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Impact of outsiders and disclosed insider trades

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ABSTRACT

We analyze a dynamic market where outsiders share part of the information about a security with a corporate insider and update their incomplete information by learning from disclosed insider trades. Particular focus is on the insider's response to increasing number of learning outsiders.

1. Introduction

Using an extension of the frameworks of Foster and Viswanathan (1994) and Huddart et al. (2001), this paper analyzes an N-period dynamic market where outsiders observe part of the information about a security prior to trading and update their incomplete information by learning from disclosed insider trades during trading. Kyle (1985) examines the case of the monopolist insider. Holden and Subrahmanyam (1992) examine the case of oligopolistic insiders. Foster and Viswanathan (1994) examine case of asymmetrically informed traders. Huddart et al. (2001) examine the monopolist setting with disclosure. Cao and Ma (2000) examine the oligopolistic setting with disclosure. Our paper attempts to fill the gap in the literature by examining the setting of asymmetrically informed traders with disclosure.[1]

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[1] Vo (2001) discusses a static model where trades are disclosed only once. As a special case of our model (i.e. $m = 1$; $n = 1$), it is different from ours in that it neither examines the dynamic impacts of disclosure on the trading strategy of the insider nor examines the impact of number of informed outsiders on a dynamic market.

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We find that, in the presence of learning informed outsiders, there is an N-period dynamically recursive equilibrium. A critical part of the insider's trading strategy when facing disclosure and outsiders is the random component attached to her trades. The insider's response to the increasing number of learning outsiders is to increase the variance of her random component. A consequence of this response is that the insider has to direct more random order flow to disguise her information. This random order flow injects additional liquidity to the market and lowers overall trading costs.

2. The model

Consider a model with four types of agents: m partially informed outsider, an insider, a market maker, and liquidity traders. There is a security whose value, $v = \alpha + s$, is normally distributed with prior mean p_0 and variance Σ_0. The first component, α, is related to information known only to the insider. The second, s, is related to information obtainable by an outsider. Prior to trading, the insider learns the value of the security by observing both signals α and s. An outsider can become partially informed at a cost by observing the signal s at time 0, which is denoted by s_0 and is drawn from an independent and normal distribution with zero mean and variance Ω_0. In addition, trades from non-strategic liquidity Kyle-type traders are given as u, which is independently and normally distributed with a zero mean and variance of σ_u^2.

The insider and informed outsiders determine their optimal trading strategies by backward induction to maximize their expected profits. At the beginning of the first round, the market maker sets the price equal to its expected value conditional on her information, $p_1 = E[v \mid p_0, \Delta x_1 + m\Delta y_1 + \Delta u_1]$ where $\Delta x_1, \Delta y_1, \Delta u_1$ are respectively the order flow from the insider, each informed outsider, and liquidity traders. At the end of the first round, the insider is required to disclose her trade, Δx_1. The market maker revises the first-round price as $p_1^* = E[v \mid p_0, \Delta x_1]$ before setting the price for the next round, $p_2 = E[v \mid p_1^*, \Delta x_2 + m\Delta y_2 + \Delta u_2]$. Each informed outsider updates her prior information as $s_1^* = E[v \mid s_0, \Delta x_1]$ before submitting her order for the next round, $\Delta y_2 = \theta_2(s_1^* - p_1^*)\Delta t$.

In general, the signal for an informed outsider in the nth round is

$$s_n^* = E\left[v \mid s_{n-1}^*, \Delta x_n\right], \quad \text{where } s_{n-1}^* = E\left[v \mid s_{n-2}^*, \Delta x_{n-1}\right] \text{ and } s_0^* \equiv s_0.$$

The price in the nth round is

$$p_n = E\left[v \mid p_{n-1}^*, \Delta x_n + m\Delta y_n + \Delta u_n\right], \quad \text{where } p_{n-1}^* = E\left[v \mid p_{n-2}^*, \Delta x_{n-1}\right] \text{ and } p_0^* \equiv p_0.$$

With disclosure, the trading strategy of the insider in all trading rounds except the last one takes the following form

$$\Delta x_n = \beta_n\left(v - s_{n-1}^*\right)\Delta t + \gamma_n\left(s_{n-1}^* - p_{n-1}^*\right)\Delta t + z_n. \tag{1}$$

The first component of Eq. (1) is based on her private information; the second one is based on information she shares with informed outsiders; the third component z_n is a random component and is independently and normally distributed with a zero mean and variance of $\sigma_{z_n}^2$. The trading strategy of each informed outsider in every trading round is described by

$$\Delta y_n = \theta_n\left(s_{n-1}^* - p_{n-1}^*\right)\Delta t. \tag{2}$$

In the last trading round, the insider no longer needs to camouflage her private information and her order flow is linear in her information,

$$\Delta x_N = \beta_N\left(v - s_{N-1}^*\right)\Delta t + \gamma_N\left(s_{N-1}^* - p_{N-1}^*\right)\Delta t. \tag{3}$$

Following Foster and Viswanathan (1994), the following variables measure the flow of information (residual variance) at the end of the nth trading round,

$$\Sigma_n = \mathrm{Var}(v \mid \Delta x_1, \ldots, \Delta x_{n-1}) = \mathrm{Var}\left(v - p_n^*\right), \tag{4}$$

$$\Lambda_n = \mathrm{Var}(v \mid s_0, \ldots, s_n, \Delta x_1, \ldots, \Delta x_{n-1}) = \mathrm{Var}\left(v - s_n^*\right), \tag{5}$$

$$\Omega_n = \Sigma_n - \Lambda_n = \mathrm{Var}\left(s_n^* - p_n^*\right). \tag{6}$$