

# The Distribution of Trader Returns under the Influence of Information Asymmetry : A Multi-Agent Simulation Study

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The purpose of this study is to investigate the influence of information asymmetry on the distribution of traders' returns in financial markets. The research is carried out by analyzing the market microstructure through numerical simulations using a multi-agent market model.

In previous studies[1][2], Toth et al. had found a non-monotonic relation between traders' net returns and their information levels. The information asymmetry in their study is reflected in the different predictability levels for the future dividends of stocks. In this study, we investigate two different aspects of information asymmetry concerning with the external demands for financial assets, namely, the accuracy of information and the timing of acquisition for the information.

In our simulation model, market participants are classified into two categories, namely, informed traders and liquidity traders. Informed traders have nonpublic information about the external demand. They will trade based on private information and place only limit orders. Liquid traders do not have private information so that they trade with a motive for the liquidity of their funds. They trade randomly and place only market orders. Both traders' assets are not limited, so all traders can buy or sell arbitrary amount of stocks each time.

Informed traders are classified into five levels according to their timing of information acquisition or accuracy of information. In case of the timing of information acquisition, the highest level informed traders get the information of the next external demand first. For traders at lower levels, there is a 1-step time lag for each level in the acquisition of information. On the other hand, in case of the accuracy of information, the highest level informed traders get the most accurate information of the next external demand. Other informed traders get the information mixed with different levels of noise according to the level of the accuracy of information. We take the specific private information as the external demand of financial assets, mimicking the trading conducted by foreign investors in Tokyo Stock Exchange (TSE). A clustered time series is proposed as the model for the feed of private information. In addition, we adopt the Itayose method[3] as the trading system for the price formation.

We simulated with two constitutions of traders, carrying out 10,000 trades, with 100 runs for each set of parameters.

- 1) The fraction of liquid traders varies from 10% to 90%. The ratio of different informed traders is kept as 1:1:1:1:1.
- 2) The fraction of liquid traders is fixed at 20%. The ratio of different informed trader is

4:1:1:1:1.

As a result of simulation, we find that the information asymmetry causes a J-shaped distribution of trader returns (Figure 1), meanwhile the well-known stylized facts of price fluctuations are reproduced under a number of limited situations.

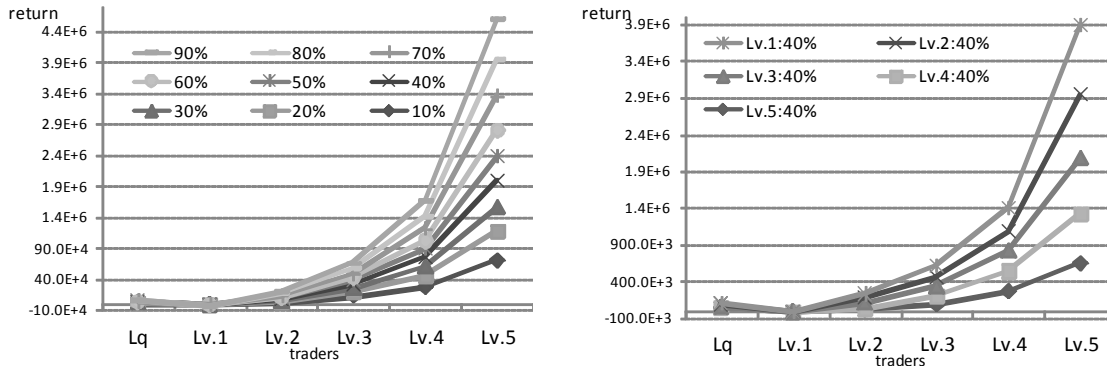


Figure 1 Distributions of traders returns

The low level informed traders lag behind and tend to suffer from loss each time when external demand (private information) switches from buy/sell to sell/buy (Table1). In case that the signal of private information is weak, the loss of accuracy puts severe effects to the lower level traders, causing their placements on wrong orders (Table 2).

Change in excess demand	existence	nonexistence
probability of behavior different from extend demand	59.1%	31.0%
average of return	-9.3	7.1

Table 1 Change in excess demand and return of level1 informed traders

value of excess demand	over 0.7	less than 0.7
probability of behavior different from extend demand	79.6%	46.3%
average of return	-36.6	8.1

Table 2 Value of excess demand and return of level1 informed traders

From the simulation and analysis above, it is clear that traders with complete private information (high level information trader) can beat the market. However, when the acquisition of the information is delayed or accuracy of the information is lost, even informed trader could become inferior in performance to traders who trade randomly (liquid trader). Such informed traders are referred as "pseudo-information traders" in a real market.

In conclusion, simulations with the multi-agent model could give a sound analysis of the mechanism behind the market phenomenon that not all the informed traders can beat the market so as to have a better performance against the noise traders. The lesson learnt from this study is the following: Don't try to take advantage of the private information unless that you are sure of its accuracy as well as its timing.

### Keywords

financial market, information asymmetry, agent based simulation, market microstructure

### References

- [1] Toth B., Scalas E., Huber J., Kirchler M., "The value of information in a multi-agent market model," *The European Physical Journal B*, v. 55, pp. 115-120, 2007.
- [2] Huber J., "J-shaped returns to timing advantage in access to information," *Journal of Economic Dynamics and Control*, v. 31, pp.2536-2572, 2007.
- [3] "What is the 'Itayose' method? , " [http://www.tse.or.jp/english/faq/list/stockprice/p\\_b.html](http://www.tse.or.jp/english/faq/list/stockprice/p_b.html)