Impacts of Position-Based Market Makers on Markets' Shares of Trading Volumes – An Artificial Market Approach

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Abstract

We investigated the competition, in terms of taking market share of trading volume, between two artificial financial markets that have exactly the same specifications except existing a market maker, the non-position-based market maker or the position-based market maker. As a result, we found that position-based market makers can play the same role of supplying liquidity to stock markets as non-position-based market makers do. Moreover, we compared the interests of their investment between non-position-based market makers and position-based market makers. Through this experiment, we revealed that position-based market makers can yield better returns than non-position-based market makers.

Keyword: Market Maker, Competition Among Stock Exchanges, Market's Share of Trading Volume, High Frequency Trading, Agent-based Simulation

1 Introduction

Recently, the harsh competition among financial markets has happened due to the development of electronic transaction systems and the globalization of financial markets. There are a lot of factors which affect the competition among financial markets: market maker system, trading hours, modes of trading, tick size, etc. We investigated the impacts of both market maker system and tick size to the competition between two markets using an artificial market.

2 Artificial Market Model

We made the artificial market model in reference to the paper [1] and added the non-position-based market maker (the simple market maker) and the position-based market maker (the position market maker) into the artificial market model according to the paper [2]. Therefore we compared the impact of both to the share of trading volumes. We adopted the continuous double auction as a mechanism of pricing. For traders, we created three types of trader: the stylized trader, the simple market maker, and the position market maker. We used the same model of the stylized trader used in the paper [1]. Market makers order both limit buying order and limit selling order simultaneously. The timing of market makers' ordering is during stylized traders' ordering. The bid price $P_{o,\mathrm{sm}}^{t,\mathrm{buy}}$ and the ask price $P_{o,\mathrm{sm}}^{t,\mathrm{sell}}$ for the simple market maker are determined with market A's best bid $P_A^{t,\mathrm{buy}}$, market B's best bid $P_B^{t,\mathrm{buy}}$, market A's best ask $P_A^{t,\mathrm{sell}}$, market B's best ask $P_B^{t,\mathrm{sell}}$, simple market maker's spread θ_{sm}, as bellow.

$$
\begin{aligned}
P_{o,\mathrm{sm}}^{t,\mathrm{buy}} &= P_{\mathrm{fv,sm}}^{t} - \frac{1}{2}(P_f \times \theta_{\mathrm{sm}}) \\
P_{o,\mathrm{sm}}^{t,\mathrm{sell}} &= P_{\mathrm{fv,sm}}^{t} + \frac{1}{2}(P_f \times \theta_{\mathrm{sm}}) \\
P_{\mathrm{fv,sm}}^{t} &= \frac{1}{2}(\max\{P_A^{t,\mathrm{buy}}, P_B^{t,\mathrm{buy}}\} \\
&\quad + \min\{P_A^{t,\mathrm{sell}}, P_B^{t,\mathrm{sell}}\})
\end{aligned}
$$

In addition, the bid price $P_{o,\mathrm{pm}}^{t,\mathrm{buy}}$ and the ask price $P_{o,\mathrm{pm}}^{t,\mathrm{sell}}$ for the position market maker are determined with its spread θ_{pm} and the weight for considering its position w_{pm}, as follows.

$$
\begin{aligned}
P_{o,\mathrm{pm}}^{t,\mathrm{buy}} &= P_{\mathrm{fv,pm}}^{t} - \frac{1}{2}(P_f \times \theta_{\mathrm{pm}}) \\
P_{o,\mathrm{pm}}^{t,\mathrm{sell}} &= P_{\mathrm{fv,pm}}^{t} + \frac{1}{2}(P_f \times \theta_{\mathrm{pm}}) \\
P_{\mathrm{fv,pm}}^{t} &= (1 - w_{\mathrm{pm}}(s_{\mathrm{pm}}^{t})^3) \times P_{\mathrm{fv,sm}}^{t}
\end{aligned}
$$

3 Simulation Analysis

We used the same parameters as [1]: the number of stylized traders $n = 1000$, the number of market makers $m = 1$, maximum value of the weight for the fundamental strategy $w_{1,\max} = 1$, maximum value

for the technical strategy $w_{2,\max} = 10$, maximum value for the noise strategy $w_{3,\max} = 1$, maximum value of time used for technical strategy $\tau_{\max} = 10000$, standard deviation of the distribution for noise strategy $\sigma_\epsilon = 0.06$, standard deviation of the distribution for deciding price on order $P_\sigma = 30$, maximum value of time when a limit order is available $t_c = 20000$, time span used for calculating the share and for the initial fixed period $t_{AB} = 100000$, fundamental price of the stock$P_f = 1000000$ and the weight for the position market maker to consider its position $w_{\mathrm{pm}} = 0.00000005$.

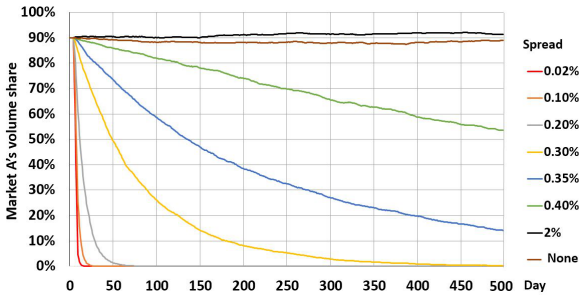

Figure1: Market A's share with the simple market maker. (ΔP_A,ΔP_B:0.001% θ_{sm}:0.2%)

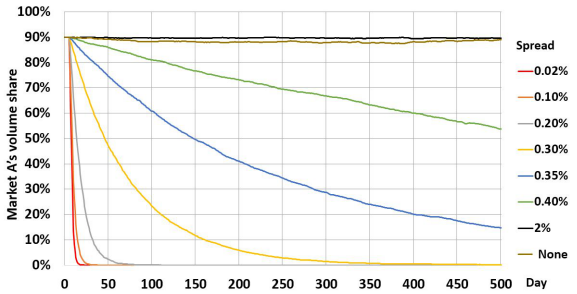

Figure2: Market A's share with the position market maker. (ΔP_A,ΔP_B:0.001% θ_{pm}:0.2%)

Figure3: Each market maker's position. (ΔP_A,ΔP_B:0.001% θ_{sm},θ_{pm}:0.2%)

We investigated the impact of both the simple market maker and the position market maker to shares of trading volumes between two markets. Market A has 90% initial share of volumes and no market maker. Market B has 10% initial share and one market maker which is the simple market maker in experiment1 and which is the position market maker in experiment2. The other things of two markets are completely the same. Figure1 shows the transfer of Market A's share with various spreads θ_{sm} and fixed tick sizes $\Delta P_A, \Delta P_B = 0.001\%$ to the fundamental price in experiment1. Figure2 shows the transfer in experiment2 with the same tick sizes as experiment1. We can observe that the smaller the spread θ_{sm} and the spread θ_{pm} are, the faster the shares of volumes transfer from Market A to Market B. Through this result, we can reveal that the position market maker can play the same role of acquiring the share of another market's volume as the simple market maker.

Figure3 shows each transfer of the simple market maker's position and the position market maker's one. The one of the simple market maker fluctuates widely. On the other hand, the one of the position market maker fluctuates around neutral position. Furthermore, we got the result that the each profit of the simple market maker and the position market maker is almost same. Through these results, we can determine that the position market maker can yield a better return than the simple market maker.

4 Conclusion

We found that the position market maker can not only supply liquidity to the stock market as well as simple market maker does but also yield a better return than simple market maker.

Disclaimer

It should be noted that the opinions contained herein are solely those of the authors and do not necessarily reflect those of SPARX Asset Management Co., Ltd. and Osaka Exchange, Inc.

References

[1] T. Mizuta, S. Hayakawa, K. Izumi and S. Yoshimura, "Simulation Study on Effects of Tick Size Difference in Stock Markets Competition," International Workshop on Agent-based Approaches in Economic and Social Complex Systems 2013, pp.235-246, Tokyo, Japan, Sep. 2013.

[2] Y. Nakajima and Y. Shiozawa, "Usefulness and feasibility of market maker in a thin market," ICEES(International Conference Experiments in Economic Sciences), 47, Okayama and Kyoto, Japan, Dec. 2004.