Evaluation of Taxation Policy on Transactions in Financial Markets Using a Multi-Agent Model

S.Yamazaki[a], Y. Chen[a], Y. Hashimoto[a] and H. Ohashi[a]

[a]Department of Systems Innovation
Graduate School of Engineering, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan
yamazaki@crimson.q.t.u-tokyo.ac.jp

Nowadays dealings in foreign exchange and stock markets have become extremely active, along with the rapid increase of the liquidity of value resulting from the globalization of the market economy and the IT revolution. Thanks to the rise in speculative trading of financial assets, both the instability of the market and the risk of loss of value are amplified which could threaten the steady growth of global economy.

Keynes proposed in 1936 an imposition of a low tax on transactions in order to stabilize the stock market. In 1978, James Tobin also suggested imposing a low tax (0.1%) on all the foreign exchange transactions[1]. Although it has never been installed, the Tobin tax is expected to be able to suppress the activity of the short-term speculators and to lower the volatility of price fluctuations in financial markets. On the other hand, there is also a school of economists who disagree with Keynes and Tobin. Friedman pointed out[2] that the Tobin tax may lower the liquidity of the market, meanwhile increase the arbitrage chance, which would lead to a new kind of market instability.

An experimental study on the effect of the taxation policy in the real financial markets, if not virtually impossible, is very difficult to be conducted. Hence an evaluation of the taxation policy with the multi-agent simulation of the financial market becomes a necessary alternative. Through such an approach, not only the global properties of financial markets, such as the stability and the efficiency can be investigated, but also the microscopic mechanism for the change of system dynamics can be clarified.

In a series of previous simulation studies[3][4], the effect of the Tobin tax was surveyed in a multi-agent model, in which agents of different types trade in two markets and the asset price is determined by the relationship between supply and demand. Interestingly, contradictory conclusions were obtained on whether short-term speculative agents can be eliminated from the market or not. Bianconi, et al.[5] studied the influence of the Tobin tax using Minority Game(MG), one of the financial market models involving competing and adaptive agents. They included an additional cost when updating the strategy scores, mimicking the effect of the tax on transactions. An optimal tax rate was found with which both the suppression of the market volatility and maximization of revenue could be attained.

In this study, the market effects of the Tobin tax are investigated with a grand canonical Minority Game (GCMG)[6], an extended MG model which can reproduce the stylized facts of financial markets, such as fat-tailed distribution and volatility clustering of price-returns. Three aspects of the financial markets, namely, volatility, liquidity and efficiency are discussed with the introduction of the Tobin tax in the virtual market. Different market settings are installed for this study: (1) All agents are rational and take account of their market impacts when evaluating their strategies for investments[7]; (2) All agents have bounded rationality in that they only take care

of the influence of taxation and behave as price takers in trading, similar to the previous study[6]; (3) Irrational agents, who take care about neither their market impacts nor the effects of the tax on transactions, are partly introduced to construct a mixed population of traders.

Main conclusions obtained are the following (in reference of Fig. 1):

(1) When the market is dominated by agents with rationality or bounded rationality, the increase of tax rate decreases the volatility of price fluctuations.
(2) When the market is dominated by irrational agents, the increase of tax rate has a reversed effect on the suppression of volatility.
(3) A certain degree of irrationality is helpful to decrease the volatility of price fluctuation, while keeping the relatively high liquidity and efficiency of the market.

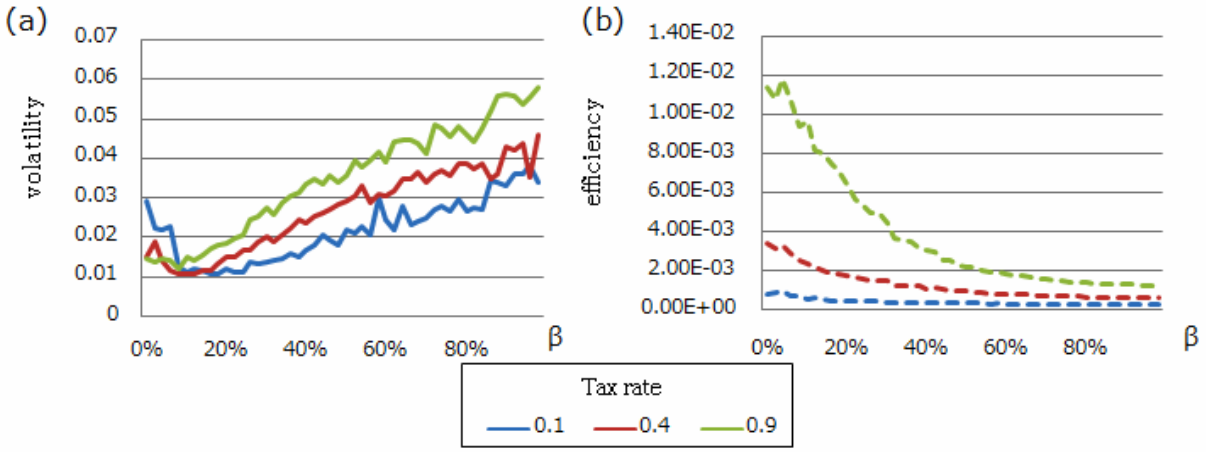

Fig. 1. Volatility of price change (a). Efficiency of market (b). β is ratio of agents of bounded rationality.

Keywords
multi-agent model, minority game, taxation, volatility of price, market liquidity, market's efficiency

References

[1] Tobin J., *Eastern Economic Journal* 4, 153-159, 1978.
[2] Friedman M., Essays in Positive Economics. Chicago University press, 1953.
[3] Westerhoff F., Dieci R., *Journal of Economics and Control* 30, 293-322, 2006.
[4] Mannaro K., Marchesi M., Setzu A., *Journal of Economics and Control* 67, 445-462, 2008.
[5] Bianconi G., Galla T., Marsili M., cond-mat/0603134, 2008.
[6] Challet D. and Marsili M., Physical Review E 68 036132, 2003.
[7] Martino A., Marsili M., *JOURNAL OF PHYSICS A: MATHEMATICAL AND GENERAL,* 508-513, 2006.