The Crowding Trading and Chinese Stock Index Futures Returns

Bin Gao[1], Xinxin Chen[1], Yu Meng[2*]
[1] *School of Economics, Guangxi University for Nationalities, Nanning, China.*
[2] *Bansomdejchaopraya Rajabhat University, Thailand.*
**Corresponding Author.*

Abstract

This paper examines the influence of crowding trading on returns in the stock index futures market. Next, we also examine how the crowding affects the stock index futures returns in different sentiment settings. We develop a model to capture crowding effects of buyer-initiated agents and seller-initiated agents. We also run empirical analysis to examine the crowding effect in futures market and related to investor sentiment. We find that both the long futures crowding effect and the short futures crowding effect. The coefficient of the long (short) futures crowding effect is 0.047 (-0.029) with a t-statistic of 14.12 (-9.60), which implies that futures return increases/decreases with the long/short futures crowding index. Our analysis also indicate a strong statistical relation between investor crowding and investor sentiment. Examining the crowding effect on futures market, we find that futures returns increase with the long spot crowding and the long futures crowding, but decrease with the short spot crowding and the short futures crowding. Besides, the joint effects of the crowding index and the investor sentiment on the futures returns are significant and systematic, strongly supported further in different sentiment settings.

Keywords: *Crowding trading, long crowding, short crowding, investor sentiment, futures returns*

I. Introduction

Recently, a lot of studies show that the institutional investors are the cause of crowded trading, which attracts negligible assets in management. Arbitrageurs use the same strategies that cause exit difficulty, and there exists a coordination problem labeled as “crowding trading” [1]. Many theoretical studies have pointed out the crowding effect on asset prices.[1, 2] Mispricing is one produce of the effect, in that investors, who tend to act in a similar fashion, would overreact to an initial under-reaction, and a great deal of such investors acting based on the same strategy would invariably lead to prices moving away from fundamental values. When the aggregate position is largely related to how easily assets can be changed into cash, investors will find it hard to close their positions. They constructed a crowding index (days to cover, DTC) and predicted that the strategy based on DTC would generate positive monthly returns.

A great deal of research has been done to investigate the effect of crowding on asset prices. Using three indicators of carry crowdedness, value crowdedness and trend crowdedness, were used in proving that when it comes to currency funds, the closing of positions, triggered by investor sentiment, could mean potential risk in crowded trades [3]. Short interest ratio and institutional ownership data were chosen for the measurement of the crowdedness of momentum, which was found to result in momentum crash, and stock prices and fundamental values going different ways [4]. Crowding leads to significantly higher returns on Chinese stocks [5]. However, the previous studies fail to address how the prices relate to the extent of crowding in futures market.

To have a better understanding towards this issue, we develop a simple model to describe the effect of crowding, which is an advancement of previous asset pricing models. Previous asset pricing research tended to divide all traders into sentimental traders (noise traders) and arbitrageurs [6, 7]. One model shows the interaction between rational speculators and noise traders [6]. Specifically, another model, which divides traders into insiders, noise

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traders, and outsiders, claims that noise traders play a disproportinately bigger role than their size in terms of their influences on market equilibrium [7]. However, these articles do not distingish two kinds of behavior, initiated, respectively, by buyers and sellers, and each kind of traders' volume could not be quantitatively measured by the empirical test. Hence, in this paper, we divide traders into buyer-initiated traders, seller-initiated traders and arbitrageurs. The buyer-initiated traders' expectation receives the positive bias to buy assets, whereas the seller-initiated traders' expectation receives the negative bias to sell assets. Compared with previous models, our model, inspired by the method, is easier to be tested empirically as the volume of buyer-initiated traders and seller-initiated traders could be quantitatively measured with trading data [8].

The aggregate position of arbitrageurs is short-selling when they face an over-priced asset, but this paper emphasizes that arbitrageurs will take not only short positions, but also long positions [1]. When the price far exceeds the fundamental value, it stands for the power of buyer-initiated traders, which is bigger than the power of the seller-initiated traders. The net power of buyer pushes the price up; the arbitrageurs will join in the market and take short positions. And vise versa.

Our model make contributions in two ways. First, we discuss how crowding affects futures returns. Three indices are introduced for long crowding, short crowding, and net crowding. Respectively, the ratios of buyer-initiated volume, seller-initiated volume, and order imbalance volume (which is defined as buyer-initiated volume less seller-initiated volume), are all set to outstanding. The three kinds of crowding indexes capture the change of the equilibrium price. The long crowding index is correlated with the change in a positive fashion, while the short crowding index does in a negative manner. It means that buyer-initiated traders pour into the market and push the price up, whereas seller-initiated traders pour into the market and pull the price down. Moreover, the net crowding is found to be able to substantially push higher futures contracts returns.

Second, we test the joint effect of the crowding and investor sentiment, that is how they push higher futures returns. Factor pricing models, in most cases, demonstrate that the influence of investor sentiment is found everywhere in stock markets [9-15]. Some researchers look at the roles investor sentiment plays in futures market [16-21]. In our regression model, we use both investor sentiment index and crowding index from spot and futures market as independent variables. The joint effects of the crowding index and the investor sentiment are significant and systematic on the futures return. Correlations analysis reveals that both investor sentiment indexes from spot and futures market may have significant effects on the net crowding index. Next, we examine how the crowding affects the stock index futures returns in different sentiment settings.

This paper tests the crowding effect in Chinese index futures market. Financial markets in China began in 1991 and it has undergone many drastic changes ever since [22]. The CSI (China Securities Index) 300 index consists of 300 heavily traded stocks on the A-share market, and seeks to replicate the performance of the market. Widely seen as a reflection of the A-share market [23] t, he index saw the volume of the CSI 300-based futures contracts reach 1.9 trillion in April, 2015, making it the largest stock index futures product worldwide. Between April 19, 2010 and September 30, 2014 [17], VOI (volume to open interest) dropped from an initial position of 26 times to 8 times. This figure was still higher than that usually observed in more mature foreign markets. In these markets, the figure is generally smaller than one. It's worth analysing the Chinese markets if one seeks to study crowding in stock index futures.

This paper organizes as follows. In section 2, the paper introduces a model and outlines our predictions. Section 3 presents our definitions of investor sentiment and crowding indexes in both spot and futures market, and further describes the data used in empirical analysis. Section 4 presents long crowding effect, short crowding effect and the net crowding effect. Section 5 examines the crowding effect in different sentiment settings. Section 6 conducts additional supporting evidence. Finally, section 7 is the conclusion.

II. Model

In this part, this work applies a simple model considering three kinds of agents in the futures market. Generally speaking, the expectations are different between the buyer-initiated trader, the seller-initiated trader and the arbitrageurs. The buyer-initiated traders' expectation receives the positive bias to buy futures, whereas the seller-initiated traders' expectation receives the negative bias to sell futures. In between, the arbitrageurs realize the fundamental value of spot. The equilibrium is analyzed as follows, with the three kinds of crowding indexes as a reliable signal for equilibrium price.

There are two dates t=0, 1. Trading is at t=0. The asset yields a payoff at t=1. The risk-free interest rate is constant and normalizes to zero. Here are two risky assets. A futures contract is traded in periods 0 and settlement in periods 1. The open interest of futures contract is L at time 0, $L>1$. The settlement price of futures contract is equal to the price of spot asset in periods 1. Let p_1 denote the spot asset price in period 1, during which we assume that p_1 is random and exogenous, $p_1 \sim N(\theta,\sigma^2)$. θ is the average of spot price, and σ^2 is the volatility of spot price in period 1.

In this situation, there are three kinds of traders, and the expectations of price in period 1 are different. A fraction O of the agents represents buyer-initiated trader who supposes that the random return has a mean $\mu^o=\theta+f(s^o)$. s^o is the optimistic bias of buyer-initiated trader, s^o >0. The function $f(s^o)$ is a monotonically increasing function of s^o, and $f(s^o)$ refers to the optimistic bias effect of buyer-initiated trader that satisfies the properties as $f(s^o)>0$ and $\mu^o > p_1$. A fraction P of the agents represents seller-initiated trader who consider that the random return has a mean $\mu^p=\theta+f(s^p)$. s^p is the pessimistic bias of sell-initiated trader, s^p <0. The function $f(s^p)$ is a monotonically increasing function of s^p, and $f(s^p)$ refers to the pessimistic bias effect of sell-initiated trader that satisfies the properties as follow $f(s^p)<0$ and $\mu^p < p_1$. It begins with one unit of the asset per-capita. A fraction A denotes those arbitrageurs who have no endowment while consider that payoff has mean $\mu^p<\theta<\mu^o$. Here, all agents are considered as risk-neutral and $O+P+A=1$.

Here, we begin with the portfolio maximization problem of the buyer-initiated trader in order to work out the model. A net demand n_0^+ at *t* =0 will be selected by buyer-initiated traders who receive the positive bias s^o that solves:

$$\max_n\left[\left(1+n\right)\left(\theta+f(s^o)\right)-nF_0-\frac{c_o}{2}n^2\right], \tag{1}$$

Here, F_0 is the price of futures contract at *t* = 0 and C_o is the (perceived) trading cost parameter of buyer-initiated trader. Here n is the net demand of investors and $(1+n)$ is the sum of investor's endowments of the shares and his position. Therefore, the net demand of buyer-initiated trader that receives the positive bias is:

$$n_o^+=\frac{\theta+f(s^o)-F_0}{c_o}. \tag{2}$$

Seller-initiated traders who receive the negative bias s^p also have to maximize the portfolio. And a net demand

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n_0^- is used to solve the following equation:

$$\max_n \left[(1+n)\left(\theta + f(s^p)\right) - nF_0 - \frac{c_p}{2} n^2 \right]. \tag{3}$$

Then the net demand of buyer-initiated trader who receive the negative time preference shock is:

$$n_o^- = \frac{\theta + f(s^p) - F_0}{c_p}. \tag{4}$$

Here we assume that A risk-neutral arbitrageurs exist. The total amount traded by arbitrageurs decide the cost of trading faced by an individual arbitrageur l who acquires n_a^l, and is given by $\frac{c}{2} n_a^l \sum_j n_a^j$.

Actual trading costs include the brokerage commission and some taxes. Here we assume that the lending fee is zero. The investors face quadratic actual trading costs. While the transaction costs are chosen partly for tractability, the previous empirical studies normally found the transaction costs to be convex [24-28].

A single arbitrageur ℓ treats all other arbitrageur's trades as given and maximized:

$$\max_n \left\{ n_a^l(\theta - F_0) - \frac{c}{2} n_a^l \sum_j n_a^j \right\}. \tag{5}$$

In an internal symmetric equilibrium, a single individual arbitrageur is homogenous. The probability that the arbitrage is short seller is 1/2. The demand of any arbitrageur must satisfy:

$$n_a^l = \frac{\theta - F_0}{c + \frac{c}{2}(A-1)}. \tag{6}$$

Hence the total demand of the arbitrageur sector n_a meets

$$n_a = A n_a^l. \tag{7}$$

Thus the total demand of the arbitrageur sector meets:

$$n_a = \frac{\theta - F_0}{c_a}. \tag{8}$$

Where

$$c_a = \frac{1}{A}\left[c + \frac{c}{2}(A-1) \right], \tag{9}$$

When the net supply is zero, we add up the demand of three types, then we get:

$$\frac{O}{c_o}\left[\theta + f(s^o) - F_0\right] + \frac{P}{c_p}\left[\theta + f(s^p) - F_0\right] + \frac{1}{c_a}\left[\theta - F_0\right] = 0, \tag{10}$$

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Or

$$F_0 = \theta + \frac{1}{z}\left[\frac{O}{c_o}\cdot f(s^o) + \frac{P}{c_p}\cdot f(s^p)\right], \tag{11}$$

Where $z = \frac{O}{c_o} + \frac{P}{c_p} + \frac{1}{c_a}$.

Suppose the first term θ is the fundamental value associated with the expectation of risk-neutral arbitrageurs, then the second three terms reflect the mispricing due to the positive bias effect $\frac{O}{zc_o} f(s^o)$ and the negative bias effect $\frac{P}{zc_p} f(s^p)$.

The ratio buyer-initiated trader minus the ratio seller-initiated trader ($O\text{-}P$) stands for the net crowding between them. To measure $O\text{-}P$ and the price sensitivity, we perform numerical simulation of $O\text{-}P$ and the price sensitivity affected by the ratio of arbitrageur. The parameters are chosen as following, $L=2$, $c_a=1$, $c_o=1$, $c_p=1$, $\alpha_S=0.01$, $c_p=1$, $\theta=10$ and $O\text{-}P \in [-0.8, +0.8]$.

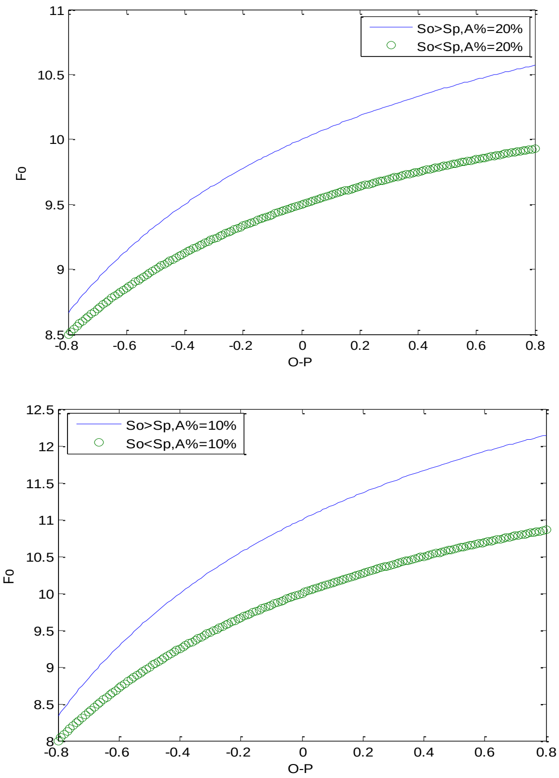

Figure 1. The Price Sensitivity to the Net Crowding of Buyer-initiated Trader and Seller-initiated Trader ($O\text{-}P$) with 20% or 10% Arbitrageurs

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Figure 1 shows that the price sensitivity to the net crowding of $O\text{-}P$ increases more or less due to the arbitrageurs factor. The futures price increases with the net crowding of $O\text{-}P$, but the range of futures price varies more or less with arbitrageurs. For example, the price increases from 8.5 to 10.5 when the net crowding of $O\text{-}P$ increases from -0.8 to 0.8 and the ratio of arbitrageurs is 20%. The price increases from 8 to 12 when the net crowding of $O\text{-}P$ increases from -0.8 to 0.8 and the ratio of arbitrageurs is 10%. It means that the price sensitivity to the net crowding of $O\text{-}P$ is bigger when there is less arbitrageur in the market.

First, we define the ratio of buyer-initiated volume to outstanding as the long crowding index. Open interest stands for the amount of futures contracts outstanding [29]. Long crowding index of buyer-initiated trader is given by

$$C^{\text{long}} := \frac{On_0^+}{L}, \tag{12}$$

Where $n_0^+ = \frac{1}{c_o z}\left\{\frac{P}{c_p}\left[f(s^o) - f(s^p)\right] + \frac{1}{c_a} f(s^o)\right\}$, So

$$\frac{\partial C^{\text{long}}}{\partial s^o} > 0, \tag{13}$$

Furthermore,

$$\frac{\partial p_0}{\partial s^o} > 0. \tag{14}$$

Thus, the equilibrium futures price is positively correlated with long crowding index. When the power of buyer-initiated traders is bigger than the power of the seller-initiated traders, the net power of buyer drives the price up. Second, we define the ratio of seller-initiated volume to outstanding as the short crowding index. Short crowding index of seller-initiated trader is given by

$$C^{\text{short}} := \frac{Pn_0^-}{L}, \tag{15}$$

Where $n_0^- = \frac{1}{c_p z}\left\{\frac{O}{c_o}\left[f(s^p) - f(s^o)\right] + \frac{1}{c_a} f(s^p)\right\}$,

$$\frac{\partial C^{\text{short}}}{\partial s^p} > 0, \tag{16}$$

Furthermore,

$$\frac{\partial p_0}{\partial s^p} < 0. \tag{17}$$

Thus, the equilibrium futures price is negatively correlated with short crowding index. When the power of seller-initiated traders is bigger than the power of the buyer-initiated traders, the net power of seller drags the price down. Third, we define the ratio of order imbalance volume to outstanding as the net crowding index. The net crowding index is given by

$$C := \frac{On_0^+ - Pn_0^-}{L}, \tag{18}$$

Where $n_0^+ = \frac{1}{c_o z}\left\{\frac{P}{c_p}\left[f(s^o) - f(s^p)\right] + \frac{1}{c_a} f(s^o)\right\}$, $n_0^- = \frac{1}{c_p z}\left\{\frac{O}{c_o}\left[f(s^p) - f(s^o)\right] + \frac{1}{c_a} f(s^p)\right\}$, $\frac{\partial C}{\partial s^o} > 0$ and $\frac{\partial C}{\partial s^p} < 0$,

Furthermore $\frac{\partial p_0}{\partial s^o} > 0$ and $\frac{\partial p_0}{\partial s^p} < 0$.

Thus, the equilibrium futures price is positively correlated with the net crowding index. This leads to the basis of our propositions and predictions.

Proposition: If the futures contract begins at t = 0, maturity data is t=1 and three kinds of investors exist in the market-buyer-initiated traders, seller-initiated traders and arbitrageurs, then the change of equilibrium futures price is: 1) positively correlated with long crowding index; 2) negatively correlated with short crowding index; 3) positively correlated with the net crowding index.

III. Data, Variables and Summary Statistics

Daily data from the China Financial Futures Exchange from April 16, 2010 to December 30, 2018. As China's first stock index futures, CSI 300 stock index future were launched on April 16, 2010. After five years, in April 2015, the China Securities Regulatory Commission declared that the trading amount of CSI 300 stock index futures have reached 1.9 trillion yuan results in it became the most largest stock index futures product all over the world. Besides, this is well ahead of the E-Mini S&P500 index futures (average turnover of 47 billion).

3.1 Sentiment index

3.1.1 Spot market sentiment index

In sentiment study, previous work has proposed some proxies as time series conditional variables. The first principle component as a common method is used to form a composite spot market sentiment index, which is based on the common changes of four potential proxies: relative strength index (RSI), psychological line index (PSY), trading volume (VOL) and adjusted turnover rate (ATR).[9] We use the spot market sentiment index proxies [17]. Each agent will be presented separately and further explained how to form a composite investor sentiment index.

Each variable consists of a sentiment component, isolated by principle component analysis. This has led to a low spot market sentiment index: $S_{spot} = 0.168RSI + 0.625PSY + 0.528VOL + 0.385ATR.$

Here, every index component is standardized first. The first principle component can explain 70.1% of the sample variance, which means that this component enables to capture most common variations.

3.1.2 Futures market sentiment index

Here, this work use the first principle component to form a composite futures market sentiment index, which based

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on the common variation in four proxies: Open interest (OI), relative strength index (RSI), psychological line index (PSY) and trading volume (VOL) [9]. The proxies for futures market sentiment index are proposed by the previous literature [17].

Each variable consists of a sentiment component, isolated by principle component analysis. This has led to a low futures market sentiment index: $S_{futrues} = 0.487OI + 0.554RSI + 0.245PSY + 0.241VOL.$

Here, every index component is standardized first. The first principle component can explain 67.5% of the sample variance, which means that this component enables to capture most common variations.

3.2 The crowding indexes

3.2.1 The spot crowding index

This section identifies the spot crowding indexes. Crowed by momentum traders, namely loser stocks, have two characteristics: they are sold heavily by both short-sellers and existing share holders [1, 5]. With the shares outstanding, the total buyer-initiated volume ($BV_{spot,t}$), and the total seller-initiated volume ($SV_{spot,t}$) data, we compute the long spot crowding index ($C^{l}_{spot,t}$), the short spot crowding index ($C^{s}_{spot,t}$) and the net spot crowding index ($C_{spot,t}$).

To calculate the long spot crowding index ($C^{l}_{spot,t}$), the day-t $C^{l}_{spot,t}$ for spot is denoted as:

$$C^{l}_{spot,t} = \frac{BV_{spot,t}}{Totel\ shares\ outstanding\ of\ \ spot\ on\ \text{day}\ t}. \tag{19}$$

Here, high $C^{l}_{spot,t}$ means that spot already has heavy buying from investors, and in other words, a large number of buyers can be seen crowding into the spot contract.

In order to calculate the short spot crowding index ($C^{s}_{spot,t}$), the day-t $C^{s}_{spot,t}$ for spot denotes as:

$$C^{s}_{spot,t} = \frac{SV_{spot,t}}{Totel\ shares\ outstanding\ of\ \ spot\ on\ \text{day}\ t}. \tag{20}$$

Here, high $C^{s}_{spot,t}$ means that the trading volume of stock already has heavy selling from investors, and in other words, a large number of sellers can be seen crowding into the spot contract.

In order to calculate the net spot crowding index ($C_{spot,t}$),[18,28,32] the day-t $C_{spot,t}$ for spot denotes as:

$$C_{spot,t} = \frac{BV_{spot,t} - SV_{spot,t}}{Totol\ shares\ outstanding\ of\ \ spot\ on\ \text{day}\ t}. \tag{21}$$

Here, $BV_{spot,t}$ denotes the total buyer-initiated volume of the spot on day t; $SV_{spot,t}$ denotes the total seller-initiated volume of the spot on day t.

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3.2.2 The futures crowding index

Some studies have suggested that in the futures market, there are some could be quiet good speculative ration. For example, the volume of open interest ration. Prior study considered in a given contract, the ratio of the total volume of contracts traded over a period of time to the size of open position at the end of period, reflecting speculation [30].

The volume-to-open-interest ratio (R1, henceforth) is defined as: $R1_t = \frac{v_t}{OI_t}$

A new speculative ratio, i.e. the value of volume to the absolute value of the change in the open interest [31]. More precisely, the ratio of volume to absolute change in open interest held R2 is defined as: $R2_t = \frac{v_t}{|\Delta OI_t|}$

The ratio of the change in open interest to volume (or R3, henceforth) is defined as [32]: $R3_t = \frac{\Delta OI_t}{v_t}$

This paper discusses the extent of crowding effects on futures returns. The ratio of buyer-initiated volume is defined to outstanding as the long crowding index ($C^l_{futures,t}$), the ratio of seller-initiated volume to outstanding as the short crowding index ($C^s_{futures,t}$), and the ratio of order imbalance volume (the difference between buyer-initiated volume and seller-initiated volume) to outstanding as the net crowding index ($C_{futures,t}$). The trading data we use here comes from RESSET database from April 16, 2010 to September 30, 2014. Consider the volume of China's stock index futures market, the volume of open positions, the buyer-initiated volume ($BV_{futures,t}$), and the seller-initiated volume ($SV_{futures,t}$).

To calculate the long futures crowding index ($C^l_{futures,t}$), we define the day-t $C^l_{futures,t}$ for futures contract as:

$$C^l_{futures,t} = \frac{BV_{futures,t}}{Open\ interest\ of\ \ stock\ index\ \ futures\ on\ day\ t}. \tag{22}$$

Here, high $C^l_{futures,t}$ means that the futures contract already has heavy buying from investors, and in other words, a large number of buyers can be seen crowding into the futures contract.

To calculate the short futures crowding index ($C^s_{futures,t}$), day-t $C^s_{futures,t}$ for futures contract is denoted as:

$$C^s_{futures,t} = \frac{SV_{futures,t}}{Open\ interest\ of\ \ stock\ index\ \ futures\ on\ day\ t}. \tag{23}$$

Here, high $C^s_{futures,t}$ means that the futures contract already has heavy selling from investors, and in other words, a large number of sellers can be seen crowding into the futures contract.

To calculate the net futures crowding index ($C_{futures,t}$), the day-t $C_{futures,t}$ for futures contract is denoted as:

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$$C_{futures,t} = \frac{BV_{futures,t} - SV_{futures,t}}{Open\ interest\ of\ \ stock\ index\ \ futures\ on\ day\ t}. \tag{24}$$

Here, $BV_{futures,t}$ is the total buyer-initiated volume of the futures contract on day t [8]; $SV_{futures,t}$ is the total seller-initiated volume of the futures contract on day t.

3.3 Summary statistics

To further analyze these numbers, Plane A of Table 1 gives a brief summary statistics on our sample. It provides the average, median, 90th and 10th percentiles, standard deviations, and time series averages of the main variables used for empirical analysis. C_{spot} = 0.0003 means that, on average, the net daily volume for spot index is 0.03% of the total shares outstanding of spot. The 90th and 10th percentile of C_{spot} are 3.7% and -4.7% of the total shares outstanding, respectively. $C_{futures}$ =-0.017 means that, on average, the net daily volume for index futures is -1.7% of the totals outstanding contracts of index futures. The 90th and 10th percentile of $C_{futures}$ are 27.9% and -29.3% of the total outstanding contracts, respectively. These results show that the crowding happens at the extremes of the distributions which means that looking at the long and short crowding separately is important. The Panel B in Table 1to report the correlations for all the variables. A significantly positive correlation is between long crowding index ($C^{l}_{spot,t}$, $C^{l}_{futures,t}$) and investor sentiment. While a significantly negative correlation is between short crowding index ($C^{s}_{spot,t}$, $C^{s}_{futures,t}$) and investor sentiment.

Table 1 Summary statistics.

Panel A

	R_{spot}	$R_{futures}$	S_{spot}	$S_{futures}$	C_{spot}	C^{l}_{spot}	C^{s}_{spot}	$C_{futures}$	$C^{l}_{futures}$	$C^{s}_{futures}$
Mean	0.000	0.000	0.000	0.000	0.0003	0.0484	0.0481	-0.017	0.438	0.455
Median	0.000	-0.001	-0.060	-0.030	-0.005	0.0466	0.0461	-0.041	0.427	0.463
90th percentiles	0.040	0.043	4.23	3.32	0.037	0.076	0.087	0.279	0.523	0.531
10th percentiles	-0.085	-0.071	-1.844	-3.067	-0.047	0.020	0.017	-0.293	0.228	0.249
Std. Dev.	0.013	0.014	1.068	1.114	0.021	0.013	0.014	0.175	0.092	0.087
Skewness	-0.093	-0.005	0.547	0.196	0.004	0.44	0.525	0.176	0.232	-0.055
Kurtosis	4.921	6.033	3.230	2.669	1.745	2.637	3.006	1.74	1.895	1.888
JB value	167.57	413.92	56.34	11.85	70.795	40.783	49.505	76.994	64.608	56.125
Probability	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000

Panel B

	R_{spot}	$R_{futures}$	S_{spot}	$S_{futures}$	C_{spot}	$C_{futures}$	C^{l}_{spot}	C^{s}_{spot}	$C^{l}_{futures}$	$C^{s}_{futures}$
R_{spot}	1.000									

$R_{futures}$	0.454	1.000								
	[21.3]	-----								
S_{spot}	0.408	0.302	1.000							
	[17.4]	[11.1]	-----							
$S_{futures}$	0.312	0.424	0.373	1.000						
	[11.6]	[18.6]	[15.0]	-----						
C_{spot}	0.511	0.353	0.466	0.319	1.000					
	[28.6]	[13.8]	[22.5]	[11.9]	-----					
$C_{futures}$	0.382	0.513	0.312	0.449	0.378	1.000				
	[15.6]	[29.0]	[11.6]	[20.8]	[15.3]	-----				
C^{l}_{spot}	0.319	0.259	0.592	0.348	0.333	0.253	1.000			

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	[11.9]	[9.1]	[59.2]	[13.5]	[12.7]	[8.9]	-----			
C^s_{spot}	-0.174	-0.116	-0.212	-0.043	-0.213	-0.134	0.332	1.000		
	[-5.8]	[-3.8]	[-7.2]	[-1.3]	[-7.3]	[-4.4]	[12.6]	-----		
$C^l_{futures}$	0.177	0.250	0.206	0.194	0.188	0.290	0.187	0.006	1.000	
	[5.9]	[8.8]	[7.0]	[6.5]	[6.3]	[10.5]	[6.3]	[0.17]	-----	
$C^s_{futures}$	-0.142	-0.178	-0.083	-0.182	-0.128	-0.233	-0.021	0.121	0.406	1.000
	[-4.7]	[-6.0]	[-2.6]	[-6.1]	[-4.2]	[-8.1]	[-0.68]	[3.9]	[17.2]	-----

IV. The Crowding Effect in Futures Market

This section tests our first prediction on whether the extent of crowding has influence on the futures returns. The sample period runs from 4, 2010 to 12, 2018 and Chinese financial market is the focusing place to study how crowding affects stock index futures returns. We predict that long crowding index increasing shall lead to futures returns increasing simultaneously, whereas short crowding index decreasing shall lead to futures return decreasing simultaneously. Moreover, net crowding index shall have positive and significant effect on futures contracts returns.

4.1 Long crowding effect and short crowding effect in futures market

Extant literature detected the presence of carry crowdedness, trend crowdedness and value crowdedness [3]. After a few years, scholars detected long crowding and short crowding from net crowding in stock market [5]. In this section, crowding index is separated into four categories: the long spot crowding index, the short spot crowding index, the long futures crowding index and the short futures crowding index. The test tries to find out whether the long spot crowding effect, the short spot crowding effect, the long futures crowding effect and the short futures crowding effect exist in the futures returns. We regression analysis of these types:

$$R_{futures,t} = \alpha + \beta^l_{c,futures} C^l_{futures,t} + \beta^s_{c,futures} C^s_{futures,t} + \beta_{s,spot} S_{spot,t} + \beta_{s,futures} S_{futures,t} + \varepsilon_t , \tag{25}$$

$$R_{futures,t} = \alpha + \beta^l_{c,spot} C^l_{spot,t} + \beta^s_{c,spot} C^s_{spot,t} + \beta_{s,spot} S_{spot,t} + \beta_{s,futures} S_{futures,t} + \varepsilon_t , \tag{26}$$

$$\begin{aligned} R_{futures,t} = \alpha &+ \beta^l_{c,spot} C^l_{spot,t} + \beta^s_{c,spot} C^s_{spot,t} + \beta^l_{c,futures} C^l_{futures,t} \\ &+ \beta^s_{c,futures} C^s_{futures,t} + \beta_{s,spot} S_{spot,t} + \beta_{s,futures} S_{futures,t} + \varepsilon_t . \end{aligned} \tag{27}$$

Here, $R_{futures,t}$ is the return of futures contract at day t; $C^l_{futures,t}$ is the long futures crowding index at day t; $C^s_{futures,t}$ is the short futures crowding index at day t; $C^l_{spot,t}$ is the long spot crowding index at day t; $C^s_{spot,t}$ is the short spot crowding index at day t. Similarly, we look forward to positive coefficients for the $\beta_{s,spot}$ and $\beta^l_{c,futures}$ parameters, as spot sentiment increasing and futures sentiment increasing shall precede futures returns increasing in the short run. In addition, we expect positive estimates for the $\beta^l_{c,spot}$ and $\beta^l_{c,futures}$ parameter, as long spot crowding increasing and long futures crowding increasing shall precede futures returns increasing in the short run. Lastly, we look forward to negative estimates for the $\beta^s_{c,spot}$ and $\beta^s_{c,futures}$ parameters because short spot crowding increasing and short futures crowding increasing shall decrease futures returns in the short run.

Table 2 The roles of long and short crowding index on futures market returns.

Panel A						
Variables	1	2	3	4	5	6
INTERCEPT	-0.00861	0.005506	-0.00229	-0.00196	-0.00215	-0.00201
	[-12.1386]	[7.5760]	[-4.9014]	[-4.1786]	[-4.7022]	[-4.3688]
$C^l_{futures}$	0.047528		0.120349	0.112761	0.101477	0.100287

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	[14.1248]		[43.6928]	[35.6528]	[27.4526]	[26.8136]
$C^{s}_{futures}$		-0.0293	-0.09707	-0.09198	-0.08093	-0.08054
		[-9.6077]	[-40.6764]	[-35.4395]	[-25.4236]	[-25.2877]
S_{spot}				0.001246		0.000559
				[4.7346]		[1.9747]
$S_{futures}$					0.002295	0.002026
					[7.4299]	[6.0071]
ADJ. R^2	0.159637	0.080355	0.674767	0.681311	0.690834	0.691692
N	2138	2138	2138	2138	2138	2138
Panel B						
Variables	1	2	3	4	5	6
INTERCEPT	-0.00873	0.00346	-0.00327	-0.00393	0.001022	-0.00184
	[-12.9343]	[4.6831]	[-5.1349]	[-2.3578]	[1.7624]	[-1.2995]
C^{l}_{spot}	0.043046		0.073199	0.077514	0.035029	0.053482
	[15.2811]		[25.8693]	[7.4686]	[11.5026]	[6.0268]
C^{s}_{spot}		-0.02044	-0.06365	-0.06469	-0.04546	-0.04985
		[-5.9921]	[-20.1524]	[-16.2594]	[-16.0832]	[-14.4556]
S_{spot}				-0.00051		-0.00223
				[-0.4321]		[-2.2133]
$S_{futures}$					0.006416	0.006474
					[20.4121]	[20.5622]
ADJ. R^2	0.177286	0.031337	0.402013	0.401561	0.568533	0.570091
N	2138	2138	2138	2138	2138	2138
Panel C						
Variables	1	2	3	4	5	6
INTERCEPT	-0.01312	0.007748	-0.00305	-0.00645	-0.00193	-0.00567
	[-16.9464]	[8.8606]	[-5.3296]	[-5.0756]	[-3.2738]	[-4.5317]
C^{l}_{spot}	0.033006		0.020263	0.041623	0.015285	0.038861
	[11.5366]		[7.5789]	[5.4656]	[5.5800]	[5.1963]
C^{s}_{spot}		-0.01539	-0.0159	-0.02071	-0.01702	-0.02239
		[-4.5196]	[-5.7213]	[-6.4701]	[-6.2229]	[-7.1080]
$C^{l}_{futures}$	0.036041		0.103873	0.104787	0.089332	0.08995
	[10.8461]		[30.0609]	[30.3221]	[21.8272]	[22.0663]
$C^{s}_{futures}$		-0.0266	-0.08431	-0.08495	-0.07098	-0.07132
		[-8.63689]	[-29.0715]	[-29.3235]	[-20.0639]	[-20.2538]
S_{spot}				-0.00259		-0.00287
				[-2.9938]		[-3.3853]
$S_{futures}$					0.002132	0.00219
					[6.3496]	[6.5467]
ADJ. R^2	0.254024	0.097155	0.691318	0.693661	0.702552	0.705514
N	2138	2138	2138	2138	2138	2138

Panel a of Table 2 reports the empirical results from Equation (25). The crowding indexes from index futures market are considered as the independent variables, index futures market and stock market sentiment factors are considered as control variables. The coefficients of Panel A essentially reveal the long futures crowding effect and the short futures crowding effect. The coefficient of the long (short) futures crowding effect is 0.047 (-0.029) with a t-statistic of 14.12 (-9.60) in specification (1) and (2) of Panel A, which implies that futures return increases/decreases with the long/short futures crowding index.

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Similarly, Panel B of Table 2 reports the empirical results from Equation (26). The crowding indexes from stock market are as the independent variables, index futures market and stock market sentiment factors are as control variables. The coefficients of Panel B essentially present the long spot crowding effect and the short spot crowding effect. The futures returns are positively correlated with the long spot crowding index (0.043, t-statistic=15.28), but negatively correlated with the short spot crowding index (-0.020, t-statistic=-5.99) in specification (1) and (2) of Panel B.

Furthermore, Panel C of Table 2 reports the empirical results from Equation (27). The crowding indexes from two market are as the independent variable, index futures market and stock market sentiment factors are as control variables. For example, in specification (3) of Panel C, futures returns are positively correlated with the long spot crowding index (0.020, t-statistic=7.57) and the long futures crowding index (0.103, t-statistic=30.06), but negatively with the short spot crowding index (-0.015, t-statistic=-5.72) and the short futures crowding index (-0.084, t-statistic=-29.07).

As we were mentioned above, the results strongly show that all the long spot crowding effect, the short spot crowding effect, the long futures crowding effect and the short futures crowding effect have significant influences on futures returns. Furthermore, futures returns increase with the long spot crowding and the long futures crowding, but decrease with the short spot crowding and the short futures crowding. The result is consistent with former studies that have claimed that short crowding is a key factor during crisis periods [33-36].

4.2 The net crowding effect in futures market

Previous researches have shown that investor sentiment and the net crowding index may have significant effect on asset prices. Here, the analysis is discussed through the following models:

$$R_{futures,t} = \alpha + \beta_{c,spot} C_{spot,t} + \beta_{c,\,futures} C_{futures,t} + \beta_{s,spot} S_{spot,t} + \beta_{s,\,futures} S_{futures,t} + \varepsilon_t \quad . \tag{28}$$

Here, $R_{futures,t}$ is the returns of stock index futures contract at day t; is the spot sentiment of stock index at day t; $S_{futures}$ is the futures sentiment of stock index futures contract at day t; $C_{spot,t}$ is the net spot crowding index at day t; $C_{futures}$ is the net futures crowding index at day t. We anticipate a positive and significant coefficient on the net spot and futures crowding index.

Table 3 Regressions of futures market returns on the net crowding index.

Variables	1	2	3	4	5	6	7
INTERCEPT	-0.0184	-0.0192	-0.0182	-0.0105	-0.0158	-0.0002	-0.0428
	[-25.44]	[-34.85]	[-25.01]	[-11.83]	[-11.76]	[-0.78]	[-27.54]
$C_{futures}$	0.0384	0.0401	0.0379				0.0824
	[26.642]	[38.222]	[26.163]				[23.643]
C_{spot}				0.0188	0.0286	0.0056	0.0062
				[12.262]	[12.004]	[5.261]	[3.383]
$S_{futures}$	0.0011		0.0008	0.0066		0.0078	0.0022
	[3.238]		[2.151]	[21.932]		[22.887]	[6.426]
S_{spot}		0.0009	0.0007		0.0020	0.0008	0.0005
		[3.595]	[2.655]		[4.094]	[2.072]	[1.805]
ADJ. R^2	0.6762	0.6769	0.6780	0.5286	0.3285	0.4894	0.6946
N	2138	2138	2138	2138	2138	2138	2138

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Table 3 tries to find spot crowding effect and futures crowding effect through analyzing regressions of futures returns at daily frequency. We find that futures sentiment in specification (1) is positively correlated and significant with the futures returns (0.0011: t-statistic=3.23), and spot sentiment is also positively correlated and significant with the futures returns (0.0009: t-statistic=3.595) [21]. It shows that futures returns is higher when spot sentiment and futures sentiment are optimistic, meaning that futures crowding index has a significantly positive effect on futures returns. The coefficients of futures crowding index in specification (1), (2) and (3) are 0.0384 (t-statistic=26.642), 0.0401 (t-statistic=38.222) and 0.0379 (t-statistic=26.163), which corroborates that increasing futures crowding index enhances futures returns. Moreover, the coefficients of spot crowding index in specification (4), (5) and (6) are 0.0188 (t-statistic=12.262), 0.0286 (t-statistic=12.004) and 0.0056 (t-statistic=5.261), which again corroborates that increasing spot crowding index enhances futures returns.

In conclusion, the above results testify that both the net spot crowding index and the net futures crowding index have a significantly positive impact on futures returns. What’s more, the net futures crowding index than the net spot crowding index has more significant impacts on stock returns.

V. The Crowding Effect in Different Sentiment Settings

So far, our work shows that there is an important and strong relation in investor sentiment and investor crowding. Our model also predicts that the net crowding index is positively correlated with investor sentiment. In the further study, we look at how crowding affects the return of stock index futures in different sentiment states: optimistic futures market sentiment ($S_{futures}^{+}$) and pessimistic futures market sentiment ($S_{futures}^{-}$). The return of market returns for the same period variables in different periods of sentiment is shown in Table 4.

Table 4 Regressions of market returns s in different sentiment periods.

Panel A							
Variables	1	2	3	4	5	6	7
INTERCEPT	-0.006	-0.011	-0.011	-0.020	-0.021	-0.020	-0.017
	[-2.83]	[-7.355]	[-5.514]	[-17.32]	[-18.055]	[-17.301]	[-11.06]
C_{spot}	0.020	0.021	0.021				0.007
	[5.959]	[9.422]	[6.858]				[2.497]
$C_{futures}$				0.040	0.041	0.039	0.042
				[23.629]	[22.025]	[21.555]	[19.839]
S_{spot}	0.002		0.001	0.002		0.002	0.003
	[3.007]		[1.780]	[5.645]		[5.219]	[5.459]
$S_{futures}$		0.005	0.006		0.003	0.003	0.002
		[8.453]	[7.827]		[2.090]	[2.128]	[1.746]
ADJ. R^2	0.212	0.294	0.293	0.490	0.569	0.590	0.634
N	1018	1018	1018	1018	1018	1018	1018
Panel B							
Variables	1	2	3	4	5	6	7
INTERCEPT	-0.021	-0.009	-0.015	-0.020	-0.016	-0.016	-0.021
	[-13.46]	[-7.15]	[-9.54]	[-25.77]	[-13.99]	[-14.15]	[-14.52]
C_{spot}	0.026	0.016	0.026				0.012
	[9.276]	[7.715]	[10.034]				[5.020]
$C_{futures}$				0.043	0.037	0.038	0.033
				[19.378]	[15.786]	[15.939]	[12.660]
S_{spot}	0.002		0.004	0.001		0.001	0.003

	[3.129]		[6.099]	[1.779]		[1.907]	[4.639]
$S_{futures}$		0.007	0.008		0.003	0.003	0.004
		[9.543]	[11.062]		[4.302]	[4.648]	[5.547]
ADJ. R^2	0.151	0.260	0.307	0.419	0.438	0.450	0.464
N	1120	1120	1120	1120	1120	1120	1120

In Table 4, Panel A reports the time series regression results on the futures market returns ($R_{futures}$), which is a dependent variable set for the high futures sentiment. In panel a specification (7), in the case of high futures sentiment, the C_{spot} loading is estimated at 0.007, the t statistic is 2.497, the $C_{futures}$ loading is estimated at 0.042 with the t statistic of 19.839. Panel B in Table 4 is the time series regression result of futures market returns ($R_{futures}$) under low futures sentiment. In panel B specification (7), in the case of low futures sentiment, the C_{spot} loading is estimated at 0.012 with the t statistic of 5.020, the $C_{futures}$ loading is estimated at 0.033 with the t statistic of 12.66. In summary, the above results are consistent with the model results, crowding significantly affects the earnings of stock index futures in different sentiment settings.

VI. Additional Supporting Evidence

6.1 The change of crowding effect

To provide a robust check for the change of crowding effect, we take the change of crowding as equal as the difference between the current crowding index and the previous crowding index, that is, $\Delta C_{i,t} = C_{i,t} - C_{i,t-1}$. The following factor models are used to observe the change of crowding effect:

$$R_{futures,t} = \alpha + \beta_{c,spot}\Lambda C_{spot,t} + \beta_{c,futures}\Delta C_{futures,t} + \beta_{s,spot}S_{spot,t} + \beta_{s,futures}S_{futures,t} + \varepsilon_t \quad (29)$$

Here, $R_{futures,t}$ is the returns of stock index futures contract at day t; S_{spot} is the spot sentiment of stock index at day t; $S_{futures}$ is the futures sentiment of stock index futures contract at day t; $\Delta C_{spot,t}$ is the change of spot crowding at day t; $\Delta C_{futures,t}$ is the change of futures crowding at day t. We anticipate a positive and significant coefficient on the change of spot and futures crowding index.

Table 5 Time-series regressions of futures market returns based on the changes of investor crowding index.

Variables	1	2	3	4	5	6
INTERCEPT	-0.0002	-0.0001	-0.0002	-0.0001	-0.0002	-0.0001
	[-0.5243]	[-0.3237]	[-0.6003]	[-0.5355]	[-0.7830]	[-0.5350]
ΔC_{spot}	0.0111		0.0023		0.0056	
	[8.5881]		[2.7665]		[5.2610]	
$\Delta C_{futures}$		0.0515		0.0320		0.0319
		[23.3248]		[16.4585]		[16.6050]
S_{spot}			0.0060		0.0008	0.0016
			[15.9282]		[2.0728]	[5.1168]
$S_{futures}$				0.0066	0.0078	0.0057
				[23.9735]	[22.8872]	[17.3023]

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ADJ. R^2	0.0632	0.3497	0.2413	0.5854	0.4894	0.5955
N	2138	2138	2138	2138	2138	2138

Table 5 gives a regression estimate based on changes in the investor crowding index. Consistent with the evidence in Section 4, we find that changes in spot congestion ($\Delta C_{spot,t}$) and the change of futures crowding ($\Delta C_{futures,t}$) are positively and significantly correlated with futures returns. In specification (1), the coefficient of the change of spot crowding ($\Delta C_{spot,t}$) is 0.0111 (t-statistic=8.588), and in specification (2), the coefficient of the change of futures crowding ($\Delta C_{futures,t}$) is 0.0515 (t-statistic=23.324), which means that the change of futures crowding effect is significantly and robustly related to futures returns.

6.2 The effect of lagged crowding index

To further understand the relations between crowding and returns, we estimate the following factor models to observe the effect of lagged crowding index:

$$R_{futures,t} = \alpha + \beta_{c,spot} C_{spot,t-1} + \beta_{c,futures} C_{futures,t-1} + \beta_{s,spot} S_{spot,t} + \beta_{s,futures} S_{futures,t} + \varepsilon_t \quad . \tag{30}$$

Here, $R_{futures,t}$ is the returns of stock index futures contract at day t; $S_{spot,t}$ is the spot sentiment of stock index at day t; $S_{futures,t}$ is the futures sentiment of stock index futures contract at day t; $C_{spot,t-1}$ is the lagged spot crowding index at day $t-1$; $C_{futures,t-1}$ is the lagged futures crowding index at day $t-1$. We anticipate a positive and significant coefficient on the lagged spot and futures crowding index.

Table 6 Regressions of futures market returns on the lagged net crowding index.

Variables	1	2	3	4	5	6	7
INTERCEPT	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
	[-0.528]	[-0.614]	[-0.601]	[-0.818]	[-0.786]	[-0.825]	[-0.824]
$C_{spot,t-1}$	0.0118		0.0028		0.0061		0.0030
	[8.973]		[2.163]		[5.598]		[2.063]
$C_{futures,t-1}$		0.0282		0.0161		0.0161	0.0180
		[22.588]		[14.057]		[14.241]	[13.171]
S_{spot}			0.0060		0.0008	0.0017	0.0021
			[15.743]		[1.947]	[5.165]	[5.718]
$S_{futures}$				0.0067	0.0078	0.0057	0.0054
				[23.352]	[22.952]	[16.843]	[14.703]
ADJ. R2	0.0687	0.3208	0.2424	0.5488	0.4911	0.5594	0.5714
N	1080	1080	1080	1080	1080	1080	1080

Table 6 shows the regression estimates based on the lagged spot and futures crowding index. We find that both the lagged spot crowding index ($C_{spot,t-1}$) and the lagged futures crowding index ($C_{futures,t-1}$) are positively and significantly correlated with futures returns, as the coefficient of the lagged spot crowding index ($C_{spot,t-1}$) is 0.0118 (t-statistic=8.973) in specification (1), and the coefficient of the lagged futures crowding index ($C_{futures,t-1}$) is 0.0282 (t-statistic=22.588) in specification (2).

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6.3 Inclusion of Other Control Variables

To provide a robust check for the crowding effect, we add the past returns and trading volume as control variables [37]. After adding these control variables into regressions, the results have shown the crowding effect has a significant positive effect on futures returns. We estimate the following factor models to observe the robustness test of the crowding effect:

$$R_{futures,t} = \alpha + \beta_{c,spot} C_{spot,t} + \beta_v Volume_t + \beta_R R_i + \varepsilon_t \quad (31)$$

$$R_{futures,t} = \alpha + \beta_{c,\,futures} C_{futures,t} + \beta_v Volume_t + \beta_R R_i + \varepsilon_t \quad (32)$$

Here, $R_{futures,t}$ is the returns of stock index futures contract at day t; $C_{spot,t}$ is the net spot crowding index at day t; is the net futures crowding index at day t; $Volume_t$ is trading volume of stock index futures contract at day t; R_i is the accumulate returns of previous N days (R_1 , R_2 , R_3 , $\mathrm{N}=1,2,3$). We anticipate a positive and significant coefficient on spot and futures crowding index.

Table 7 Regressions of futures market returns on the net crowding index including other control variables.

Variables	1	2	3		4	5	6
INTERCEPT	-0.0002	-0.0002	-0.0001	INTERCEPT	-0.0001	-0.0001	-0.0001
	[-0.396]	[-0.391]	[-0.363]		[-0.267]	[-0.304]	[-0.287]
C_{spot}	0.0125	0.0118	0.0118	$C_{futures}$	0.0314	0.0250	0.0231
	[9.001]	[8.930]	[9.071]		[32.458]	[27.086]	[25.731]
Volume	0.0061	0.0066	0.0068	Volume	0.0031	0.0061	0.0065
	3.4977	3.8327	3.9233		[2.403]	[4.448]	[4.619]
R_1	0.0920			R_1	0.5057		
	[2.860]				[18.642]		
R_2		0.0539		R_2		0.2121	
		[2.485]				[11.533]	
R_3			0.0541	R_3			0.1353
			[3.113]				[9.299]
ADJ. R^2	0.0815	0.0798	0.0828		0.5018	0.4131	0.3895
N	2138	2138	2138		2138	2138	2138

Table 7 shows the robust check for the crowding effect. We find that the net spot and futures crowding index have positive and significant impacts on futures returns with inclusion of the control variables. As we can see, the coefficient of the net spot crowding index is 0.0125 (t-statistic=9.001) in specification (1), and the coefficient of the net futures crowding index is 0.0314 (t-statistic=32.458) in specification (4), meaning that the crowding effect is significantly and robustly related with futures returns.

In summary, results produced by our multi-factor model are in line with our main supposition: there is connection between changes in both spot and futures crowding, and in futures returns. The results also show that the lagging spot crowd index and the lagging futures crowding index have a significant impact on futures returns.

VII. Conclusions

This paper confirms the crowding effect on futures market. A simple model is developed to analyze the crowding effect of buyer-initiated agents and seller-initiated agents in futures market. The joint effects of the crowding and

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the investor sentiment are investigated, which are proved to have systematic influence on the futures returns.

There are two takeaways in this paper. Firstly, the crowding indexes are reliable signals of futures returns. Futures returns increase with the long spot crowding and the long futures crowding, but decrease with the short spot crowding and the short futures crowding. Both spot net crowd index and futures net crowd index have a significantly positive impact on futures returns. Secondly, the joint effect of crowded index and investor sentiment on futures returns is significant and systematic, and is further supported in different sentiment settings.

Overall, findings in this paper provide evidence towards how the crowding affects the efficiency of futures market. Monitoring the crowding is quite valuable for market regulators, policy makers and investors in futures market. Future researches may explain some financial anomalies, such as the excess volatility, through analyzing the crowding.

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References

[1] J.C. Stein, “Presidential address: sophisticated investors and market efficiency,” The Journal of Finance, vol. 64, no. 4, pp. 1517-1548, 2009.
[2] N. Barberis, R. Thaler, “A survey of behavioral finance,” Handbook of the Economics of Finance, 1, pp. 1053-1128, 2003.
[3] M. Pojarliev, R.M. Levich, “Detecting crowded trades in currency funds,” Financial Analysts Journal, vol. 67, no. 1, pp. 26-39, 2011.
[4] P. Yan, “Crowded trades, short covering, and momentum crashes,” In SSRN Working Paper, 2013.
[5] C. Yang, L. Zhou, “Individual stock crowded trades, individual stock investor sentiment and excess returns,” The North American Journal of Economics and Finance, vol. 38, pp. 39-53, 2016.
[6] J.B. De Long, A. Shleifer, L.H. Summers, R.J. Waldmann, “Noise trader risk in financial markets,” Journal of Political Economy, pp. 703-738, 1990.
[7] B. Mendel, A. Shleifer, “Chasing noise,” Journal of Financial Economics, vol. 104, no. 2, pp. 303-320, 2012.
[8] C. Lee, M.J. Ready, “Inferring trade direction from intraday data,” The Journal of Finance, vol. 46, no. 2, pp. 733-746, 1991.
[9] M. Baker, J. Wurgler, “Investor sentiment and the cross-section of stock returns,” The Journal of Finance, vol. 61, no. 4, pp. 1645–1680, 2006.
[10] M. Baker, J. Wurgler, Y. Yuan, “Global, local and contagious investor sentiment,” Journal of Financial Economics, vol. 104, pp. 272-287, 2012.
[11] L. Cen, H. Lu, L. Yang, “Investor sentiment, disagreement, and the breadth-return relationship,” Management Science, vol. 59, no. 5, pp. 1076-1091, 2013.
[12] W.M. Fong, B. Toh, “Investor sentiment and the max effect,” Journal of Banking & Finance, vol. 46, pp. 190-201, 2014.
[13] R. Greenwood, A. Shleifer, “Expectations of returns and expected returns,” The Review of Financial Studies, vol. 27, no. 3, pp. 714-746, 2014.
[14] J.S. Kim, D. Ryu, S.W. Seo, “Investor sentiment and return predictability of disagreement,” Journal of Banking & Finance, vol. 42, pp. 166-178, 2014.
[15] R.F. Stambaugh, “Presidential address: investment noise and trends,” The Journal of Finance, vol. 69, no. 4, pp. 1415-1453, 2014.

[16] B. Gao, C. Yang, “Forecasting stock index futures returns with mixed-frequency sentiment,” International Review of Economics & Finance, vol. 49, pp. 69-83, 2017.
[17] B. Gao, C. Yang, “Investor trading behavior and sentiment in futures markets,” Emerging Markets Finance and Trade, vol. 54, no. 3, pp. 707-720, 2018.
[18] D.P. Simon, R.A. Wiggins, “S&P futures returns and contrary sentiment indicators,” Journal of Futures Markets, vol. 21, no. 5, pp. 447-462, 2001.
[19] C. Wang, “Investor sentiment and return predictability in agricultural futures markets,” Journal of Futures Markets, vol. 21, no. 10, pp. 929-952, 2001.
[20] C. Wang, “Investor sentiment, market timing, and futures returns,” Applied Financial Economics, vol. 13, no. 12, pp. 891-898, 2003.
[21] C. Yang, B. Gao, “The term structure of sentiment effect in stock index futures market,” The North American Journal of Economics and Finance, vol. 30, pp. 171-182, 2014.
[22] Y. He, J. Wang, C. Wu, “Domestic versus foreign equity shares: Which are more costly to trade in the Chinese market?” International Review of Economics and Finance, vol. 27, pp. 465–481, 2013.
[23] J. Yang, Z. Yang, Y. Zhou, “Intraday price discovery and volatility transmission in stock index and stock index futures markets: Evidence from China,” Journal of Futures Markets, vol. 32, no. 2, pp. 99-121, 2012.
[24] W.J. Breen, L.S. Hodrick, R.A. Korajczyk, “Predicting equity liquidity,” Management Science, vol. 48, no. 4, pp. 470-483, 2002.
[25] R.F. Engle, R. Ferstenberg, J. “Russell, measuring and modeling execution cost and risk,” The Journal of Portfolio Management, vol. 38, no. 2, pp. 14-28, 2012.
[26] N. Gârleanu, L.H. Pedersen, “Dynamic trading with predictable returns and transaction costs,” The Journal of Finance, vol. 68, no. 6, pp. 2309-2340, 2013.
[27] H. Hong, D. Sraer, “Quiet bubbles,” Journal of Financial Economics, vol. 110, no. 3, pp. 596-606, 2013.
[28] F. Lillo, J.D. Farmer, R.N. Mantegna, “Econophysics: Master Curve for Price-impact Function,” Nature, vol. 421, no. 6919, pp. 129-130, 2003.
[29] H. Hong, M. Yogo, “What does futures market interest tell us about the macroeconomy and asset prices?” Journal of Financial Economics, vol. 105, no. 3, pp. 473-490, 2012.
[30] P. Garcia, R.M. Leuthold, H. Zapata, “Lead-lag relationships between trading volume and price variability: new evidence,” The Journal of Futures Markets, vol. 6, pp. 1–10, 1986.
[31] O. Gwilym, M. Buckle, P. Evans, “The volume-maturity relationship for stock index, interest rate and bond futures contracts,” EBMS Working Paper EBMS/2002/3, 2002.
[32] J.J. Lucia, A. Pardo, “On measuring speculative and hedging activities in futures markets from volume and open interest data,” Applied Economics, vol. 42, no. 12, pp. 1549-1557, 2010.
[33] V.V. Acharya, T. Philippon, M. Richardson, & N. Roubini, “Prologue: A bird’s eye view, the financial crisis of 2007–2009: causes and remedies,” Wiley Periodicals, vol. 18, pp. 89–137, 2009.
[34] M.K. Brunnermeier, “Deciphering the liquidity and credit crunch 2007-2008,” Journal of Economic Perspectives, vol. 23, pp. 77-100, 2009.
[35] A.E. Khandani, A.W. Lo, “What happened to the quants in august 2007? Evidence from factors and transactions data,” Journal of Financial Markets, vol. 14, no. 1, pp. 1-46, 2011.
[36] L.H. Pedersen, “When everyone runs for the exits,” Journal of Central Banking, vol. 5, pp. 177-199, 2009.
[37] R. Kaniel, G. Saar, S. Titman, “Individual investor trading and stock returns,” The Journal of Finance, vol. 63, no. 1, pp. 273-310, 2008.

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