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Unskilled traders, overconfidence and information acquisition

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ABSTRACT

The value of an asset has two components, referred to as obvious and obscure. Unskilled traders are only aware of the obvious component and thus overestimate the precision of the information they may acquire. Unskilled traders are overconfident when informed and the intensity at which they trade makes researching the obscure component profitable to skilled traders, and this even when research costs are such that no information acquisition takes place in a skilled-only market. Hence overconfidence in our model encourages research by all, including the skilled (rational) traders.

1. Introduction

Overconfidence is encountered in many spheres of human activity (Moore and Healy, 2008; Skala, 2008). In trading models, it is generally represented as an underestimation of variance (Odean, 1998). When information acquisition is considered, overconfident traders are more likely to purchase information than rational traders, and the former may even crowd out the latter (Ko and Huang, 2007; García et al., 2007). In this paper, we consider a trading model where some traders are overconfident because they are unskilled and unaware of it (Kruger and Dunning, 1999; Ehrlinger et al., 2008). Unskilled traders have a limited knowledge of the factors affecting the asset and trade aggressively when informed. Rather than forcing skilled traders out of the market, the presence of unskilled traders may encourage them to gather information.

Our model builds on Grossman and Stiglitz (1980) with an asset that has two components, referred to as obvious and obscure. Information about each component can be acquired at a cost. Skilled traders know there are two components while the unskilled believe value to be entirely driven by the obvious component. An informed and unskilled trader overestimates the precision of his private information and trades more aggressively than would a skilled trader, thus revealing much information about the obvious component though the asset price. This encourages skilled traders to research the obscure component as they can then become almost fully informed by paying the obscure cost only. Hence contrary to Ko and Huang (2007) and García et al. (2007), the presence of overconfident traders in our model generates rational (skilled) research.

The two types of traders in our model could be viewed as a representation of the dual-process hypothesis (Evans, 2008; Evans and Stanovich, 2013), which suggests that there be fast and intuitive thinkers and slow and deliberative thinkers. Mata et al. (2013) show that the former display overconfidence while the latter tend to be well calibrated. This setup differs from that of Gervais and Odean (2001), who present a model where the unskilled

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is overconfident when he wrongly believes to be better than average, and where overconfidence fades away as one eventually learns his true type.

2. The model

An asset with a liquidation value $\theta = A + B$ is traded by a continuum of agents located on the interval [0, 1]. $A = a + \epsilon_a$, $B = b + \epsilon_b$ and the variables a, b, ϵ_a and ϵ_b are all normally and independently distributed: $a \sim N(\bar{a}, \sigma_a^2)$, $b \sim N(\bar{b}, \sigma_b^2)$, $\epsilon_a \sim N(0, \sigma_{\epsilon_a}^2)$ and $\epsilon_b \sim N(0, \sigma_{\epsilon_b}^2)$. A trader can, ahead of trading, learn the value of a at a cost c_a and the value of b at a cost c_b.

A fraction m of market participants, referred to as unskilled, ignore the existence of B and believe that $\theta = a + \epsilon_a$. Unskilled traders are identified by u and skilled traders, who are aware of both A and B, are identified by s. Unskilled and skilled traders simultaneously submit demand schedules, along with noise traders who submit $z \sim N(0, \sigma_z^2)$, and a market-clearing price ensues. Each trader has a CARA utility function given by $U(w) = -e^{-\rho w}$, with $\rho > 0$ and $w = (\theta - p)x - \iota_a c_a - \iota_b c_b$, where x represents the position taken by the trader, p is the clearing price, $\iota_a = 1$ if the trader learns a and zero otherwise, and $\iota_b = 1$ if the trader learns b and zero otherwise. Traders have zero initial positions and no budget constraints. Let $\mu_{a,j}$, $\mu_{b,j}$, $\mu_{ab,j}$ and $\mu_{n,j}$ denote the quantity of traders of type $j = s, u$ informed of a, b, both a and b, and uninformed, respectively, with $\mu_{a,s} + \mu_{b,s} + \mu_{ab,s} + \mu_{n,s} = 1 - m$ and $\mu_{a,u} + \mu_{n,u} = m$.

Definition 1. An equilibrium is a set of trading functions $X_{i,j}(I_i, p)$, where $I_i \in \{\emptyset, a, b, \{a, b\}\}$, and a price p such that, for all $i \in [0, 1]$ and $j = s, u$:

1. For each agent i with information set I_i, $X_{i,j}(I_i, p)$ is a solution to
$$\max_x E_j\left[-e^{-\rho((\theta-p)x)} \,\middle|\, I_i, p\right];$$
2. The price p is such that
$$\int_0^{1-m} X_{i,s}(I_i, p)di + \int_{1-m}^{1} X_{i,u}(I_i, p)di + z = 0;$$
3. $\mu_{a,j}$, $\mu_{b,j}$, $\mu_{ab,j}$ and $\mu_{n,j}$ are such that
$$E_j\left[-e^{-\rho((\theta-p)X_{i,j}(I_i,p)-c(I_i))}\right] \geq E_j\left[-e^{-\rho((\theta-p)X_{i,j}(I_i',p)-c(I_i'))}\right]$$
for all $i \in [0, 1]$ and $j = s, u$, where $I_i, I_i' \in \{\emptyset, a, b, \{a, b\}\}$, $I_i' \neq I_i$, $c(a) = c_a$, $c(b) = c_b$ and $c(a, b) = c_a + c_b$.

As developed in Vives (2008), a trader of type $j = s, u$ prefers the information set I over I' if

$$e^{\rho(c(I)-c(I'))}\sqrt{\frac{\mathrm{Var}_j(\theta|I, p)}{\mathrm{Var}_j(\theta|I', p)}} < 1, \quad (1)$$

where Var_s denotes the correct variance and Var_u denotes the variance from the viewpoint of an unskilled trader. Throughout the paper, we make the following assumption in order to reduce the number of cases to consider in equilibrium:

$$e^{\rho(c_a-c_b)}\sqrt{\frac{\mathrm{Var}(\theta|a, p)}{\mathrm{Var}(\theta|b, p)}} = e^{\rho(c_a-c_b)}\sqrt{\frac{\sigma_b^2 + \sigma_{\epsilon_a}^2 + \sigma_{\epsilon_b}^2}{\sigma_a^2 + \sigma_{\epsilon_a}^2 + \sigma_{\epsilon_b}^2}} < 1. \quad (2)$$

Condition (2) implies that a skilled trader finds learning a more profitable than learning b when all other traders are uninformed. This condition means that a is relatively cheaper than b in terms of uncertainty resolution. For example, a could represent financial information easily accessible from the internet while b could represent the talent and motivation of top employees and management, new projects, and so on. Factor a is more obvious than b as a factor influencing θ, and is also cheaper to analyze.

We have ordered learning a as being more cost-effective than learning b. We now order learning both a and b ahead of learning a only:

$$e^{\rho(c_a+c_b-c_a)}\sqrt{\frac{\mathrm{Var}(\theta|a, b, p)}{\mathrm{Var}(\theta|a, p)}} = e^{\rho c_b}\sqrt{\frac{\sigma_{\epsilon_a}^2 + \sigma_{\epsilon_b}^2}{\sigma_b^2 + \sigma_{\epsilon_a}^2 + \sigma_{\epsilon_b}^2}} < 1. \quad (3)$$

That is, when no one else is informed, a skilled trader prefers learning both a and b to learning a alone. This condition rules out the case where a trader has to choose between learning a or b. If a is affordable from the viewpoint of a skilled trader, then becoming fully informed is also affordable.

Lemma 1. *If inequalities (2) and (3) hold, then*

$$e^{\rho c_a}\sqrt{\frac{\mathrm{Var}_u(\theta|a, p)}{\mathrm{Var}_u(\theta|p)}} = e^{\rho c_a}\sqrt{\frac{\sigma_{\epsilon_a}^2}{\sigma_a^2 + \sigma_{\epsilon_a}^2}} < 1,$$

i.e. an unskilled trader always finds profitable to learn a when all other traders are uninformed.

Proof. Inequality (2) yields $\frac{e^{\rho c_a}}{\sqrt{\sigma_a^2+\sigma_{\epsilon_a}^2+\sigma_{\epsilon_b}^2}} < \frac{e^{\rho c_b}}{\sqrt{\sigma_b^2+\sigma_{\epsilon_a}^2+\sigma_{\epsilon_b}^2}}$ and thus $e^{\rho c_a}\sqrt{\frac{\sigma_{\epsilon_a}^2}{\sigma_a^2+\sigma_{\epsilon_a}^2}} < e^{\rho c_a}\sqrt{\frac{\sigma_{\epsilon_a}^2+\sigma_{\epsilon_b}^2}{\sigma_a^2+\sigma_{\epsilon_a}^2+\sigma_{\epsilon_b}^2}} < e^{\rho c_b}\sqrt{\frac{\sigma_{\epsilon_a}^2+\sigma_{\epsilon_b}^2}{\sigma_b^2+\sigma_{\epsilon_a}^2+\sigma_{\epsilon_b}^2}} < 1$, where the last inequality stems from (3).

Note that Lemma 1 holds for any value of ρ, σ_a^2 and $\sigma_{\epsilon_a}^2$. It even holds when

$$e^{\rho(c_a c_b)}\sqrt{\frac{\mathrm{Var}(\theta|a, b, p)}{\mathrm{Var}(\theta|p)}} = e^{\rho(c_a+c_b)}\sqrt{\frac{\sigma_{\epsilon_a}^2 + \sigma_{\epsilon_b}^2}{\sigma_a^2 + \sigma_b^2 + \sigma_{\epsilon_a}^2 + \sigma_{\epsilon_b}^2}} > 1. \quad (4)$$

If (2)–(4) hold, information is prohibitively costly to skilled traders and no information acquisition takes place in equilibrium in a skilled-only market. Introducing unskilled traders in such a market is then beneficial since it generates research in component a. Research in component b depends on the parameter values, as we will now see.

If conditions (2)–(4) hold, then a fraction of unskilled traders become informed of a and their demand function is given by (details in the Appendix)

$$X_u(a, p) = \frac{1}{\rho\sigma_{\epsilon_a}^2}(a - p).$$