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Herding with costly information ☆

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Abstract

This paper incorporates costly information into a model of observational learning. Individuals would like to avoid the cost of buying information and free-ride on the public history. The paper characterizes when learning is nevertheless complete. Necessary and sufficient conditions for complete learning follow from an elementary principle: a player purchases information only if it can influence her action. With a "coarse" action space, learning is complete if and only if for every cost $c > 0$, a positive measure of types can acquire, at cost less than c, an experiment that can overturn the public history. With a "rich" action space, learning is complete if and only if for every cost $c > 0$, a positive measure of types can acquire any informative signal at cost weakly less than c. The results are applied to financial markets to evaluate when markets are informationally efficient despite information being costly.

JEL classification: D82; D83

Keywords: Social learning; Herding; Information acquisition; Responsiveness

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1. Introduction

Why do individuals imitate each other? The observational learning literature, initiated by Banerjee (1992) and Bikhchandani et al. (1992), offers the following perspective: when Alice sees many others before her choosing the same action, she infers that sufficiently many of them have private information that favors that action. That inference can induce her to follow suit even if her own information indicates otherwise. By joining the herd, Alice's action obscures her information from future players, and thus, induces informational inefficiency.

Understanding how this motive for imitation influences long-run behavior is the main theme of the herding literature. Are herds guaranteed to form, and if so, can they persist indefinitely on incorrect actions? In a seminal paper, Smith and Sørensen (2000) show that herding is inevitable but herds persist indefinitely on incorrect actions if and only if information is of bounded persuasiveness.

These insights are developed in a setting where all individuals obtain information for free. But individuals often have to devote time and resources to acquire information. Once players find it costly to acquire information, there is a new motive for herding, namely that a player can use the "wisdom of the crowd" to avoid incurring the cost of information acquisition. For example, when choosing among health insurance plans, individuals typically find it costly to learn about the various characteristics of these plans, and one might instead choose the same plans that one learns that one's co-workers have chosen (Sorensen, 2006). Analogously, in the adoption of agricultural technology, individuals may herd on the technological choices of others rather than learn about the efficacy of various technological interventions oneself (Conley and Udry, 2001). Information costs strengthen the motive to herd.

The goal of this paper is to ask the main question of the herding literature once information is costly—when do herds persist only on correct actions and never on incorrect actions? This paper answers this question by combining the most basic principle of information demand—*information is valuable only if it can change one's action*[1]—with the martingale techniques of Smith and Sørensen (2000) to characterize long-run learning. The lesson provided by the main result, Theorem 1, is simple:

> *Herds persist only on correct actions if and only if for every interior public belief, players acquire information that can overturn it with positive probability.*

This result applies in both discrete and continuous action spaces, with information costs being modeled non-parametrically, and allowing for players to be heterogeneous in their information acquisition costs. Below, I describe more of the framework, the obstacles that are encountered, and the intuition for this result.

Individuals sequentially choose from a menu of options while being uncertain about the realization of a payoff-relevant state of the world. Prior to making that choice, each individual observes the full history of prior choices, and then chooses whether to conduct an experiment (or test) whose stochastic result reveals some information about the underlying state of the world. The cost of that experiment may depend both on its characteristics (e.g., its informativeness) and on characteristics particular to that individual. This heterogeneity captures differences in both

[1] This fundamental property is implicit in Blackwell's comparison of information structures (Blackwell, 1951, 1953) and is described by Arrow (1971) who attributes it to Marschak (1959). This property is also used by Schlee (1990) and Grant et al. (1998) as a point of contrast for theories in which information has intrinsic value.