighed by retail investors due to fund flows tend to have lower subsequent returns. And Lee (2013) uses turnover and mutual fund flows to measure individual stock investor sentiment, and further explains a

broad set of financial market anomalies. Nevertheless, these papers only study the role of the single individual stock sentiment, and lose light of the composite individual stock sentiment index. Moreover, these papers lose sight of the combined effects of individual stock investor sentiment and individual stock crowded trades on excess returns, and further compare the effect of individual stock investor sentiment and individual stock crowded trades. In this paper, we employ the first principle component analysis by Baker and Wurgler (2006) to construct the composite individual stock sentiment index, and further investigate the roles of individual stock investor sentiment.

An alternative explanation for stock prices is that crowded trades affect asset prices (see, e.g., Barberis & Thaler, 2003; Hanson & Sunderam, 2014; Menkveld, 2014; Pojarliev & Richard, 2011; Sias, Turtle, & Zykaj, 2016; Stein, 2009; Yan, 2013), suggesting that large groups of investors follow similar strategies resulting in crowded equity positions that destabilizes markets. Specifically, Barberis and Thaler (2003) demonstrate that investors prefer to trade in the same direction as other investors, thereby exacerbating the mispricing. Specially, Stein (2009) conducts a formal research on the crowded-trade problem which focuses on how many others using the same strategy, and argues that investors push prices beyond fundamental values when an unexpectedly large number of investors adopt the same strategy.

Then, a range of literatures investigate the role of crowded trades on asset prices empirically. Pojarliev and Richard (2011) measure carry crowdedness, trend crowdedness and value crowdedness to prove that crowded trades harbor potential risk once sentiment induces liquidation of positions. Yan (2013) uses short interest ratio and the institutional ownership data to measure crowdedness of momentum, and argues that crowdedness of momentum leads to momentum crash and pushes prices away from fundamental values. Sias et al. (2016) further verify that hedge funds' demand shocks are, on average, positively related to subsequent raw and risk-adjusted returns when they do buy and sell the same stocks. Nevertheless, the related literatures have two limitations. First, the extant empirical literatures merely describe the crowded trades of institutional investors; therefore, these measures of crowded trades are institution-level crowded trades which is different from our stock-level crowded-trade measure. Second, these studies do not investigate the combined effects of crowded trades and investor sentiment. In this paper, we shed new light on individual stock crowded trades, and further lucubrate the joint effects of individual stock crowded trades and individual stock investor sentiment on excess returns.

3. Preliminary analyses

The primary data for our study consist of the 183 current components of the CSI 300 Index from 1 April 2005 to 30 September 2014. Specifically, we restrict the sample to stocks which have to be present at the beginning and at the end of the year in both the CSI 300 Index and RESSET[1] database in any given year. We start from 2005 because the State Council of China approved the reform of the shareholder structure in 2005. According to Fig.1, the average returns of 183 stocks co-move with the returns of Shenzhen Composite Index, the returns of Shanghai Composite Index, and the returns of CSI 300 Index from April 2005 to September 2014, therefore, the results of analysis are generalizable even if the analysis is only conducted over 183 different stocks of the CSI 300 Index.[2]

Specifically, we use RESSET to obtain stock prices, stock returns, and risk free rate data. We obtain daily returns on risk factors which include $RMRF_t$ (market excess returns), SMB_t (small-minus-big firm returns), and HML_t (high-minus-low returns) in RESSET database. Specifically, the Fama-French three factors of China Stock Markets are computed using Chinese stock returns based on the method of Fama and French (1993). Furthermore, we use RESSET to obtain the relative strength index ($RSI_{i,t}$), psychological line index ($PSY_{i,t}$), trading volume ($VOL_{i,t}$) and turnover rate data to measure the individual stock investor sentiment ($S_{i,t}$). Finally, we use Wind[3] to obtain the shares outstanding, the total buyer-initiated volume ($BV_{i,t}$), and the total seller-initiated volume ($SV_{i,t}$) data, and further measure the individual stock crowded-trade indexes. Specifically, the individual stock crowded-trade indexes consist of the individual stock crowded-trade index ($C_{i,t}$), the individual stock buyer-initiated crowded-trade index ($C^b_{i,t}$), the individual stock seller-initiated crowded-trade index ($C^s_{i,t}$).

3.1. The individual stock investor sentiment index

We measure individual stock investor sentiment index using the daily variables. This index is constructed using four proxies of investor sentiment: relative strength index ($RSI_{i,t}$), psychological line index ($PSY_{i,t}$), trading volume ($VOL_{i,t}$) and

[1] RESSET Financial Research Database (RESSET) is mainly for colleges and universities, financial research institutions, research departments of financial enterprises in China, providing support for empirical research and model test. RESSET is designed by numerous experts from Tsinghua University, Peking University, and the London School of Economics.

[2] The correlations between the average returns of 183 stocks and Shenzhen Composite Index, the returns of Shanghai Composite Index, and the returns of CSI 300 Index are 0.923615, 0.906334 and 0.946353 respectively from April 2005 to September 2014. Therefore, the results of analysis are generalizable even if the analysis is only conducted over 183 different stocks of the CSI 300 Index.

[3] Wind is the provider of financial data, information and services in mainland China. Wind has built up a top-tier financial database focusing on securities data, with a wide coverage of equities, funds, bonds, foreign exchanges, insurance, futures, derivatives, commodities, macro economy and financial news. The timely updated information is always there to satisfy institutional investors' diversified needs. Knowing the demand diversification among investment institutions, research institutes, academic institutes and government bodies, Wind has developed series of professional analytics and applications for indexing, data extraction and analysis, portfolio management and many other areas. With all these tools, users could get real-time, accurate and complete financial data and information and the analytical results.

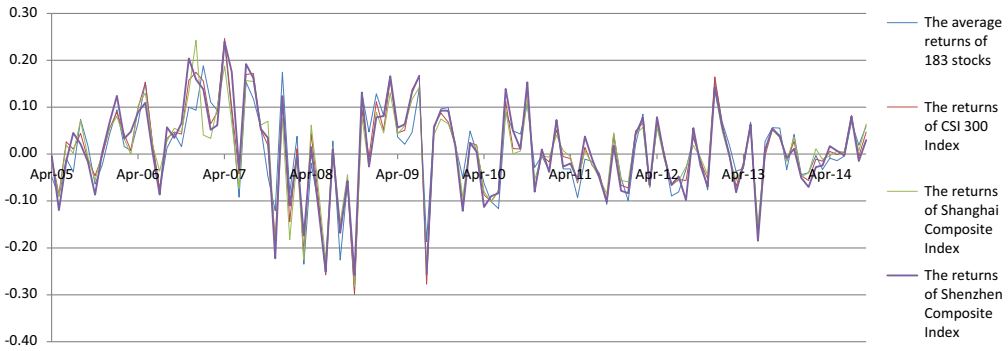

Fig. 1. The co-movements of returns.

adjusted turnover rate ($ATR_{i,t}$). Specifically, we use the first principle component by Baker and Wurgler (2006) to form the individual stock investor sentiment index that is based on the common variation in four underlying proxies of stock i for sentiment. We take the daily sentiment proxies of the 183 current components of the CSI 300 Index in RESSET database from 1 April 2005 to 30 September 2014. Specially, we first introduce each proxy separately.

Relative strength index ($RSI_{i,t}$): The relative strength index can serve as a sentiment index showing whether the market is oversold or overbought. The related literatures use the relative strength index as one of sentiment indicator to form a composite index of sentiment (see, e.g., Chen, Chong, & Duan, 2010; Kim & Ha, 2010). Specifically, the relative strength index of stock or portfolio i at day t ($RSI_{i,t}$) is:

$$RSI_{i,t} = 100 \times RS_{i,t}/(1 + RS_{i,t}). \tag{1}$$

where $RS_{i,t} = \frac{\sum_{t=1}^{6} \max(P_{i,t} - P_{i,t-1}, 0)}{\sum_{t=1}^{6} \max(P_{i,t-1} - P_{i,t}, 0)}$, $P_{i,t}$ is the closing price of stock or portfolio i at day t, and $P_{i,t-1}$ is the closing price of stock or portfolio i at day $t-1$. If the relative strength index is below 50, it generally means that the stock's losses are greater than the gains. When the relative strength index is above 50, it generally means that the gains are greater than the losses. And the market is overbought with RSI of 80, and the market is oversold with RSI of 20. Therefore, the relative strength index is served as one of the sentiment proxy accordingly.

Psychological line index ($PSY_{i,t}$): The related literatures serve the psychological line index as a sentiment indicator to look behind the obvious sentiment of the market and detect undertones for a trend change and construct the composite investor sentiment index (see, e.g., Kim & Ha, 2010; Yang & Zhou, 2015). The psychological line index of stock or portfolio i at day t ($PSY_{i,t}$) is:

$$PSY_{i,t} = T_i^u/T_i \times 100. \tag{2}$$

where T_i^u is the number of days when the closing price of stock or portfolio i at day t is higher than the closing price of stock or portfolio i at day $t-1$, and T_i is the trading period of stock or portfolio i at day t. And the market is overbought with PSY of 75, and the market is oversold with PSY of 25. Overall, the relative strength index is served as one of the sentiment proxy.

Trading volume ($VOL_{i,t}$): Baker and Stein (2004) suggest that trading volume carrying information about the market can serve as a sentiment indicator. Liao, Huang, and Wu (2011) use individual stock trading volume and S&P500 index trading volume as sentiment indicators. The trading volume is used as one of the sentiment proxy accordingly.

Adjusted turnover rate ($ATR_{i,t}$): Baker and Stein (2004) suggest that turnover rate can serve as a sentiment index. But the turnover rate cannot judge whether the investor sentiment is optimistic or pessimistic, Yang and Zhou (2015) use the adjusted turnover rate to differentiate optimism and pessimism. Specifically, the adjusted turnover rate of stock or portfolio i at day t (ATR) is:

$$ATR_{i,t} = \frac{R_{i,t}}{|R_{i,t}|} \times \frac{VOL_{i,t}}{\text{shares outstanding at day t}}. \tag{3}$$

where R_{it} is the return of stock or portfolio i at day t, VOL_{it} is the trading volume of stock or portfolio i at day t. If return is above zero, the adjusted turnover rate is positive which indicates that the stock market is bullish. If return is below zero, the adjusted turnover rate is negative which indicates that the stock market is bearish.

Therefore, we use the relative strength index ($RSI_{i,t}$), psychological line index ($PSY_{i,t}$), trading volume ($VOL_{i,t}$) and adjusted turnover rate ($ATR_{i,t}$) in the same day, perform principal component analysis, and retain the first principal component as the individual stock investor sentiment index.

3.2. The individual stock crowded-trade indexes

The objective in this section is to identify the individual stock crowded-trade indexes. Stein (2009) think investors' uncertainty about the number of other investors who might be pursuing a particular trading strategy, the other investors' current capital and liquidity positions, and the nature of their alternative investment opportunities might create the crowded-trade problem and push prices further away from fundamentals. Yan (2013) use short interest ratio and the level of selling from existing investors to capture loser stocks that are crowded by momentum traders, suggesting stocks with high short interest ratio and level of selling from existing investors undergo heavy selling from both arbitrageurs are able to short and existing investors originally holding a long position. In this section, we exploit the investors' crowded trades about the exact amount of buyer-initiated volume and seller-initiated volume on individual stock i to develop a new approach to detect the individual stock crowded trades. Specifically, using the shares outstanding ($OS_{i,t}$), the total buyer-initiated volume ($BV_{i,t}$), and the total seller-initiated volume ($SV_{i,t}$) data, we compute individual stock crowded-trade index ($C_{i,t}$), individual stock buyer-initiated crowded-trade index ($C^b_{i,t}$), and individual stock seller-initiated crowded-trade index ($C^s_{i,t}$).

To compute the individual stock crowded-trade index ($C_{i,t}$), we define the day-t C for stock i as:

$$C_{i,t} = \frac{BV_{i,t} - SV_{i,t}}{OS_{i,t}}. \tag{4}$$

Here, $BV_{i,t}$ is the total buyer-initiated volume of the individual stock i on day t, $SV_{i,t}$ is the total seller-initiated volume of the individual stock i on day t, and $OS_{i,t}$ is the outstanding shares of stock i at day t. A given day's $C_{i,t}$ indicates that most investors have significant positive ($C_{i,t} > 0$, i.e., the total buyer-initiated volume is greater than the total seller-initiated volume) or negative ($C_{i,t} < 0$, i.e., the total seller-initiated volume is greater than the total buyer-initiated volume) exposure to individual stock i. Therefore, it can detect the crowded trades on individual stock i.

To compute the individual stock buyer-initiated crowded-trade index ($C^b_{i,t}$), we define the day-t C^b for stock i as:

$$C^b_{i,t} = \frac{BV_{i,t}}{OS_{i,t}}. \tag{5}$$

Here, $BV_{i,t}$ is the total buyer-initiated volume of the individual stock i on day t, and $OS_{i,t}$ is the outstanding shares of stock i at day t. A given day's $C^b_{i,t}$ indicates whether most investors have significant positive exposure to individual stock i ($C^b_{i,t} > C^s_{i,t}$, i.e., the total buyer-initiated volume is greater than the total seller-initiated volume). It means that stock has already undergone heavy buying from investors, therefore, stock i is likely to be crowded by stock buyers.

To compute the individual stock seller-initiated crowded-trade index ($C^s_{i,t}$), we define the day-t C^s for stock i as:

$$C^s_{i,t} = \frac{SV_{i,t}}{OS_{i,t}}. \tag{6}$$

Here, $SV_{i,t}$ is the total seller-initiated volume of the individual stock i on day t, and $OS_{i,t}$ is the outstanding shares of stock i at day t. A given day's $C^s_{i,t}$ indicates whether most investors have significant negative exposure to individual stock i ($C^s_{i,t} > C^b_{i,t}$, i.e., the total seller-initiated volume is greater than the total buyer-initiated volume). It means that stock has already undergone heavy selling from investors, therefore, stock i is likely to be crowded by stock sellers.

3.3. Summary statistics

Table 1 provides the time-series averages of the cross-sectional means, medians, standard deviations, and other statistics for the main variables used in the empirical analysis. As the summary statistics in Table 1, the mean and median of $R_{i,t}$ are 0.0731% and 0.0000 respectively. The average (median) $Rmrf_t$ is 0.0729% (0.0016). The cross-sectional average (median) Smb_t is 0.0583% (0.0012). The average (median) Hml_t is −0.0057% (−0.0002). The mean and median of $S_{i,t}$ are 0.0000 and −0.0546 respectively. And the mean and median of $\Delta S_{i,t}$ are 0.0407% and 1.0840 respectively. The average of the crowded-trade index $C_{i,t}$ is 0.0756%. The individual stock crowded-trade index $C_{i,t}$ average is the difference of 0.0120 due to the individual stock buyer-initiated crowded-trade index $C^b_{i,t}$ average and 0.0112 due to the individual stock seller-initiated crowded-trade index $C^s_{i,t}$ average. Likewise, the average of the change of individual stock crowded-trade index $\Delta C_{i,t}$ is −0.00015%. The change of individual stock crowded-trade index $\Delta C_{i,t}$ average is the difference of 0.00014% due to the change of individual stock buyer-initiated crowded-trade index $\Delta C^b_{i,t}$ average and 0.00029% due to the change of individual stock seller-initiated crowded-trade index $\Delta C^s_{i,t}$ average.

4. Individual stock crowded-trade effect and individual stock investor sentiment effect

4.1. Regression results excluding the Fama-French three factors of China Stock Markets

Theory and historical anecdote both suggest that investor sentiment (see, e.g., Baker & Wurgler, 2006, 2007) or crowded trades (see, e.g., Sias et al., 2016; Stein, 2009) may have significant impacts on asset prices. In this section, we incorporate

Table 1
Summary statistics.

Variables	Mean × 10^3	Std. Dev × 10	Min × 10	Median × 10^3	Max	*N*
$R_{i,t}$	0.7307	0.3008	−6.7451	0.0000	1.975	422,730
$R_{f,t}$	0.0935	0.0004	0.0003	0.1010	0.0001	422,730
$Rmrf_t$	0.7286	0.1846	−0.9130	1.6000	0.0992	422,730
Smb_t	0.5831	0.0714	−0.5140	1.2000	0.0236	422,730
Hml_t	−0.0565	0.0497	−0.2320	−0.2000	0.0303	422,730
$S_{i,t}$	0.0000	14.6001	−82.9712	54.5933	17.3920	422,730
$\Delta S_{i,t}$	0.4068	10.8401	−154.0691	0.0000	19.6076	422,730
$C_{i,t}$	0.7555	0.0763	−1.6418	0.0000	0.3228	422,730
$C^b_{i,t}$	11.9596	0.1548	0.0000	7.2957	1.0473	422,730
$C^s_{i,t}$	11.2040	0.1329	0.0000	7.3105	0.7244	422,730
$\Delta C_{i,t}$	−0.0015	0.1075	−2.9674	0.0000	0.4450	422,547
$\Delta C^b_{i,t}$	0.0014	0.1168	−6.3301	0.0000	0.9251	422,547
$\Delta C^s_{i,t}$	0.0029	0.0954	−4.2841	0.0000	0.4801	422,547

Note: This Table reports descriptive statistics for all variables used in the empirical analysis. $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $Rmrf_t$ is the market return in excess of risk-free rate at day t, Smb_t is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks at day t, Hml_t is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks at day t, $S_{i,t}$ is the individual investor sentiment of stock i at day t, $\Delta S_{i,t}$ is the individual investor sentiment change of stock i at day t, $C_{i,t}$ is the crowded trades of stock i at day t, $C^b_{i,t}$ is the buyer-initiated crowded trades of stock i at day t, $C^s_{i,t}$ is the seller-initiated crowded trades of stock i at day t, $\Delta C_{i,t}$ is the change of crowded trades of stock i at day t, $\Delta C^b_{i,t}$ is the change of buyer-initiated crowded trades of stock i at day t, and $\Delta C^s_{i,t}$ is the change of seller-initiated crowded trades of stock i at day t. The sample period is from Apr. 2005 to Sep.2014 for all variables, covering a total of 2310 days, and the sample includes the 183 current components of the CSI 300 Index in Chinese Stock Market which are issued before Apr. 2005.

both individual stock investor sentiment and individual stock crowded trades into the regression to formalize their joint effects on the excess returns. Thus, we organize our analysis around the following models

$$R_{i,t} - R_{f,t} = \alpha + \beta_s \Delta S_{i,t} + \varepsilon_t, \tag{7}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_c \Delta C_{i,t} + \varepsilon_t, \tag{8}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_s \Delta S_{i,t} + \beta_c \Delta C_{i,t} + \varepsilon_t. \tag{9}$$

Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $\Delta S_{i,t}$ is the individual stock investor sentiment change of stock i at day t, $\Delta C_{i,t}$ is the change of crowded trades of stock i at day t. We expect a positive coefficient for the β_s parameter because increasing sentiment should precede increasing returns in the short run. We also anticipate a positive estimate for the β_c parameter because increasing crowded trades should precede increasing returns in the short run.

Table 2 looks for individual stock crowded-trade effect and individual stock investor sentiment effect by proceeding daily regressions of excess returns on the change of individual stock crowded trades and the change of individual stock investor sentiment excluding the Fama-French three factors of China Stock Markets. Consistent with the analysis of Yang and Zhou (2015), we find that the change of individual stock investor sentiment is positive and significant with excess returns (0.0164: t-statistic = 475.55) in specification (1) of Table 2. This shows that excess returns are higher when individual stock investor sentiment is optimistic. In specification (2) of Table 2, we demonstrate that change of individual stock crowded trades also have a positive and significant impacts on excess returns (1.2901: t-statistic = 337.68), which corroborates that increasing individual stock crowded trades will enhance excess returns. Moreover, the coefficients of change of individual stock investor sentiment and change of individual stock crowded trades in specification (3) are 0.0134 (t-statistic = 334.93) and 0.5659 (t-statistic = 140.56). Therefore, the above results testify that both individual stock investor sentiment and individual stock crowded trades have positive and significant impacts on excess returns. The results are consistent with the view that returns to crowded trades will be generally positive during periods of inflows.

4.2. Regression results including the Fama-French three factors of China Stock Markets

We next investigate if these patterns are also evident including the Fama-French three factors of China Stock Markets (see, e.g., Fama & French, 1993) as control variables which have become standard in recent asset pricing studies. Specifically, we compute the individual stock investor sentiment effect and individual stock crowded-trade effect from the well-known comovement using the multivariate regressions

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \varepsilon_t, \tag{10}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_s \Delta S_{i,t} + \varepsilon_t, \tag{11}$$

Table 2
Individual stock crowded-trade effect and individual stock investor sentiment effect excluding the Fama-French three factors of Chinese Stock Markets.

	(1)	(2)	(3)
Intercept $\times 10^3$	0.6150***	0.6236***	0.6171***
	(16.47)	(15.19)	(16.91)
$\Delta S_{i,t}$	0.0164***		0.0134***
	(475.55)		(334.93)
$\Delta C_{i,t}$		1.2901***	0.5659***
		(337.68)	(140.56)
$Adj.R^2$	0.3486	0.2125	0.3777
N	422,547	422,547	422,547

Note: This table reports estimates from daily regressions of individual excess returns on individual stock crowded trades and individual stock investor sentiment excluding the Fama-French three factors of China Stock Markets in Eqs. (7)–(9). Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $\Delta S_{i,t}$ is the individual investor sentiment change of stock i at day t, $\Delta C_{i,t}$ is the change of crowded trades of stock i at day t. The crowded trades of stock i at day t is defined as $C_{i,t} = \frac{BV_{i,t} - SV_{i,t}}{OS_{i,t}}$, therefore, the change of crowded trades of stock i at day t is defined as $\Delta C_{i,t} = C_{i,t} - C_{i,t-1}$. Here, $BV_{i,t}$ is the buyer-initiated volume of stock i on day t, SV_{it} is the seller-initiated volume of stock i on day t, and $OS_{i,t}$ is the outstanding shares of stock i at day t. The sample period is from Apr. 2005 to Sep.2014 for all variables, covering a total of 2310 days, and the sample includes the 183 current components of the CSI 300 Index in Chinese Stock Market which are issued before Apr. 2005. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_c \Delta C_{i,t} + \varepsilon_t, \tag{12}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_s \Delta S_{i,t} + \beta_c \Delta C_{i,t} + \varepsilon_t. \tag{13}$$

Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $Rmrf_t$ is the market return in excess of risk-free rate at day t, Smb_t is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks at day t, Hml_t is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks at day t, $\Delta S_{i,t}$ is the individual stock investor sentiment change of stock i at day t, $\Delta C_{i,t}$ is the change of crowded trades of stock i at day t. Including the Fama-French three factors of China Stock Markets, we still expect a positive coefficient for the β_s parameter because increasing sentiment should precede increasing returns in the short run. Intuitively, we also anticipate a positive estimate for the β_c parameter because increasing crowded trades should precede increasing returns in the short run.

Table 3 clarifies the individual stock investor sentiment effect and individual stock crowded-trade effect by proceeding daily regressions of excess returns on the change of individual stock crowded trades and the change of individual stock investor sentiment including the Fama-French three factors of China Stock Markets. We start in specification (1) by looking at $Rmrf_t$, Smb_t, Hml_t. The coefficients on the change of individual stock investor sentiment and the change of individual stock crowded trades diminish once we control for $Rmrf_t$, Smb_t, and Hml_t, but the significance of individual stock investor sentiment effect and the significance of individual stock crowded-trade effect do not depend on including or excluding these controls. In specification (2) of Table 3, the change of individual stock investor sentiment $\Delta S_{i,t}$ coefficient estimate is 0.0125 with a t-statistic of 404.30. Apparently, the result demonstrates that when individual stock investor sentiment is high, excess returns are higher relative to excess returns with low individual stock investor sentiment. And the estimate of the change of individual stock crowded-trade index $\Delta C_{i,t}$ is 0.9686 (t-statistic = 297.04), suggesting that excess returns are high when the change of individual stock crowded-trade index $C_{i,t}$ is high. Specification (4) shows that adding the change of individual stock crowded-trade index $\Delta C_{i,t}$ and the change of individual stock investor sentiment $\Delta S_{i,t}$ to $Rmrf_t$, Smb_t, and Hml_t increase the explanatory of the regression. Collectively, both the individual stock crowded trades and individual stock investor sentiment have positive and significant impacts on excess returns. Moreover, in ancillary tests, our untabulated results show that the values of individual stock investor sentiment index and individual stock crowded-trade index have similar results on stock prices.[4] In sum, this evidence suggests that stock prices change with individual stock investor sentiment and individual stock crowded trades.

[4] The coefficient of individual stock investor sentiment ($S_{i,t}$) is 0.0033 (z-statistic = 153.56) and the coefficient of individual stock crowded-trade index ($C_{i,t}$) is 1.900 (z-statistic = 447.57) in $R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_s S_{i,t} + \beta_c C_{i,t} + \varepsilon_t$.

Table 3
Individual stock crowded-trade effect and individual stock investor sentiment effect including the Fama-French three factors of Chinese Stock Markets.

	(1)	(2)	(3)	(4)
Intercept × 10^3	−0.1484***	−0.0117	−0.0683**	0.0010
	(−3.94)	(−0.37)	(−2.00)	(0.03)
$Rmrf_t$	0.9484***	0.7097***	0.8171***	0.6919***
	(454.35)	(379.50)	(418.78)	(377.03)
Smb_t	0.1420***	0.1951***	0.1668***	0.1968***
	(25.67)	(41.51)	(33.14)	(42.08)
Hml_t	−0.2010***	−0.1483***	−0.2024***	−0.1565***
	(−26.60)	(−22.12)	(−28.18)	(−23.84)
$\Delta S_{i,t}$		0.0125***		0.0101***
		(404.30)		(288.73)
$\Delta C_{i,t}$			0.9686***	0.4679***
			(297.04)	(135.71)
$Adj.R^2$	0.3435	0.5263	0.4566	0.5461
N	422,547	422,547	422,547	422,547

Note: This table reports estimates from daily regressions of individual excess returns on individual stock crowded trades and individual stock investor sentiment including the Fama-French three factors of China Stock Markets in Eqs. (10)–(13). Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $Rmrf_t$ is the market return in excess of risk-free rate at day t,Smb_t is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks at day t, Hml_t is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks at day t, $\Delta S_{i,t}$ is the individual investor sentiment change of stock i at day t, $\Delta C_{i,t}$ is the change of crowded trades of stock i at day t. The crowded trades of stock i at day t is defined as $C_{i,t} = \frac{BV_{i,t} - SV_{i,t}}{OS_{i,t}}$, therefore, the change of crowded trades of stock i at day t is defined as $\Delta C_{i,t} = C_{i,t} - C_{i,t-1}$. Here, $BV_{i,t}$ is the buyer-initiated volume of stock i on day t, SV_{it} is the seller-initiated volume of stock i on day t, and $OS_{i,t}$ is the outstanding shares of stock i at day t. The sample period is from Apr. 2005 to Sep.2014 for all variables, covering a total of 2310 days, and the sample includes the 183 current components of the CSI 300 Index in Chinese Stock Market which are issued before Apr. 2005. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

5. Individual stock buyer-initiated crowded-trade effect, Individual stock seller-initiated crowded-trade effect, and individual stock investor sentiment effect

5.1. Regression results excluding the Fama-French three factors of China Stock Markets

Pojarliev and Richard (2011) detect carry crowdedness, trend crowdedness and value crowdedness. In this section, we separate individual stock crowded-trade index into two categories of individual stock crowded-trade indexes: the individual stock buyer-initiated crowded-trade index and the individual stock seller-initiated crowded-trade index. Therefore, our second test centers on whether there are individual stock buyer-initiated crowded-trade effect, individual stock seller-initiated crowded-trade effect and individual stock investor sentiment effect on the excess returns. We run regressions of these types

$$R_{i,t} - R_{f,t} = \alpha + \beta_{bc}\Delta C^{b}_{i,t} + \beta_{sc}\Delta C^{s}_{i,t} + \varepsilon_t, \tag{14}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{s}\Delta S_{i,t} + \beta_{bc}\Delta C^{b}_{i,t} + \varepsilon_t, \tag{15}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{s}\Delta S_{i,t} + \beta_{sc}\Delta C^{s}_{i,t} + \varepsilon_t, \tag{16}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{s}\Delta S_{i,t} + \beta_{bc}\Delta C^{b}_{i,t} + \beta_{sc}\Delta C^{s}_{i,t} + \varepsilon_t. \tag{17}$$

Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $S_{i,t}$ is the individual stock investor sentiment of stock i at day t, $\Delta C^{b}_{i,t}$ is the change of buyer-initiated crowded trades of stock i at day t, $\Delta C^{s}_{i,t}$ is the change of seller-initiated crowded trades of stock i at day t. Likewise, we still expect a positive coefficient for the β_s parameter because increasing sentiment should precede increasing returns in the short run. Furthermore, we also anticipate a positive estimate for the β_{bc} parameter because increasing buyer-initiated crowded trades should precede increasing returns in the short run. However, we expect a negative estimate for the β_{sc} parameter because increasing seller-initiated crowded trades would decrease excess returns in the short run.

The results are shown in Table 4. The coefficients on the change of individual stock investor sentiment index, the change of individual stock buyer-initiated crowded-trade index, and the change of individual stock seller-initiated crowded-trade index essentially reveal the individual stock investor sentiment effect, the individual stock buyer-initiated crowded-trade effect, and individual stock seller-initiated crowded-trade effect in Table 4. The coefficient of the change of the individual stock buyer-initiated (seller-initiated) crowded-trade index is 1.4386 (−0.9493) with a t-statistic of 358.74 (−193.35) in specification (1) of Table 4, which implies that excess return increases (decreases) with individual stock buyer-initiated (seller-initiated) crowded trades. In specification (2) of Table 4, the coefficient on the change of individual stock investor sentiment is 0.0158 (t-statistic = 345.01), which is consistent in sign and magnitude. Specially, the coefficient of the change of individual stock buyer-initiated crowded-trade index, β_{bc}, is 0.0892 with a t-statistic of 21.06. Similarly, the excess returns

Table 4
Individual stock buyer-initiated (seller-initiated) crowded-trade effect and individual stock investor sentiment effect excluding the Fama-French three factors of Chinese Stock Markets.

	(1)	(2)	(3)	(4)
Intercept $\times 10^3$	0.6224***	0.6152***	0.616***	0.6171***
	(15.37)	(16.48)	(16.75)	(16.95)
$\Delta S_{i,t}$		0.0158***	0.0172***	0.0144***
		(345.01)	(496.21)	(317.02)
$\Delta C^b_{i,t}$	1.4386***	0.0892***		0.4428***
	(358.74)	(21.06)		(92.63)
$\Delta C^s_{i,t}$	−0.9493***		−0.4529***	−0.6627***
	(−193.35)		(−115.16)	(−147.12)
$Adj.R^2$	0.2338	0.3493	0.3684	0.3810
N	422,547	422,547	422,547	422,547

Note: This table reports estimates from daily regressions of excess returns on individual stock buyer-initiated crowded trades, individual stock seller-initiated crowded trades and individual stock investor sentiment excluding the Fama-French three factors of China Stock Markets in Eqs. (14)–(17). Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $\Delta S_{i,t}$ is the individual investor sentiment change of stock i at day t, $\Delta C^b_{i,t}$ is the change of buyer-initiated crowded trades of stock i at day t, $\Delta C^s_{i,t}$ is the change of seller-initiated crowded trades of stock i at day t. Specifically, the buyer-initiated crowded-trade index C^b of stock i at day t is defined as $C^b_{i,t} = \frac{BV_{i,t}}{OS_{i,t}}$, and the seller-initiated crowded-trade index C^s of stock i at day t is defined as $C^s_{i,t} = \frac{SV_{i,t}}{OS_{i,t}}$. Here, $BV_{i,t}$ is the buyer-initiated volume of stock i on day t, SV_{it} is the seller-initiated volume of stock i on day t, and $OS_{i,t}$ is the outstanding shares of stock i at day t. Therefore, the change of buyer-initiated (seller-initiated) crowded trades of stock i at day t is defined as $\Delta C^b_{i,t} = C^b_{i,t} - C^b_{i,t-1}$ ($\Delta C^s_{i,t} = C^s_{i,t} - C^s_{i,t-1}$). The sample period is from Apr. 2005 to Sep. 2014 for all variables, covering a total of 2310 days, and the sample includes the 183 current components of the CSI 300 Index in Chinese Stock Market which are issued before Apr. 2005. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

are positively correlated with the change of individual stock investor sentiment (0.0172, t-statistic = 496.21), and are negatively correlated with the change of individual stock seller-initiated crowded-trade index (−0.4529, t-statistic = −115.16) in specification (3) of Table 4. Furthermore, specification (4) of Table 4 shows the combined effect of individual stock investor sentiment, individual stock buyer-initiated crowded trades, and individual stock seller-initiated crowded trades. And the results shows that excess returns are positively correlated with the change of individual stock investor sentiment (0.0144, t-statistic = 317.02) and the change of individual stock buyer-initiated crowded-trade index (0.4428, t-statistic = 92.63), and negatively with the change of individual stock seller-initiated crowded-trade index (−0.6627, t-statistic = −147.12).

The above results strongly support the view that all the individual stock investor sentiment, individual stock buyer-initiated crowded trades, and individual stock seller-initiated crowded trades have significant impacts on excess returns. More importantly, excess returns increase with individual stock buyer-initiated crowded trades, and decrease with individual stock seller-initiated crowded trades.

5.2. Regression results including the Fama-French three factors of China Stock Markets

We also investigate the combined effect of individual stock investor sentiment, individual stock buyer-initiated crowded trades and individual stock seller-initiated crowded trades including $Rmrf_t$, Smb_t, Hml_t as control variables. Therefore, we run regressions of these types

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_{bc} \Delta C^b_{i,t} + \beta_{sc} \Delta C^s_{i,t} + \varepsilon_t, \tag{18}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_s \Delta S_{i,t} + \beta_{bc} \Delta C^b_{i,t} + \varepsilon_t, \tag{19}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_s \Delta S_{i,t} + \beta_{sc} \Delta C^s_{i,t} + \varepsilon_t, \tag{20}$$

$$R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_s \Delta S_{i,t} + \beta_{bc} \Delta C^b_{i,t} + \beta_{sc} \Delta C^s_{i,t} + \varepsilon_t. \tag{21}$$

Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $Rmrf_t$ is the market return in excess of risk-free rate at day t, Smb_t is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks at day t, Hml_t is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks at day t, $\Delta S_{i,t}$ is the individual stock investor sentiment of stock i at day t, $\Delta C^b_{i,t}$ is the change of buyer-initiated crowded trades of stock i at day t, $\Delta C^s_{i,t}$ is the change of seller-initiated crowded trades of stock i at day t. Including $Rmrf_t$, Smb_t, Hml_t as control variables, we expect β_{bc} (β_s) to be positive since individual stock of buyer-initiated crowded trades (individual stock investor sentiment) should push stock prices up, however, we expect β_{sc} to be negative since individual stock seller-initiated crowded trades would push stock prices down.

Table 5 reports the estimates and t-statistics with Eqs. (18)-(21). The coefficients on the change of individual stock investor sentiment ($\Delta S_{i,t}$), the change of individual stock buyer-initiated crowded-trade index ($\Delta C^b_{i,t}$), and the change of individual

Table 5
Individual stock buyer-initiated (seller-initiated) crowded-trade effect and individual stock investor sentiment effect including the Fama-French three factors of Chinese Stock Markets.

	(1)	(2)	(3)	(4)
Intercept $\times 10^3$	−0.0889***	−0.0268	0.0086	−0.0009
	(−2.66)	(−0.84)	(0.27)	(−0.03)
$Rmrf_t$	0.8190***	0.7216***	0.6898***	0.6937***
	(429.38)	(386.25)	(366.14)	(374.14)
Smb_t	0.1980***	0.2064***	0.1853***	0.1980***
	(40.21)	(44.14)	(39.62)	(43.02)
Hml_t	−0.1972***	−0.1534***	−0.1476***	−0.1568***
	(−28.10)	(−23.01)	(−22.12)	(−23.89)
$\Delta S_{i,t}$		0.0107***	0.01304***	0.0100***
		(263.60)	(410.50)	(246.71)
$\Delta C^b_{i,t}$	1.1260***	0.2453***		0.4826***
	(333.26)	(67.80)		(117.80)
$\Delta C^s_{i,t}$	−0.6033***		−0.2291***	−0.4560***
	(−146.61)		(−66.64)	(−117.12)
$Adj.R^2$	0.4808	0.5314	0.5313	0.5462
N	422,547	422,547	422,547	422,547

Note: This table reports estimates from daily regressions of excess returns on individual stock buyer-initiated crowded trades, individual stock seller-initiated crowded trades and individual stock investor sentiment including the Fama-French three factors of China Stock Markets in Eqs. (18)–(21). Here, $R_{i,t}$ is the return of stock i at day t, $R_{f,t}$ is the risk-free rate of return at day t, $Rmrf_t$ is the market return in excess of risk-free rate at day t, Smb_t is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks at day t, Hml_t is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks at day t, $\Delta S_{i,t}$ is the individual investor sentiment change of stock i at day t, $\Delta C^b_{i,t}$ is the change of buyer-initiated crowded trades of stock i at day t, $\Delta C^s_{i,t}$ is the change of seller-initiated crowded trades of stock i at day t. Specifically, the buyer-initiated crowded trades C^b of stock i at day t is defined as $C^b_{i,t} = \frac{BV_{i,t}}{OS_{i,t}}$, and the seller-initiated crowded trades C^s of stock i at day t is defined as $C^s_{i,t} = \frac{SV_{i,t}}{OS_{i,t}}$. Here, $BV_{i,t}$ is the buyer-initiated volume of stock i on day t, SV_{it} is the seller-initiated volume of stock i on day t, and $OS_{i,t}$ is the outstanding shares of stock i at day t. Therefore, the change of buyer-initiated (seller-initiated) crowded trades of stock i at day t is defined as $\Delta C^b_{i,t} = C^b_{i,t} - C^b_{i,t-1}$ ($\Delta C^s_{i,t} = C^s_{i,t} - C^s_{i,t-1}$). The sample period is from Apr. 2005 to Sep.2014 for all variables, covering a total of 2310 days, and the sample includes the 183 current components of the CSI 300 Index in Chinese Stock Market which are issued before Apr. 2005. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

stock seller-initiated crowded-trade index ($\Delta C^s_{i,t}$) diminish once we control for *RMRF*, *SMB*, *HML*, but the significance of the explanatory effect does not depend on including or excluding these controls. Including $Rmrf_t$, Smb_t, Hml_t as control variables, the change of individual stock buyer-initiated crowded-trade index $\Delta C^b_{i,t}$ has a positive estimate (1.1260 with a t-statistic of 333.26), and the change of individual stock seller-initiated crowded-trade index $\Delta C^s_{i,t}$ has a negative estimate (−0.6033 with a t-statistic of −146.61) in specification (1). We evaluate the abilities of individual stock investor sentiment, buyer-initiated crowded trades, and individual stock seller-initiated crowded trades to explain excess returns. In view of the change of individual stock investor sentiment (0.0100 with a t-statistic of 246.71), the estimates of the change of individual stock buyer-initiated crowded-trade index $\Delta C^b_{i,t}$ and the change of individual stock seller-initiated crowded-trade index $\Delta C^s_{i,t}$ in specification (4) are 0.4826 (t-statistic = 117.80) and −0.4560 (t-statistic = −117.12).

From the empirical results, we find that all the individual stock investor sentiment, individual stock buyer-initiated crowded trades, and individual stock seller-initiated crowded trades have significant coefficient estimates when all the variables are included in the factor model. Specifically, excess returns increase with the individual stock buyer-initiated crowded trades, and decrease with the individual stock seller-initiated crowded trades. Moreover, in ancillary tests, our untabulated results show that the values of individual stock investor sentiment index, individual stock buyer-initiated crowded-trade index, and individual stock seller-initiated crowded-trade index have similar results on stock prices.[5]

6. Robustness tests

We conduct a number of additional robustness to verify the sensitivity of our results to various model perturbations. In this paper, we examine associations among individual stock investor sentiment, individual stock crowded trades and excess returns for stocks sorted by firm size. To set the stage, we group stocks into two groups according to their mean values of market capitalizations. The large-size stocks are those with above-median values of market capitalizations for the sample period, and the small-size stocks are those with below-median values of market capitalizations for the sample period. The binary split between large-size stocks and small-size stocks allows us to explore the size effect. Therefore, we can investigate the roles of individual stock investor sentiment and individual stock crowded trades excluding or including the Fama-

[5] The coefficient of individual stock investor sentiment ($S_{i,t}$) is 0.0044 (z-statistic = 433.96), the coefficient of individual stock buyer-initiated crowded-trade index ($C^b_{i,t}$) is 1.8428 (z-statistic = 433.96) , and the coefficient of individual stock seller-initiated crowded-trade index ($C^s_{i,t}$) is −2.0680 (z-statistic = −453.02) in $R_{i,t} - R_{f,t} = \alpha + \beta_{Rmrf} Rmrf_t + \beta_{Smb} Smb_t + \beta_{Hml} Hml_t + \beta_s S_{i,t} + \beta_{bc} C^b_{i,t} + \beta_{sc} C^s_{i,t} + \varepsilon_t$.

French three factors of China Stock Markets as control variables. Specifically, we divide individual stock crowded trades into individual stock buyer-initiated crowded trades and individual stock seller-initiated crowded trades.

In the first set of our tests, we examine the roles of individual stock crowded trades and individual stock investor sentiment on excess returns sorted by firm size.

Table 6 shows the coefficients from the regressions of excess returns on the change of individual stock crowded trades and the change of individual stock investor sentiment sorted by firm size. For the small-cap individual stocks in Panel A, the change of individual stock investor sentiment ($\Delta S_{i,t}$) loading is 0.0172 (t-statistic = 338.45) in specification (1) of Table 6, the change of individual stock crowded-trade index ($\Delta C_{i,t}$) loading is positive (1.2336) and statistically significant (t-statistic = 248.61) in specification (2) of Table 6, and the change of individual stock crowded-trade index ($\Delta C_{i,t}$) loading remains positive (0.5466) and statistically significant (t-statistic = 102.35) with the significant effect of individual stock investor sentiment (0.0138 with a t-statistic of 230.97) in specification (3) of Table 6. For the large-cap individual stocks in Panel B, the change of individual stock investor sentiment ($\Delta S_{i,t}$) loading remains positive(0.0156) and significant (t-statistic = 335.22) in specification (1) of Table 6, the estimate of the change of individual stock crowded-trade index ($\Delta C_{i,t}$) remains positive (1.3847) and significant (t-statistic = 228.43) in specification (3) of Table 6, and the coefficient of the change of individual stock crowded-trade index ($\Delta C_{i,t}$) is large in magnitude (0.5865) and remains significant (t-statistic = 93.30) with the inclusion of the change of individual stock investor sentiment (0.0130 with a t-statistic of 242.74) in specification (3) of Table 6.

In subsequent tests, we control for the effects of the these standard risk factors when estimating the relation among individual stock crowded trades, individual stock investor sentiment and excess returns sorted-by firm size.

Including $Rmrf_t$, Smb_t, and Hml_t as control variables, Table 7 presents the factor model estimates for the two groups depending on the market capitalization. The $\Delta C_{i,t}$ loading estimate for the small-cap individual stocks (See specification (3) of Panel A in Table 7) is 0.9475 with a t-statistic of 223.31 including $Rmrf_t$, Smb_t, and Hml_t as control variables. Including $Rmrf_t$, Smb_t, and Hml_t as control variables, the $\Delta S_{i,t}$ loading estimate for the small-cap individual stocks (See specification (2) of Panel A in Table 7) is positive and significant (0.0133 with a t-statistic of 293.06). Compared with the small-cap individual stocks, we find that the change of individual stock crowded trades $\Delta C_{i,t}$ for the large-cap stocks has a positive coefficient estimate (0.9870 with a t-statistic of 192.57) in specification (3) of Panel B in Table 7 with the significance of individual stock investor sentiment (0.0115 with a t-statistic of 276.81) in specification (1) of Pane B in Table 7. Collectively, our findings indi-

Table 6
Size-stratified results for individual stock crowded-trade effect excluding the Fama-French three factors of China Stock Markets.

	(1)	(2)	(3)
Panel A: Small Size			
Intercept $\times 10^3$	0.7202***	0.7312***	0.7227***
	(13.22)	(12.29)	(13.59)
$\Delta S_{i,t}$	0.0172***		0.0138***
	(338.45)		(230.97)
$\Delta C_{i,t}$		1.2336***	0.5466***
		(248.61)	(102.35)
Adj.R^2	0.3503	0.2254	0.3809
N	212,428	212,428	212,428
Panel B: Large Size			
Intercept $\times 10^3$	0.5085***	0.0515***	0.5102***
	(9.98)	(9.11)	(10.22)
$\Delta S_{i,t}$	0.0156***		0.0130***
	(335.22)		(242.74)
$\Delta C_{i,t}$		1.3847***	0.5865***
		(228.43)	(93.30)
Adj.R^2	0.3485	0.1989	0.3744
N	210,119	210,119	210,119

Note: The table first sorts all stocks into two groups based on the average year-end market capitalization during the sample period. The small size group includes the stocks that levels of the average market capitalization below the median value for the cross-sectional sample, and the large size group includes the stock that levels of the average market capitalization above the median value for the cross-sectional sample. The regressions take the form of Eqs. (7)-(9).The t-statistics of the coefficient estimates are reported in parentheses. The daily sample period ranges from 1 April 2005 to 30 September 2014, covering a total of 2310 days. The cross-sectional sample covers 183 stocks with $i = 1, \cdots\cdots, 183$. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 7
Size-stratified results for individual stock crowded-trade effect including the Fama-French three factors of China Stock Markets.

	(1)	(2)	(3)	(4)
Panel A: Small Size				
Intercept $\times 10^3$	−0.2325***	−0.0475	−0.1235***	−0.0326
	(−4.21)	(−1.02)	(−2.48)	(−0.72)
$Rmrf_t$	0.9323***	0.6967***	0.7948***	0.6788***
	(304.05)	(256.87)	(280.81)	(255.66)
Smb_t	0.4839***	0.4496***	0.4666***	0.4483***
	(59.57)	(65.56)	(63.80)	(66.92)
Hml_t	−0.2844***	−0.1820***	−0.2641***	−0.1935***
	(−24.53)	(−18.59)	(−25.31)	(−20.23)
$\Delta S_{i,t}$		0.0133***		0.0106***
		(293.06)		(201.90)
$\Delta C_{i,t}$			0.9475***	0.4615***
			(223.31)	(100.97)
$Adj.R^2$	0.3362	0.5271	0.4622	0.5488
N	212,428	212,428	212,428	212,428
Panel B: Large Size				
Intercept $\times 10^3$	−0.0633	0.0281	−0.0141	0.0357
	(−1.26)	(0.65)	(−0.30)	(0.84)
$Rmrf_t$	0.9646***	0.7284***	0.8405***	0.7104***
	(345.01)	(286.40)	(316.04)	(283.20)
Smb_t	−0.2037***	−0.0754***	−0.1347***	−0.0649***
	(−27.50)	(−11.86)	(−19.69)	(−10.38)
Hml_t	−0.1347***	−0.1100***	−0.1405***	−0.1169***
	(−12.74)	(−12.16)	(−14.41)	(−13.14)
$\Delta S_{i,t}$		0.0115***		0.0096***
		(276.81)		(205.31)
$\Delta C_{i,t}$			0.9870***	0.4582***
			(192.57)	(85.82)
$Adj.R^2$	0.3675	0.5362	0.4621	0.5519
N	210,119	210,119	210,119	210,119

Note: The table first sorts all stocks into two groups based on the average year-end market capitalization during the sample period. The small size group includes the stocks that levels of the average market capitalization below the median value for the cross-sectional sample, and the large size group includes the stock that levels of the average market capitalization above the median value for the cross-sectional sample. The regressions take the form of Eqs. (10)-(13). The t-statistics of the coefficient estimates are reported in parentheses. The daily sample period ranges from 1 April 2005 to 30 September 2014, covering a total of 2310 days. The cross-sectional sample covers 183 stocks with $i = 1, \cdots\cdots, 183$. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

cate that individual stock crowded trades and individual stock investor sentiment have incremental ability to explain excess returns among small-cap stocks and large-cap stocks.

Later in the paper, we conduct additional tests to evaluate the significance of individual stock buyer-initiated crowded trades, the significance of individual stock seller-initiated crowded trades, and the significance of individual stock investor sentiment in explaining excess returns sorted by firm size.

Table 8 reports the individual stock buyer-initiated (seller-initiated) crowded-trade effect and identifies the main determinants of return comovements. For small-cap individual stocks in Panel A of Table 8, the change of individual stock buyer-initiated crowded-trade ($\Delta C^b_{i,t}$) coefficient estimate of 1.3847 (t-statistic = 267.07) in specification (1) indicates that increasing individual stock buyer-initiated crowded trades would increase excess returns, on the contrary, the change of individual stock seller-initiated crowded-trade ($\Delta C^s_{i,t}$) coefficient estimate of −0.8819 (t-statistic = −138.54) in specification (1) reveals that increasing individual stock seller-initiated crowded trades would decrease excess returns. Furthermore, with the prominent individual stock investor sentiment effect (0.0149 with a t-statistic of 213.27), the positive effect of individual stock buyer-initiated crowded trades and the negative effect of individual stock seller-initiated crowded trades remain unchanged in specification (4) for small-cap individual stocks. And for the large-cap individual stocks, the combined effects of individual stock buyer-initiated crowded trades and individual stock seller-initiated crowded trades remain in sign and magnitude with or without the significance of individual stock investor sentiment. For large-cap individual stocks in Panel B of Table 8, the change of individual stock buyer-initiated crowded-trade ($\Delta C^b_{i,t}$) coefficient estimate of 1.5290 (t-statistic = 238.95) in specification (1) indicates that increasing individual stock buyer-initiated crowded trades would increase excess returns, on the contrary, the change of individual stock seller-initiated crowded-trade ($\Delta C^s_{i,t}$) coefficient estimate of −1.0610 (t-statistic = −136.09) in specification (1) reveals that increasing individual stock seller-initiated crowded trades would decrease excess returns. Once again, these results are consistent with previous conclusions that increasing individual stock buyer-initiated (seller-initiated) crowded trades increase (decrease) excess returns excluding the Fama-French three factors of China Stock Markets.

Table 8
Size-stratified results for individual stock buyer-initiated (seller-initiated) crowded-trade effect excluding the Fama-French three factors of China Stock Markets.

	(1)	(2)	(3)	(4)
Panel A: Small Size				
Intercept $\times 10^3$	0.7291***	0.7203***	0.7215***	0.7228***
	(12.47)	(13.23)	(13.45)	(13.62)
$\Delta S_{i,t}$		0.0164***	0.0181***	0.0149***
		(234.11)	(353.31)	(213.27)
$\Delta C^b_{i,t}$	1.3847***	0.0966***		0.4372***
	(267.07)	(16.79)		(67.57)
$\Delta C^s_{i,t}$	−0.8819***		−0.4231***	−0.6223***
	(−138.54)		(−81.84)	(−105.40)
$Adj.R^2$	0.2514	0.3512	0.3702	0.3834
N	212,428	212,428	212,428	212,428
Panel A: Large Size				
Intercept $\times 10^3$	0.5147***	0.5085***	0.5090***	0.5101***
	(9.20)	(9.98)	(10.15)	(10.25)
$\Delta S_{i,t}$		0.0153***	0.0163***	0.0141***
		(255.93)	(350.32)	(236.16)
$\Delta C^b_{i,t}$	1.5290***	0.0443***		0.4259***
	(238.95)	(6.82)		(57.86)
$\Delta C^s_{i,t}$	−1.0610***		−0.5157***	−0.7233***
	(−136.09)		(−83.88)	(−102.21)
$Adj.R^2$	0.2147	0.3486	0.3696	0.3795
N	210,119	210,119	210,119	210,119

Note: The table first sorts all stocks into two groups based on the average year-end market capitalization during the sample period. The small size group includes the stocks that levels of the average market capitalization below the median value for the cross-sectional sample, and the large size group includes the stock that levels of the average market capitalization above the median value for the cross-sectional sample. The regressions take the form of Eqs. (14)-(17). The t-statistics of the coefficient estimates are reported in parentheses. The daily sample period ranges from 1 April 2005 to 30 September 2014, covering a total of 2310 days. The cross-sectional sample covers 183 stocks with $i = 1, \cdots\cdots, 183$. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Furthermore, we introduce the Fama-French three factors of China Stock Markets as control variables to evaluate the significance of individual stock buyer-initiated crowded trades, the significance of individual stock seller-initiated crowded trades, and the significance of individual stock investor sentiment in explaining excess returns sorted by firm size.

Table 9 shows the results of Eqs. (18)-(21) to reveal the individual stock buyer-initiated (seller-initiated) crowded-trade effect sorted by firm size. With respect to the Fama-French three factors of China Stock Markets, the change of individual stock buyer-initiated crowded-trade index ($\Delta C^b_{i,t}$) presents a positive association with excess returns, implying that increasing individual stock buyer-initiated crowded trades would increase excess returns for small-cap individual stocks in specification (1), (2) and (4) of Panel A. On the contrary, the change of individual stock seller-initiated crowded-trade index ($\Delta C^s_{i,t}$) shows a negative association with excess returns, revealing that increasing individual stock seller-initiated crowded trades decrease excess returns for small-cap individual stocks in specification (1), (3) and (4) of Panel A. And the results for the large-cap individual stocks are quite similar, individual stock buyer-initiated crowded-trade effect and individual stock seller-initiated crowded-trade effect are significant and robust with or without the significant effect of individual stock investor sentiment in Panel B of Table 9. These evidences are consistent with previous findings.

7. Conclusion

Understanding the combined effect of investor behavior and investor sentiment on the formation of stock prices is an important issue in behavioral finance. In this paper, we offer explanations of excess returns with individual stock crowded trades and individual stock investor sentiment.

We show directly that individual stock crowded trades and individual stock investor sentiment have significant effects on excess returns. Specifically, we find that excess returns increase with individual stock crowded trades and individual stock investor sentiment including or excluding the Fama-French three factors of China Stock Markets. Furthermore, excess returns increase with individual stock buyer-initiated crowded trades, and decrease with individual stock seller-initiated crowded trades including or excluding the Fama-French three factors of China Stock Markets. These evidences are consistent with the view that both investor behavior and investor sentiment have significant impacts on excess returns.

Overall, our results have two important takeaways. First, compared with the roles of market-wide sentiment (see, e.g., Baker & Wurgler, 2006, 2007; Stambaugh, Yu, & Yuan, 2012) or institutional-level crowded trades (see, e.g., Pojarliev & Richard, 2011; Sias et al., 2016), we shed new light on the combined effects of stock-level sentiment and stock-level crowded

Table 9
Size-stratified results for individual stock buyer-initiated (seller-initiated) crowded-trade effect including the Fama-French three factors of China Stock Markets.

	(1)	(2)	(3)	(4)
Panel A: Small Size				
Intercept $\times 10^3$	−0.1460***	−0.0699	−0.0245	−0.0397
	(−3.02)	(−1.51)	(−0.53)	(−0.87)
$Rmrf_t$	0.7991***	0.7132***	0.6767***	0.6845***
	(290.75)	(263.35)	(247.33)	(254.90)
Smb_t	0.4969***	0.4676***	0.4358***	0.4532***
	(69.93)	(68.61)	(63.79)	(67.59)
Hml_t	−0.2543***	−0.1914***	−0.1802***	−0.1953***
	(−25.09)	(−19.69)	(−18.49)	(−20.42)
$\Delta S_{i,t}$		0.0109***	0.0139***	0.0101***
		(175.49)	(295.96)	(162.71)
$\Delta C^b_{i,t}$	1.1095***	0.2763***		0.5050***
	(254.51)	(56.23)		(91.14)
$\Delta C^s_{i,t}$	−0.5622***		−0.2032***	−0.4302***
	(−105.36)		(−44.84)	(−84.42)
$Adj.R^2$	0.4930	0.5340	0.5315	0.5492
N	212,428	212,428	212,428	212,428
Panel B: Large Size				
Intercept $\times 10^3$	−0.0321	0.0191	0.0467	0.0390
	(−0.70)	(0.44)	(1.09)	(0.92)
$Rmrf_t$	0.8400***	0.7346***	0.7080***	0.7075***
	(320.76)	(288.73)	(276.84)	(279.70)
Smb_t	−0.1037***	−0.0671***	−0.0819***	−0.0669***
	(−15.37)	(−10.58)	(−12.95)	(−10.69)
Hml_t	−0.1398***	−0.1128***	−0.1099***	−0.1164***
	(−14.56)	(−12.69)	(−12.22)	(−13.09)
$\Delta S_{i,t}$		0.0105***	0.0120***	0.0098***
		(197.38)	(283.17)	(185.82)
$\Delta C^b_{i,t}$	1.1351***	0.1780***		0.4286***
	(211.61)	(32.40)		(68.48)
$\Delta C^s_{i,t}$	−0.6567***		−0.2759***	−0.4845***
	(−101.44)		(−51.96)	(−79.80)
$Adj.R^2$	0.4785	0.5385	0.5421	0.5521
N	210,119	210,119	210,119	210,119

Note: The table first sorts all stocks into two groups based on the average year-end market capitalization during the sample period. The small size group includes the stocks that levels of the average market capitalization below the median value for the cross-sectional sample, and the large size group includes the stock that levels of the average market capitalization above the median value for the cross-sectional sample. The regressions take the form of Eqs. (18)-(21). The t-statistics of the coefficient estimates are reported in parentheses. The daily sample period ranges from 1 April 2005 to 30 September 2014, covering a total of 2310 days. The cross-sectional sample covers 183 stocks with $i = 1, \cdots\cdots, 183$. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

trades on asset prices. Second, the joint effects of individual stock crowded trades and individual stock investor sentiment are significant and robust, which demonstrates the important roles of "anomaly factors" in asset pricing.

Our findings also raise a number of interesting issues for further research. First, we can test how the cross-section of stock returns varies with crowded trades and investor sentiment. Moreover, taking the role of investor sentiment into account, it would be interesting to examine how overcrowding trades affect stock prices, and further reveal whether stock prices far away from fundamentals with overcrowding trades and extreme investor sentiment. We hope to address these topics in our ongoing research.

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