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Empirical regularities of opening call auction in Chinese stock market

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ABSTRACT

We study the statistical regularities of an opening call auction using the ultra-high-frequency data of 22 liquid stocks traded on the Shenzhen Stock Exchange in 2003. The distribution of the relative price, defined as the relative difference between the order price in the opening call auction and the closing price on the last trading day, is asymmetric and that the distribution displays a sharp peak at the zero relative price and a relatively wide peak at the negative relative price. The detrended fluctuation analysis (DFA) method is adopted to investigate the long-term memory of relative order prices. We further study the statistical regularities of order sizes in the opening call auction, and observe a phenomenon of number preference, known as order size clustering. The probability density function (PDF) of order sizes could be well fitted by a q-Gamma function, and the long-term memory also exists in order sizes. In addition, both the average volume and the average number of orders decrease exponentially with the price level away from the best bid or ask price level in the limit-order book (LOB) established immediately after the opening call auction, and a price clustering phenomenon is observed.

1. Introduction

Call auctions and continuous auctions are two main trading mechanisms used in order-driven financial markets. In the call auction market, the orders arriving during the period of the opening call auction are batched and executed with a single price, i.e., the opening price established immediately after the opening call auction, while the continuous auction is a process of continuous matching of arriving orders on a one-by-one basis. Much effort has been devoted to studying the market performance under these two different types of trading mechanism. Compared with the continuous auction, the call auction has two major advantages. Schnitzlein compared the call and continuous auctions under asymmetric information in a laboratory asset market whose construction was based on the Kyle model [1], and found that the informed noise traders spend lower costs in the call auction [2]. Qualitatively similar results have been obtained by utilizing different modeling approaches [3,4]. Theissen further confirmed that in an experimental asset market incorporating heterogeneous information, the call auction provides lower execution costs [5]. On the other hand, the opening price in the call auction market is closer to the true value of the asset than the opening price in the continuous market [5]. These two advantages

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are also regarded as the goal of market construction [6], and it has been proposed that an electronic call auction could be incorporated into the continuous market to make it more efficient [7].

Nowadays, the call auction has been widely used as the opening or closing procedure in most electronic continuous markets. For example, the New York Stock Exchange (NYSE), London Stock Exchange (LSE), Euronext Paris, Frankfurt Stock Exchange (FWB), Tokyo Stock Exchange (TSE), Hong Kong Stock Exchange (HKEX). In this paper we mainly focus on the opening call auction in the Chinese stock market. According to the situation of market transparency defined as "the ability of market participants to observe the information in trading process", the opening call auction is divided into two categories, i.e., close call (or blind) auction and open call auction. Before July 1, 2006, the opening call auction of the Shenzhen Stock Exchange was a close call auction wherein the information about submitted orders was not observable for market participants. It is well accepted that in a sufficiently large market the transparency can improve market efficiency [8,9]. After July 1, 2006, the opening call auction of the Shenzhen Stock Exchange turned to being an open call auction in which the information is open to market participants in the same way as many foreign stock exchanges, e.g. LSE, Euronext Paris, FWB, and HKEX.

Not much work has been done towards studying the opening call auction in the Chinese stock markets. Pan et al. proposed a theoretical model of the close call auction, and further analyzed the data of Shanghai Stock Exchange to confirm their theoretical results that the market should increase the transparency in the opening call auction [10]. Li et al. empirically studied the influence of the open call auction on the market volatility in the opening of the Shenzhen Stock Exchange [11]. Up to now, the close call auction in the opening of the Shenzhen Stock Exchange has not been extensively analyzed. The study of the close call auction has potential significance for understanding the influence of transparency on market volatility.

In this paper, we study the statistical regularities of the opening call auction for 22 liquid stocks traded on the Shenzhen Stock Exchange in 2003 when the close call auction was adopted. The rest of the paper is organized as follows. In Section 2, we describe briefly the database we analyzed. Section 3 presents the statistical regularities of the order prices in the opening call auction. In Section 4, we further analyze the order size in the opening call auction. Then we study in Section 5 the limit-order book established by the unexecuted orders left at the end of the opening process. Section 6 summarizes the results.

2. Data sets

The Shenzhen Stock Exchange (SZSE) was established on December 1, 1990 and started its operations on July 3, 1991. It contains two independent markets, the A-share market and the B-share market. The former is composed of common stocks which are issued by mainland Chinese companies. It is open only to domestic investors, and traded in CNY. The latter is also issued by mainland Chinese companies, while it is traded in the *Hong Kong dollar* (HKD). It was restricted to foreign investors before February 19, 2001, and since then it has been open to Chinese investors as well. At the end of 2003, there were 491 A-share stocks and 57 B-share stocks listed on the SZSE. In the year 2003, the opening call auction was held between 9:15 am and 9:25 am, followed by the cooling periods from 9:25 am to 9:30 am, and the continuous auction operated from 9:30 am to 11:30 am and 13:00 pm to 15:00 pm.

Our analysis is based on a database recording the order flows of 22 liquid stocks extracted from the A-share market on the SZSE in the whole year of 2003 when the close call auction was adopted in the opening procedure. The trading system did not show any information about the order flows, and traders submitted orders only according to the closing price on the last trading day. The database contains the price, size and associated time of each submitted order recorded in the opening call with the time stamps accurate to 0.01 s. For more details, refer to Ref. [12]. Table 1 depicts the basic statistics of order flows in the opening call auction for 22 stocks. Remarkably, for all the stocks, the number of sell orders N_s is larger than the number of buy orders N_b, and the ratio R_N of N_s to N_b varies within the range [1.59, 2.80] with the mean value $\bar{R}_N = 2.13$. Moreover, the ratio R_s of the average size of sell orders $\langle s_s \rangle$ to the average size of buy orders $\langle s_b \rangle$ varies within the range [0.62, 2.35] with the mean value $\bar{R}_s = 1.14$. The relative order size $R_N \times R_s$ is larger than 1 for all the 22 stocks, which indicates that the total size of sell orders is larger than the total size of buy orders. This phenomenon was indeed observed in the bear market during the year 2003 that the market participants were more willing to sell.

3. Order price

3.1. Probability distribution of relative order prices

In the opening call auction, we define the relative order price x as the relative difference between the price of a submitted order and the closing price on the last trading day,

$$x(t) = \begin{cases} [p(t) - p_c]/p_c & \text{for buy orders} \\ [p_c - p(t)]/p_c & \text{for sell orders,} \end{cases} \quad (1)$$

where $p(t)$ is the price of a submitted order at time t, and p_c is the closing price on the last trading day.[1] The relative price x describes the aggressiveness of a submitted order. For buy (sell) orders, the positive value of x means that the trader is eager

[1] Ref. [13] gives an incorrect definition of relative price in the opening call auction, since the virtual transaction price is not observable for traders.