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The overconfident trader does not always overreact to his information☆

Sarina Du, Hong Liu [1,*]

KLAS and School of Mathematics and Statistics, Northeast Normal University, Changchun 130024, P.R. China

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ABSTRACT

This article develops a strategic trading model in which the outsider is overconfident on the shared information. Our result shows that a more confident outsider underreacts to his information in the sense that he trades less aggressively on his information, leading to a less profit in the trading. However, the insider trades more aggressively on the shared information and less aggressively on the private information when he faces a more overconfident outsider. Also, the overconfidence of the outsider leads to a larger insider's expected profits, an increased expected loss of noise trader, and a less efficient and less stable market.

1. Introduction

Abundant evidences show that investors and managers are prone to be overconfident in the sense that they overestimate the precision of their information. Wang (1998), Glaser and Weber (2007), etc. have predicted that traders will trade more when they are overconfident on their information while, Benos (1998) and Kyle and Wang (1997) find that a rational insider trades less when he faces with an overconfident opponent. However, we find that a more overconfident outsider trades less aggressively on his information, leading to a less profit in the trading. Also, when the rational insider's overconfident opponent is the outsider who shares some information with him, he would like to trade more aggressively on the shared information but less aggressively on his private information.

The pioneering model proposed by Kyle (1985) investigates the optimal trading strategies of a rational and risk-neutral insider with a precise signal about the risky asset's fundamental value[2]. Based on this model, Holden and Subrahmanyam (1992) and Foster and Viswanathan (1996) consider a market with multiple competing insiders, and they show that competition among insiders accelerates the release of their private information. Huddart et al. (2001) present an insider's equilibrium trading strategy in a multi-period rational expectations framework based on Kyle (1985), given the requirement that the insider must publicly disclose his stock trades after the fact. Gong and Liu (2012) and Zhang (2008) extend Huddart et al. (2001) by allowing for competition among identical informed agents and the existence of outsiders, respectively. All the papers mentioned above have the assumption that the insider is rational while, Wang (1998) extends Kyle's (1985) model by assuming that there is an irrational insider in the market, and finds that heterogeneous prior beliefs lead to a large increase in the trading volume. In addition, Kyle and Wang (1997), Wang (1997) and Harris and Raviv (1993) all consider the case of heterogeneous prior beliefs. A consistent finding is that the more overconfident investors overreact to their private information, the more aggressive the trade is while, in this paper we try to give a model to show that the overconfident outsider does not always overreact to his information. Also, we study the trading behavior of a rational insider facing an overconfident outsider and analyze the impacts on the market efficiency, the market depth and the profits of each trader.

Using an extension of the framework of Kyle (1985), this paper analyzes a strategic trading model with the presence of overconfident outsider and the public information. Strictly speaking, the outsider shares some information with the insider, but he overestimates its precision. Market makers have a knowledge of a public signal concerning the liquidity value and set the price conditional on their information, including the order imbalance and the public information, in a semi-strong efficient way. We find that the rational insider puts a positive weight on private information and puts a bigger weight on the shared information than the overconfident outsider does. This is different from the result of Liu and Zhang (2011),

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* Corresponding author at: School of Mathematics and Statistics, Northeast Normal University, Changchun, 130024, P.R. China. Tel.: +86 13596039631.
E-mail address: liuh653@nenu.edu.cn (H. Liu).

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2 Holden and Subrahmanyam (1994), Zhang (2004), etc give the risk-averse informed trader case based on the model of Kyle(1985). Kyle (1985) has led to a large literature that is covered well in Vives (2010).

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which finds that the insider and the outsider put the same weight on the shared information. We also show that the risk-neutral market makers use the public information correctly, while neither the insider nor the outsider considers about the public information when formulating their trading strategies. This distinguishes our model from Zhou (2011), which finds that the rational insider trades manipulatively on public information when he trades with overconfident market makers. Also, a more overconfident outsider trades less aggressively on his shared information while, the insider trades less aggressively on his private information and put a bigger weight on their shared information when he faces a more confident outsider. Intuitively, the rational insider would like to trade more aggressively on the shared information to take advantage of "misvalued" opportunities made by the overconfident outsider. Furthermore, a more confident outsider can get less profit and leads to a smaller marker depth, a less efficient market, more profits of the insider and a more loss of the noise traders.

This paper is structured as follows. In Section 2, we present the model. In Section 3, we identify the unique linear Nash equilibrium of the model. Section 4 concludes. In Appendix A we provide proofs.

2. The model

A single risky asset is traded in the market among four kinds of risk-neutral traders: an informed insider, an outsider, noise traders and competitive market makers. The ex-post liquidation value of the risky asset is a random variable $\tilde{v}=\tilde{\zeta}+\tilde{s}+\tilde{\in}$, normally distributed with mean p_0 and variance σ_v^2 i.e. $\tilde{v}\sim N(p_0,\sigma_v^2)$. The first part, $\tilde{\zeta}$, is related to the private information known only to the insider. Prior to trading, the insider learns the value of the security by observing the signal $\tilde{\zeta}$, $\tilde{s}$ and $\tilde{\in}$. The second part, $\tilde{s}$, which is normally distributed with zero mean and variance $t_s\sigma_v^2$, is related to the shared information obtainable by the outsider (but not by market makers and noise traders). We set $\left(\sqrt{t_s}\sigma_v\right)^{-1}$ as the precision of the shared information. However, the overconfident outsider overestimates it as $\left(k\sqrt{t_s}\sigma_v\right)^{-1}(0\leq k\leq 1)$. In other words, for shared information, the insider has the rational belief: $(\tilde{s})$, while the outsider has the overconfident belief: $(k\tilde{s})$. And the third part, $\tilde{\in}$, which is normally distributed with zero mean and variance $t_\varepsilon\sigma_v^2$, is public information known to all traders but not to noise traders. And random variables $\tilde{\zeta}$, $\tilde{u}$, $\tilde{\in}$ and $\tilde{s}$ are mutually independent.

We conform the trading process to Luo (2001) and Liu and Zhang (2011). There two periods, period 0 and period 1, in the economy. At period 0, the information (public and private) is released and the trading takes place. After the announcement of the information, the insider submits an order $\tilde{x}=X\left(\tilde{v},\tilde{s},\tilde{\in}\right)$ based on his information $\left(\tilde{v},\tilde{s},\tilde{\in}\right)$, and the outsider chooses his trading strategy by submitting an order $\tilde{y}=Y\left(\tilde{s},\tilde{\in}\right)$ based on the information $\left(\tilde{s},\tilde{\in}\right)$. The market makers receive these orders along with those of noise traders whose exogenously generated total demand $\tilde{u}$ is normally distributed with mean zero and variance σ_u^2. After receiving the total order $\tilde{w}=\tilde{x}+\tilde{y}+\tilde{u}$ (but not each individual's) and the public information $\tilde{\in}$, the market makers set the price $\tilde{p}=P\left(\tilde{w},\tilde{\in}\right)$ of the risky asset in a semi-strong efficient way such that they expect to earn a zero profit. At period 1, the uncertainty is resolved and the risky asset payoff is realized.

Let $\tilde{\pi}_I(X,P)=(\tilde{v}-\tilde{p})\tilde{x}$, $\tilde{\pi}_O(Y,P)=(\tilde{v}-\tilde{p})\tilde{y}$, denote the resulting trading profits of the insider and that of the outsider, respectively. Use E_I, E_M to denote the insider's and market makers' expectation conditional on their information, respectively. And E_O denotes the expectation of the overconfident outsider conditional on the overestimated information.

Definition 1. An equilibrium consists of the insider's and outsider's trading strategies and market makers' pricing rule (X, Y, P), such that the following two conditions hold:

(1) Profit maximization: for any alternate trading strategy X' of the insider,

$$E_I\left[\tilde{\pi}(X,P)|\tilde{v},\tilde{s},\tilde{\in}\right]\geq E_I\left[\tilde{\pi}(X',P)|\tilde{v},\tilde{s},\tilde{\in}\right].$$

For any alternate trading strategy Y' of the outsider,

$$E_O\left[\tilde{\pi}(Y,P)|\tilde{s},\tilde{\in}\right]\geq E_O\left[\tilde{\pi}(Y',P)|\tilde{s},\tilde{\in}\right].$$

(2) Market efficiency: $P\left(\tilde{\in},\tilde{w}\right)=E_M\left(\tilde{v}|\tilde{\in},\tilde{w}\right)$.

3. The unique linear equilibrium

The concept of linear equilibrium is similar to the that of Liu and Zhang (2011). And the linear equilibrium satisfying the following:

Theorem 3.1. There exists a unique linear Nash equilibrium, in which X, Y, P are linear functions, with the constants a, b, c, α, β, θ, γ, δ, η and λ such that[3]

$$\tilde{x}=X\left(\tilde{v},\tilde{s},\tilde{\in}\right)=a+\alpha\tilde{\in}+\beta(\tilde{v}-p_0)+\theta\tilde{s}, \tag{3.1}$$

$$\tilde{y}=Y\left(\tilde{s},\tilde{\in}\right)=b+\gamma\tilde{s}+\delta\tilde{\in}, \tag{3.2}$$

$$\tilde{p}=P\left(\tilde{\in},\tilde{w}\right)=c+p_0+\eta\tilde{\in}+\lambda\tilde{w}, \tag{3.3}$$

with

$$a=b=c=0, \tag{3.4}$$

$$\alpha=-\frac{1}{2\lambda}, \tag{3.5}$$

$$\beta=\frac{1}{2\lambda}, \tag{3.6}$$

$$\theta=-\frac{k}{2(4-k)\lambda}, \tag{3.7}$$

$$\gamma=\frac{k}{(4-k)\lambda}, \tag{3.8}$$

$$\delta=0, \tag{3.9}$$

$$\lambda=\frac{\sigma_v}{\sigma_u}\sqrt{\frac{4-2k}{(4-k)^2}t_s+\frac{1}{4}(1-t_s-t_\varepsilon)}, \tag{3.10}$$

$$\eta=1,\quad \tilde{w}=\tilde{x}+\tilde{y}+\tilde{u}. \tag{3.11}$$

Proof. See the appendix.

Since the insider's information is $(\tilde{v},\tilde{s},\tilde{\in})$, i.e. $\left(\tilde{\zeta},\tilde{s},\tilde{\in}\right)$, the equilibrium trading strategy of the insider can be rewritten as $\tilde{x}=(\alpha+\beta)\tilde{\in}+\beta$

[3] Especially, when $k=1$, the conclusion is same as the theorem of Liu and Zhang (2011) (when $M=1$).