A Simple Model of Herding Behaviour

Abhijit V. Banerjee, QJE (1992)

Motivation

- Choice of restaurants
- Choice of assets in a stock market (“beauty contests” pick the winner)
- Voting behaviour
- Academic research (“hot topics”)

Previous Research

- Complementarity in fashions: Karni and Schmeidler (1989)
- Network externalities in production and consumption: Katz and Shapiro (1985)
- Lock-in by historical accident: Arthur (1989)
- Agency models where its is profitable to lie: Scharfstein and Stein (1990)

Workhorse

- Others might have information that I don't have and hence it might be profitable to follow them.

The Model

- N agents maximising risk neutral vN-M utility functions
- set of assets indexed by numbers in $[0,1]$; the return to investing in asset i is $z(i) \in R$
- Unique i^*such that $z(i) = 0 \forall i \neq i^*$ and $z(i^*) = \dot{z} > 0$
- i^* is the preferred asset. All other assets give 0 payoff
- All players have uniform priors on $[0,1]$
- Each player receives a signal s_i with prob. α and no signal with prob. $1-\alpha$
- $s_i = i^*$ with prob. β and $s_i\tilde{}U[0,1]$ with prob. $1-\beta$
- Decision making is sequential. One person goes after the other
- A person observes all the choices made before him by others
- A person decides on the basis of past histories and his signal (if he has one)
- Bayesian Nash strategies are optimal decision rules

Assumptions

Assumption A

If a person has no signal and everyone else before him has chosen $i = 0$ she always chooses $i = 0$

- $i = 0$ a default option?

Assumption B

If a person is indifferent between following his own signal or someone else's choice he always follows his own signal

Assumption C

When a decision maker is indifferent between following more than one of the previous decision makers, she chooses to follow the one with the highest value of i.

- just a tie-breaking rule

Decision making

First Decision Maker

- Case 1: Got signal...follow it
- Case 2: No signal...choose $i = 0$
- So choice of $i = 0$ signals to others that you didn't have a signal
- What if $i^* = 0$ and you get the correct signal?...Banerjee: "this happens with probability zero"

Second Decision Maker

- Case 1: No signal...follow first guy
- Case 2: Got signal AND first guy chose $i = 0$...follow own signal
- Case 3: Got signal AND first guy chose $i \neq 0$...follow own signal because both are as likely to be right

Third Decision Maker

History 1: Both preceding players chose $i = 0$

- No signal: choose $i = 0$
- Got signal: follow signal

History 2: One preceding player chose $i = 0$ and other chose $i' \neq 0$

- No signal: follow the guy who chose $i \neq 0$
- Got signal: follow own signal

History 3: Both preceding players chose same $i' \neq 0$

- No signal: follow the other players
- $s_3 = i'$: choose i'
- $s_3 \neq i'$: choose i' $\quad (\because prob[i^* = i' \mid History3] > prob[i^* = s_3 \mid History3])$ The accuracy of the first person's choice is embellished by the fact that he has been followed.

History 4: One player chose $i' \neq 0$ and the other player chose $i'' \neq 0, i'' \neq i'$

- No signal: follow higher i
- Got signal: follow own signal

Equilibrium Decision Rule

Under assumptions A, B and C, the *unique* (Nash) equilibrium decision rule that everyone will adopt is:

1. First decision maker follows her signal if she has one; otherwise chooses $i = 0$

2. For $k > 1$, if the k^{th} decision maker has a signal

FOLLOW THE SIGNAL if either a) or b) happens

- a) Her signal matches an option that has already been chosen
- b) Her signal does not match an option that has already been chosen and no option other than $i = 0$ has been chosen by more than one person.

3. For $k > 1$, if the k^{th} decision maker has a signal

- If one of the already chosen options (other than the one with the highest i) has been chosen by more than one person then FOLLOW THAT OPTION unless your signal matches one of the options already chosen.
- In the latter case choose the signal

4. For $k > 1$, if the k^{th} decision maker has a signal

- If the only option chosen by more than one person is the one with the highest i then choose the highest i unless his signal matches one of the already chosen options in which case he should choose his signal

5. If the k^{th} decision maker does not have a signal

- Choose $i = 0$ if and only if everyone else chose $i = 0$
- Choose the highest i that has already been chosen unless one of the other options has been chosen by more than one person, in which case the latter option must be chosen

The model is solved by forward induction and hence uniqueness is guaranteed

Results

Possibility of herding

- If first person chooses $i \neq 0$ and the second person follows her, the third person will always follow them. All subsequent decision makers will also choose the same option
- After k different options have been chosen, if the next decision maker does not have a signal, she will choose the option with the highest value of i. Following this all subsequent decision makers will choose the same option unless one of their signals matches one of the options already chosen. This can happen only if the correct option has already been chosen.
- There can be herding at an incorrect option unless the first decision maker to have a signal made the correct choice or someone coming after her but before the subsequent decision maker without a signal, made the correct choice.

Probability that no one in the population will choose the right option:

$$[1 - \alpha(1 - \beta)]^{-1}(1 - \alpha)(1 - \beta)$$

- decreasing in both α and β
- However if everyone took their decision without looking at anyone else then at least some people ($(\alpha\beta/100)\%$) will choose the correct option since they got the right signal

Welfare Issues

Consider the alternative decision rule D^* for all agents:

- If you have a signal, follow that signal unless someone before you has followed someone else, in which case you should follow too
- If you don't have a signal, pick an option that has not been picked by anyone else, unless someone before has already followed someone else
- This specification allows an arbitrarily large fraction of the population to make the correct choice
- The economy may be better off if the early decision makers are not allowed to observe the choices made by the other decision makers
- Issues of enforcement
- Destroying information in this sense may be beneficial