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Trading behavior and profits in experimental asset markets with asymmetric information☆

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ABSTRACT

We study trading behavior and its profitability in experimental asset markets with asymmetrically informed traders. We find that insiders make most of their profits from trades which are initiated by their limit orders. The average informed lose most with market orders and their losses are highest when they pick up insiders' limit orders. Uninformed traders act as liquidity providers. They place the highest number of limit orders and end up with the market return.

1. Introduction

The importance of limit order markets (LOMs) as the major trading mechanism on financial markets has increased enormously within the past decades.[1] These markets are characterized by the absence of market makers and thereof liquidity is provided by traders posting limit orders (LOs) themselves. LOs (either bids or asks) are offers to trade a certain quantity of a certain stock for a prespecified price. A transaction is completed, if an offer is accepted by another trader, which is called a market order (MO). Both order types have distinct features and traders face the following trade-off. LO execution is not guaranteed but these orders execute at low costs, whereas MOs offer immediate execution at higher costs (e.g. bid–ask spread).

Given that LOMs constitute a highly complex interaction environment little is known about the trading behavior, i.e. the choice between LOs and MOs, implemented by asymmetrically informed traders.[2] Early models by

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[1] See Parlour and Seppi (2008) and Gould et al. (2013) for surveys on limit order markets. LOMs are highly competitive, efficiently aggregate information and outperform other market mechanisms (Glosten, 1994). Hollifield et al. (2006) estimate that the gains from trade in LOM are 90% of maximum possible gains-from-trade. Examples for limit order markets are: Euronext (Brussels, Amsterdam, Paris), London Stock Exchange, Stockholm Stock Exchange, Toronto Stock Exchange, and Archipelago Exchange. Examples for trading systems: INET, ArcaEx, Reuters D2000-2. NYSE, Nasdaq, London stock exchange are hybrid markets where designated market makers have to compete with other traders submitting quotes to the limit order book.

[2] The discussion is restricted to models with asymmetric information. For LOM models with symmetric information, see e.g. Parlour (1998), Foucault (1999); Foucault et al. (2005).

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Glosten and Milgrom (1985) and Kyle (1985) replicate pure dealer markets, restricting traders to submitting market orders. Recent contributions relax this assumption and build theoretical models of LOMs. Chakravarty and Holden (1995) conclude that informed traders prefer to use market orders but strategically informed investors might use limit orders as insurance to bound the (random) price at which their market orders will be traded. In the models of Harris (1998) and Kaniel and Liu (2006) informed traders condition the use of limit vs. market orders on the "lifespan" of the information. They use market orders if information is short-lived and limit orders if information is persistent. Goettler et al. (2009) distinguish between informed traders who know the fundamental value of the stock and "uninformed" traders who know this information one period later. They conclude that informed traders submit the bulk of limit orders to the market, and competition among informed traders results in private information often being reflected in the limit order book.[3]

Anand et al. (2005) provide some empirical evidence by using detailed order and audit data from the NYSE and defining institutional investors as informed traders. Their results show that informed traders act as liquidity takers in the first half of a trading day and become liquidity suppliers in the second half of a day.[4] Their empirical results are supported by findings of Bloomfield et al. (2005). They set up an experimental LOM, which is populated by informed traders and liquidity traders, who have to fulfill exogenous trading requirements. Informed traders are found to act as liquidity takers earlier in the market and as liquidity suppliers later on. Liquidity traders, on the other hand, provide liquidity at the beginning and use market orders towards the end to meet their trading targets.

In this paper we extend the research on trading behavior of asymmetrically informed traders. In particular, we impose a cumulative information structure to investigate differences in trading behavior among five information levels. Our experimental market setup is based on already established models that implement more than two information levels.[5] With this approach we are able to investigate the trading behavior and its economic consequences of traders who know the fundamental value of the asset (insiders), traders who receive (slightly) outdated fundamental information, and traders who do not receive any information on fundamentals. Our analysis focuses on two specific aspects. First, we study subjects' trading behavior conditional on their information level and conditional on changes in their fundamental information. Second, we analyze subjects' trading profits conditional on information level and conditional on changes in their fundamental information.

We find that insiders make most of their profits from trades which are initiated by their limit orders. Their profits are highest when the change in their fundamental information is large. Traders who receive outdated information perform worst. They lose most with market orders and do not gain from trades which are initiated by their limit orders. Especially, the worst performing traders who receive the oldest information often place market orders, paying the bid–ask spread to uninformed traders or picking up limit orders of well informed traders. Uninformed traders act as liquidity providers since they place the highest (lowest) number of limit (market) orders. On average, they make little losses from their market orders, small profits from their trades initiated by their limit orders and end up with approximately zero profits.

2. Model and experimental implementation

In each experimental market 10 traders interact in a continuous double auction for 24 periods. They trade stocks of a virtual company for virtual money (Taler, the experimental currency). The markets investigated are identical to those studied in Kirchler (2009).

2.1. Asset value

Changes in the asset's fundamental value (FV) from period to period are determined by the following random process:

$$FV_k = FV_{k-1} \cdot (1 + \epsilon_k), \quad (1)$$

FV_k denotes the FV in period k and ϵ is a normally distributed random variable with a mean of 0.5% and a standard deviation of 7.2%. The initial FV in period zero is 40 Taler. Fig. 1 shows the eight FV realizations used in the study. Four paths are random realizations, and for each its counterpart mirrored at the dotted line – the unconditional expected value of FV – is calculated.

2.2. Information system

Provision of asymmetric information on the assets' FV is inspired by an approach of Hellwig (1982), which gives better informed traders a timing advantage in receiving information about the fundamental value of the stock.[6] The idea behind this information structure is that relevant fundamental information is first known by insiders and then trickles down over time to the broad public, which receives outdated information. Moreover, uninformed traders do not even collect this information.

Hence, only the best informed traders (labeled I4, insiders) learn the fundamental value of the asset in period k. Information provided to I4 in period k will be available to I3 (the next lower level) in period $k+1$, to I2 in period $k+2$, and to I1 in period $k+3$. Basically, all informed traders receive the same information, but at different times.[7] In particular, at the beginning of each period k, I4 receives the

[3] Note that all models operate with two information levels.

[4] However, the categorization of institutional investors as informed traders (insiders) is ambiguous. Jensen (1968), Fama (1991), Malkiel (2005) document below average performance for this kind of investors. Thus, the value of their (superior) information is questionable.

[5] See e.g., Huber (2007); Huber et al. (2008), Kirchler (2009, 2010), and Huber et al. (2011). Instead of adapting existing experimental asset market models with two information levels we chose this approach for the sake of consistency and to gain more insights into well established models.

[6] The model in Goettler et al. (2009) implements a similar approach.

[7] The instructions in Appendix A provide a graphical representation of the information structure.