Lecture 6: The Indirect Evolutionary Approach and the Endowment Effect

1. The indirect evolutionary approach

How do preferences evolve?

Indirect evolutionary approach (Gueth and Yari 1992)

Different preferences over objects of choice (e.g. consumption bundles or strategies) feasible

rational choices of the agents according to their preferences $\Longrightarrow$

different preferences lead to different choices $\Longrightarrow$

different preferences lead to different "evolutionary success", and more "successful" preferences survive and spread.

"evolutionary success"

literally: number of off-springs (e.g. can explain e.g. distaste of rotten food)

learning of valuations - internalization

action or object gives reward (e.g. social appreciation); this in turn leads to valuation of action or object

e.g. consumption of certain good gives social appreciation $\Longrightarrow$ agent experiences this often $\Longrightarrow$ agent develops taste for this good.

objects of learning process are valuations, not actions $\Longrightarrow$ indirect evolutionary approach

Are the preferences chosen by this process similar to measure of evolutionary success?

Not necessarily in strategic situations: "relative evolutionary success" of a preference determines, whether it survives, not absolute evolutionary success.

Example

Huck and Oechssler (1999): Explains taste for fairness

2. Explaining the endowment effect (Huck et al 2005)

endowment effect (EE): a person's valuation of a good is higher if he possesses the good than if he does not $\iff$
willingness to accept (WTA) $>$ willingness to pay (WTP)

Experimental results (e.g. Knetsch/Sinden (84), Knetsch (89))

$$\frac{WTA}{WTP} = 4$$

Interpretations of observations

1) "misled bargaining behavior": people pretend to attach higher values to own goods because this is useful in everyday life.

But: in experiments with incentives to tell the truth + learning differences between WTP and WTA smaller, but do not vanish (Kahneman et al 90)

2) loss aversion: real differences in valuations because losses loom larger than gains

consistent with prospect theory for decision under risk (Kahneman and Tversky 1979)

What causes differences in valuation?

Basic idea: EE can be an evolutionary advantage in bargaining situations

2.1. The model

continuum of individuals

2 goods, each individual endowed with one unit of one good

evolutionary success is a function of the amounts of goods consumed, x and y

$$R : \mathbb{R}^2_+ \rightarrow \mathbb{R}_+$$

$R(x, y)$ continuously differentiable, strictly monotone, strictly concave.

each individual i characterized by "valuation-function" u_i that represents preferences.

Valuation may depend on ownership-status

$$u_i : \mathbb{R}^2_+ \times \{x - owner, y - owner\} \rightarrow \mathbb{R}$$

$u_i(x, y, ownership - status)$ describes reward-driven valuation of goods and determines behavior in bargaining

class of feasible valuation functions

$$u_i(x, y, ownership - status) = \begin{cases} R(x, y) + e_i x, \text{ if } i \text{ is a } x - owner \\ R(x, y) + e_i y, \text{ if } i \text{ is an } y - owner \end{cases}$$

endowment parameter e_i measures amount of EE; if $e_i = 0$, valuation independent of endowment.

μ specifies distribution of endowment parameters over population.

Which e_i will be learned through evolutionary process process? How will μ change over time?

time continuous; at each point in time:

2 persons (i.e. 2 endowment parameters) randomly drawn from population according to μ
Equal probabaility random process determines x and y owner.
bargaining determines allocation of their joint endowment; bargaining depends on e_i, e_j; without agreement, both remain with initial endowment
goods consumed (no agreement: consumption of initial endowments) $\Longrightarrow$ evolutionary success of the (possibly different) endowment parameters
"evolutionary" process: μ changes such that $e_i s$ with higher reward spread out in population ("success" monotone dynamics).

Bargaining Process: If a pareto-improving allocation exists, Nash bargaining solution. Else no trade

Notation:

x, y: consumption of x-owner $\implies$

$1-x$, $1-y$: consumption of y-owner

e_x, e_y endowment parameters

disagreement points:

$$\begin{aligned} u_x(1,0) &= R(1,0) + e_x \\ u_y(0,1) &= R(0,1) + e_y \end{aligned}$$

Nash bargaining solution given by solution of problem:

$$\max_{x,y} [R(x,y) + e_x x - R(1,0) - e_x] \times$$
$$[R(1-x, 1-y) + e_y(1-y) - R(0,1) - e_y]$$

Trade is possible, iff the following condition holds (R_x, R_y partial derivatives)

$$R_x(0,1)R_y(1,0) - R_x(1,0)R_y(0,1) \geq e_x R_y(0,1) + e_y R_x(1,0) + e_x e_y$$

$\widehat{e}_x$: maximum e_x for which condition for trade holds when $e_y = 0$.
$\widehat{e}_y$: maximum e_y for which condition for trade holds when $e_x = 0$.
$\widehat{e} = \min(\widehat{e}_x, \widehat{e}_y)$

$(x^*(e_x, e_y), y^*(e_x, e_y))$: bargaining result for x-owner = consumption of x-owner

2.2. Reward of an EE

Proposition: The evolutionary reward of an player i without an endowment effect ($e_i = 0$) is strictly increasing in e_i if the endowment parameter of his bargaining partner j, e_j, is below $\widehat{e}$.

$\widetilde{R}(e_i, \mu)$: expected evolutionary reward of person i with e_i when confronted with distrubution μ.

Proposition: For $e_i = 0$ and any μ with $\mu([0, \widehat{e})) > 0$, $\widetilde{R}(e_i, \mu)$ is strictly increasing in e_i.

2.3. Evolutionary Dynamics

state space Ω: set of all probability measures over endowment parameter.

dynamics $\varphi(\mu^0)$ describes how distribution of endowment parameters changes over time, starting from initial distribution μ^0.

The dynamics is success monotonicity, if for all open subsets A and A' of $\mathbb{R}_+$ the following holds:

$$\frac{1}{\mu^t(A)}\int_A \widetilde{R}(e_i,\mu)d\mu^t(e_i) \quad > \quad \frac{1}{\mu^t(A')}\int_{A'} \widetilde{R}(e_i,\mu)d\mu^t(e_i)$$

$$\text{iff } \frac{\dot{\mu}^t(A)}{\mu^t(A)} \quad > \quad \frac{\dot{\mu}^t(A')}{\mu^t(A')}$$

Boundary states: States where strictly positive mass is on $e = 0$ and/or on $e > \widehat{e}$

$$B := \{\mu : \mu(0) > 0 \text{ and/or } \mu((\widehat{e}, \infty)) > 0\}$$

Proposition: For any success monotone dynamics, all states $\mu \in B$ are not Lyapunov stable.

D denotes all states with strictly positive mass on any open intervall with a lower bound of zero.

$$D := \{\mu : \forall \delta > 0, \mu((0, \delta)) > 0\}$$

"If the system starts in D, nothing is a-priori excluded".

Proposition: For any success monotone dynamics, if the dynamics starts at any $\mu_0 \in D$, the proportion of types with $e = 0$ or $e > \widehat{e}$ converges to zero as t goes to infinity.

Conclusions

indirect evolution of preferences in bargaining situations leads to valuations that exhibit EE

after such a process has taken place, EE should be observed also in non-bargaining situations, e.g. on markets.

In general:
Indirect evolutionary approach is useful against abitrary assumptions about preferences: If it is difficult to come up with plausible situation where a specific preference has evolved, basing an analysis on such a preference is doubtful.