Social learning with endogenous observation ☆

Yangbo Song

School of Management and Economics, the Chinese University of Hong Kong, Shenzhen, China

Abstract

I study the problem of social learning in a model where agents move sequentially. Each agent receives a private signal about the underlying state of the world, observes the past actions in a neighborhood of individuals, and chooses her action attempting to match the true state. In contrast to the most existing literature that assumes an exogenous observation structure, observation in this paper is endogenous. More specifically, each agent must pay a cost to make any observation and can strategically choose the set of actions to observe. I show that when private beliefs are strong relative to cost, observation becomes fully informative if and only if the size of the observed actions extends to infinity. In addition, costly observation may lead to better learning than free observation, and the order of acquiring signal and observation significantly affects the learning pattern.

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1. Introduction

How do people aggregate dispersed information? Imagine a scenario with a sequence of many agents, each trying to match her action with some underlying state of the world, e.g., consumers

choosing the highest quality product, firms implementing the technology with the highest productivity, etc. Each agent may have some informative signal about the state. Combining all the signals will reveal the state to the entire society, but such signals are typically not directly observable to others. However, an agent's action is observable and informative regarding her knowledge; thus agents can still hope for some level of information aggregation. Therefore, it is of great importance to investigate the relation between the type of observation structure and the type of information aggregation that is achievable.

A large and growing literature has studied this problem of observational learning, and has made the prevalent assertion that when private beliefs are bounded, efficient information aggregation may fail (Bikhchandani, Hirshleifer and Welch 1992; Banerjee 1992; Smith and Sorensen 2000; Acemoglu et al. 2011). The reason is that the informativeness of an observed action sequence may overwhelm the informativeness of every single signal, which leads an agent and her successors to abandon their private information and "herd" on the wrong action. This result is built on the common modeling assumption that observation is exogenous: agents observe some predecessors' actions for free, while they are not able to choose whose actions to observe or whether to observe at all. In practice, however, observation is typically both costly and strategic. First, time and resources are required to obtain information regarding others' actions. Second, an agent would naturally choose to observe what are presumably more informative actions based on the positions of individuals in the decision sequence. In this paper, I analyze an endogenous observation framework and address how it affects information aggregation.

My model adopts a standard setting of social learning with Bayesian agents. There is an underlying state of the world which is binary in value. A large number of agents sequentially choose between two actions with the goal of matching their action with the true state. Each agent receives a private signal which is not perfectly revealing about the state. After receiving her signal, each agent may observe some of her predecessors' actions. The main difference between my model and much of the existing literature is that observation is costly and endogenous: each agent chooses whether to pay a fixed cost to observe a number of her predecessors. Exactly which of the predecessors to observe is the agent's strategic choice, and the number of others to observe is limited by an exogenous capacity structure. By observing a predecessor, the agent knows the action of the other, but not the other's private signal or which agents that have been observed by the other. After this process of information gathering, the agent takes her own action.

The main result of this paper states that when private beliefs can be sufficiently strong relative to cost (but may still be bounded), efficient information aggregation can be achieved, in the sense that the observed action sequence becomes perfectly revealing about the state. This learning pattern occurs in every equilibrium if and only if the size of the observed actions extends to infinity. To briefly capture the underlying argument, first note that each agent will rationally choose not to observe when her private signal is rather informative, i.e. when the marginal benefit from observation is lower than the cost. Consequently, each agent's action indicates her private information with a probability bounded away from zero, which can be used to show that observing additional actions always improves informativeness. Finally, such improvement ensures that every wrong belief occurring with positive probability can be corrected with almost certainty by observing sufficiently many additional actions; therefore, a sequence of infinite actions must reveal the true state. The result brings about interesting implications that are absent in the literature. For instance, herding may occur in a society with no observation cost but never occurs in a society with a sufficiently large cost, and the learning probability may also be higher in the latter. Also, the relative order of gathering private information and observation greatly affects the learning pattern.