Lecture 4: Reciprocity and the Impact of Beliefs

Experimental evidence that more than pure distributional concern matters: e.g. Blount (1995), Bolle, Kritikos (1999), Charness, Rabin (2002), Engelmann, Strobel (2004), Gneezy et al (2000).

1. Reciprocity and the Gift Exchange Experiment (Charness 2004)

Gift exchange game with exogenous matching of buyers and sellers (no market)

three treatments
T1: price p set unilaterally by buyer
T2: price set by random device
T3: price set by third party (experimenter)

Prediction with only distributional concerns: p-e relation the same for all treatments.

Experimental results: p-e significantly steeper in T1 than in T2 and T3 $\implies$

Not only distributional concerns, but also reciprocity seems to have an impact.

Reciprocity: A person behaves reciprocally, if he is kind to someone who is kind to him, and he is unkind to someone who is unkind to him. $\implies$

If only reciprocity, p should have no impact on e in T2 and T3.

In literature "fairness" and "reciprocity" often confused, or words used interchangeable.

2. A Theory of Sequential (Pure) Reciprocity (Dufwenberg and Kirchsteiger 2004)

based on Rabin (1993), which applies only to static games.

2.1. The model

Extensive form game with finite number of players and complete information
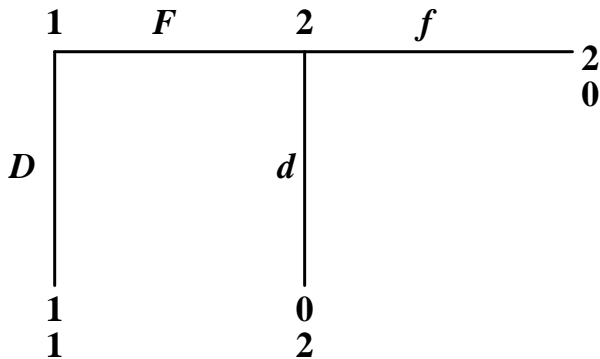
strategies chosen by players determine "material payoff" (i.e. money)

what is "kind behavior" in a game?

player 1's behavior (strategy) is kind to 2, if it intends to give 2 a large material payoff, large compared with set of possible payoffs $\implies$

Intentions crucial

How to observe intentions? - Example

By choosing F, does 1 intend to give 2 a lot?

Should 2 think that 1's choice of F intends to give a lot to 2?

Answer depends on beliefs of 1 about 2's strategy, and on 2's belief about 1's belief about 2's strategy

$\implies$ utility depends not only on strategy combination, but also on beliefs

$\implies$ approach of psychological game theory required
(see Lecture 5 for general description of PGT)

Notation:

Strategy set of i, A_i; $a_i \in A_i$

first order beliefs b_{ij} : belief of i about strategy of j - probability distribution over A_j.

second order beliefs c_{ijk}: belief of i about belief of j about strategy of k.

Assumption: second order beliefs are point beliefs - c_{ijk} probability distribution over A_k (and not probability distribution over probability distribution ....)

$\pi_i(a)$: material payoff of i (money or other objective measure; not vNM-utility)

kindness of i toward j:

$$k_{ij}(a_i, (b_{ik})_{k \neq i}) = \pi_j(a_i, (b_{ik})_{k \neq i}) - \\ 0.5[\max_{\alpha_i \in A_i} \pi_j(\alpha_i, (b_{ik})_{k \neq i}) + \min_{\alpha_i \in A_i} \pi_j(\alpha_i, (b_{ik})_{k \neq i})]$$

belief of i about kindness of j towards i:

$$\lambda_{iji}(b_{ij}, (c_{ijk})_{k \neq j}) = \pi_i(b_{ij}, (c_{ijk})_{k \neq j}) - \\ 0.5[\max_{\beta_j \in A_j} \pi_i(\beta_j, (c_{ijk})_{k \neq j}) + \min_{\beta_j \in A_j} \pi_i(\beta_j, (c_{ijk})_{k \neq j})]$$

utility function:

$$U_i(a_i, b_{ik}, (c_{ijk})_{k \neq j}) = \pi_i(a_i, (b_{ik})_{k \neq i}) + \\ \sum_{j \neq i} Y_{ij} \left[k_{ij}(a_i, (b_{ik})_{k \neq i}) \lambda_{iji}(b_{ij}, (c_{ijk})_{k \neq j}) \right]$$

with Y_{ij} measuring how sensitive i is to reciprocity concerns vis-a-vis j.

sequential reciprocity equilibrium (SRE)

optimisation in all subgames $\implies$ sequential rationality

updating of perception of opponents kindness $\implies$ updating of incentives

R: set of all nodes r which are roots of subgames

$a_i(r)$: a_i, except for path to r

$A_i(r, a_i)$: set of all strategies of i, for which holds:

consistent with r

at all infosets but r and those on the path to r behavior as described by a_i

Definition: a^* is a Sequential Reciprocity Equilibrium, if for all i and all r:

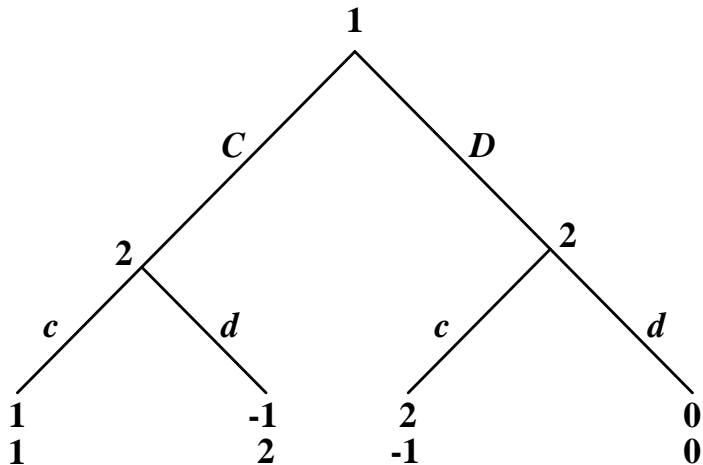1) $a_i^*(r)$ is $argmax_{A_i(r,a_i^*)} U_i(a_i, b_{ij}(r), c_{iji}(r))$

2) $a_j^*(r) = b_{ij}(r)$ for all $j \neq i$

3) $a_k^*(r) = c_{ijk}(r)$ for all $j \neq i, k \neq j$

Theorem: for all finite extensive form games an SRE exists

2.2. Examples

a) Sequential prisoners dilemma - Simple version of gift exchange game

Result 1: If player 1 defects (chooses D), player 2 also defects in every SRE.

Intuition: For any belief and second order belief of 2, D is worse for 2 than C. Hence, 2 has no incentive to forego monetary payoff in order to be kind to 1.

Result 2: If player 1 cooperates, the following holds in all SRE:

a) If $Y_2 > 1$, player 2 cooperates.

b) If $Y_2 < 0.5$, player 2 defects.

c) If $0.5 < Y_2 < 1$, player 2 cooperates with a probability of $p = \frac{2Y_2 - 1}{Y_2}$.

Intuition: for high Y_2, the nice choice of 1 is reciprocated by nice choice of 2. For low Y_2, monetary incentives dominate.

Result 3: If $Y_2 < 0.5$, defection is $1's$ unique equilibrium behavior.

Intuition: Since 2 will for sure be unkind, even a very reciprocal player 1 has no incentive to be kind to 2.

Result 4: If $Y_2 > 1$, $1's$ equilibrium behavior is characterized by one of the following three possibilities:

a) Player 1 cooperates (regardless of Y_1).

b) $Y_1 > 1$ and player 1 defects.

c) $Y_1 > 1$ and player 1 cooperates with probability $q = \frac{Y_1 - 1}{2Y_1}$.

Intuition: If 2 behaves reciprocally, there are some equilibria. 1 might cooperate for monetary and for reciprocity reasons. If Y_1 is high, there also exists an equilibrium where they get stuck in mutual distrust - selfulfilling beliefs.

b) Centipede game
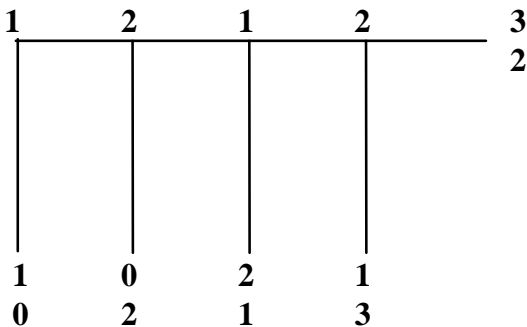
Very low reciprocity motivation: Standard solution
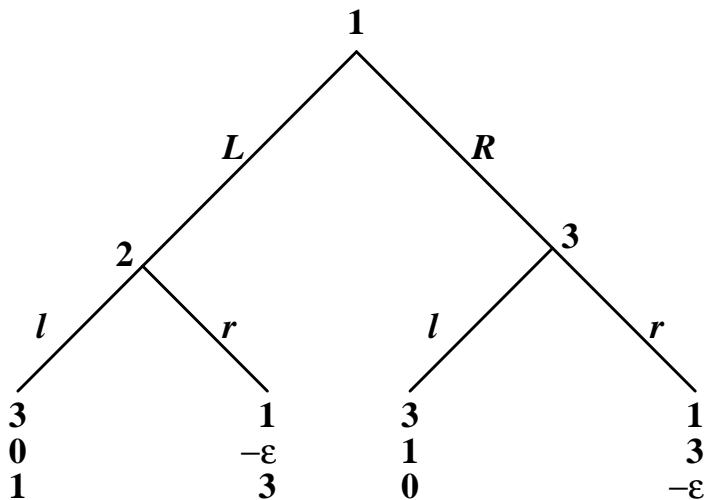High reciprocity motivation: players stay to the end
Medium range: only mixed strategy equilibria

$\implies$ in games with perfect information
pure SRE need not exist
even for generic material payoffs SRE not unique

c) So long Sucker

Player 1 gets always "punished", irrespectively of what he does.

d) Wage undercutting (D&K 2000)

Stage 1: two identical workers make simultaneously wage offers.

Stage 2: firm decides which worker to employ (at most one)

Stage 3: employed worker decides about his effort

Result: If workers are sufficiently motivated by reciprocity

a) Low wage worker shirks, high wage worker provides high effort

b) If available, firm chooses high wage worker.

This approach models only reciprocity, and does not take distributional concerns into account.

Purpose is to model a specific behavioral phenomenon in order to get a better understanding of particular economic observations (see e.g. Dufwenberg, Kirchsteiger 2000)

Models of distributional concerns and reciprocity

Falk, Fischbacher (1998)

Charness, Rabin (2002)