Social Learning with Endogenous Information

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A literature models observational social learning and rational herding.

- Individuals choose actions from a menu in fixed sequential order.
- Each obtains private info about payoff-relevant state of the world.
- Each observes all prior actions, but not prior information.
- Inference from prior actions may outweigh one's private signal
  $\Longrightarrow$ rational herding.

Typical assumption: individuals obtain information for free.

But individuals often herd to economize on the cost of information.

motivating question

How does costly information influence social learning?

outline

Consider setting where:

- There is a menu of experiments that can be undertaken.
- Each observes prior actions and then chooses experiment.
- After observing experiment's realization, individual chooses action.
- Individuals are heterogeneous in costs of experimenting.

Paper offers a general treatment across discrete and continuous action spaces, with information acquisition costs modeled non-parametrically.

Approach is elementary.

taxonomy I

Throughout: $\omega \in \{0, 1\}$ and $\mu = \Pr(\omega = 1)$.

Players choose $a \in A$ and obtain $u(a, \omega)$.

Higher actions strictly preferred if $\omega = 1$; opposite if $\omega = 0$.

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e.g. "Discrete-action" space: $U(a, \omega) = \mathbf{1}_{a=\omega}$ and $a \in \{0,1\}$.

taxonomy II

Choice of information acquisition:

a) No experiment: costs 0.

b) Any experiment $X \in \mathcal{X}$ at cost $c(X, \theta)$.

Cost depends on one's cost-type, θ.

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Experiment X is affordable if $\Pr(c(X, \theta) < k) > 0$ for every $k > 0$.

Information is affordable if $\mathcal{X}$ has an affordable experiment.

Overturning information is affordable if for every p_* and p^*, there exists an affordable experiment that can generate beliefs outside $[p_*, p^*]$.

Theorem

In a responsive decision problem, learning is complete if and only if information is affordable.

In a UAC decision problem, learning is complete if and only if overturning information is affordable.

general intuition

Public belief is a martingale $\implies$ beliefs converge.

Beliefs can converge only if

- learning is complete, or
- no further information is acquired.

intuition for responsive

Responsive DP: $a^*(\mu) \neq a^*(\nu)$ if $\mu \neq \nu$.

Information leads one to *tweak* one's action.

$\Longrightarrow$ every bit of info is valuable at a non-degenerate belief.

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$\Longrightarrow$ every bit of info is valuable at a non-degenerate belief.

Info is affordable $\Longrightarrow$ someone finds free info
$\Longrightarrow$ positive measure of types acquire info.

Info is unaffordable $\Longrightarrow$ lower bound on cost of info
$\Longrightarrow$ no acquisition of info at extreme beliefs.

intuition for UAC

Unresponsive at Certainty: $\alpha^*(\mu) = \alpha^*(1)$ for $\mu < 1$.

Once beliefs put sufficiently high mass on a state, only info that can *swing* one's action is valuable.

$\implies$ only overturning info is valuable at those beliefs.

intuition for UAC

Unresponsive at Certainty: $a^*(\mu) = a^*(1)$ for $\mu < 1$.

Once beliefs put sufficiently high mass on a state, only info that can *swing* one's action is valuable.

$\Longrightarrow$ only overturning info is valuable at those beliefs.

Overturning info is affordable $\Longrightarrow$ someone finds free overturning info
$\Longrightarrow$ positive measure of types acquire info.

Overturning info is unaffordable $\Longrightarrow$ lower bound on cost
$\Longrightarrow$ no acquisition of info at some beliefs (overturning or otherwise).

unintended consequence I

Same characterization applies even if all past information is observed, so long as only zero measure of types gain info for free.

Implication: central friction for herding without costly information acquisition may not be relevant once information is costly.

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Apart from characterizing learning with costly information, paper offers a new taxonomy for "continuous" vs. "discrete" action models.

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I argue that this conventional categorization misses the point.

Suppose $\mathcal{U}(a, \omega) = -(a - \omega)^2$ but $a \in \left[\frac{1}{4}, \frac{3}{4}\right]$. Actions are continuous, but this is a UAC decision problem.

In other words, the following viewpoint appears incorrect:

> *Herding arises because the signal space is richer than the action space...*

an application

Paper applies framework to sequential trading in financial markets in a Glosten-Milgrom framework.

Result: Prices converge to value if and only if information is affordable, but the bid-ask spread vanishes regardless.

conclusion

Previous studies that incorporate info costs in social learning have:

a) parametric assumptions (normal or perfect signals)

b) do not nest the standard observational learning environment,

c) proofs that use parametric structure.

Paper pursues an elementary approach that offers general insights without parametric structure.

Analysis formalizes the key economic force: if the decision problem is responsive, information is always valuable, and if the decision problem is UAC, information can be worthless.