Liquidity Cost of Market Orders in Taiwan Stock Market: A Study based on An Order-Driven Agent-Based Artificial Stock Market

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Abstract

One of the functions of stock market is providing liquidity to investors. Liquidity of securities varies from one to another and it is of crucial importance for shareholders to assess the liquidity of their assets. Liquidity risk is also an important topic in risk management. One can easily calculate the transaction cost of market orders using historical data, but historical information may be just one ensemble out of many underlying possibilities. In order to avoid the problem of “naïve empiricism”, we construct an order-driven agent-based artificial stock model based on Daniels, Farmer, Gillemot, Iori, and Smith (2003) zero-intelligence agent-based model (DFGIS model). However, our model is tailored to the matching rule employed by Taiwan Stock Exchange (TWSE) which is known as “call auction” and is an alternative to the continuous matching. In TWSE, orders are matches once every 25 seconds.

Our order-driven model is an “event time” model, the same with the original DFGIS model, not a real time model. There are five parameters in our model: relative frequency of limit order placement \( p(\alpha) \), relative frequency of market order placement \( p(\mu) \), relative frequency of order cancellation \( p(\delta) \), relative frequency of doing nothing \( p(n) \), average order size \( \sigma \), and five kinds of events: limit order placement (L), market order placement (M), order cancellation (C), doing nothing (N), and matching (T). We use Python programming language to implement this model. The program of our model generate “event list” first, for example, LLMMNNNC…T, and then execute each event sequentially. We also provide two ways to generate the event list. The first one is to generate events sequentially according to relative frequency of each kind of event. The second way is to generate durations of events first from the autoregressive conditional duration (ACD) model initiated by Engle and Russell (1998), and then determines a sequence of events. The parameters of ACD are estimated using historical order placement data from TWSE. The difference between these two methods is that the duration of events is determined randomly in the first method, whereas for the second method the durations of events

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may be the replicates of the behavior of real data.

In recent years, many kinds of securities other than stocks, such as Exchange-Traded Funds (ETFs) and Real Estate Investment Trusts (REITs), are listed in TWSE. We are interested in liquidity of these “non-stock securities” in TWSE and have obtained historical data of two securities in TWSE, they are Polaris/P-shares Taiwan Dividend+ ETF (0056.TW) and Cathay No.2 Real Estate Investment Trust (01007T.TW).

Our empirical estimates show that the liquidity costs of market order of these two securities are generally smaller than 4%, and largely lied between 0% and 1%. One can easily liquidate all of his holdings of these two securities in one trading day without additional transaction cost, if he holds 40% of daily trade volume.

We, however, find that simulation costs of market orders in our model, with a range from 0% to 7%, are generally larger than those of real data. One possible reason for this departure is that investors in stock markets generally do not place their orders blindly. They tend to wait for the appearance of opposite order size, and then place their orders. This behavior does not exist in our simulation. Regardless of this difference, our model may still be a good simulation tool for transaction cost assessment when one would like to liquidate their asset in a short span of time. Specifically, we find that if one holds more than 20% of daily trade volume and wants to liquidate his holdings in one trading day, a transaction cost is inevitable. As a numerical example, if one holds 40% of average daily trade volume and wants to liquidate in one day, the resultant transaction cost is 2% to 3%. Furthermore, to liquidate the two securities (0056.TW, 01007T.TW) in one day without incurring any liquidity cost, the holdings should not exceed 20% of daily trade volume.