Lecture 2: Distributional Concerns

1. Dictator Games, Public Goods Experiments - Altruism

Dictator Game

2 persons "game"

player 1 decides unilaterally about division of amount of money c.

If players are selfish: player 1 takes c and gives nothing to player 2.

Experimental results (Forsythe et al)

player 1 gives about 20% of c to player 2

Possible interpretations

a) subjects did not understand game

b) subjects are not purely selfish

Interpretation a) not plausible

Interpretation b) explored: Altruism

Private provision of public goods (e.g. Ledyard 1995)

N : set of partipants

Simultaneous choice of distribution of endowment E on private consumption c_i and contribution to public good g_i.

payment function for player $i \in N$

$$y_i = c_i + k . \sum_{j \in N} g_j$$

with $\frac{1}{|N|} < k < 1$

Nash equil, if participants selfish: $g_i = 0$ for all i

efficient allocation: $g_i = E$ for all i

Experimental results

g_i significantly larger than zero, significantly smaller than E.

Possible Explanation: Altruism (e.g. Andreoni)

A model of Altruism

$$u_i(y_i, y_{-i}),\ \text{with}\ \frac{\partial u_i}{\partial y_i} > 0, \frac{\partial u_i}{\partial y_k} > 0 \text{ for all } k \in N \backslash \{i\}$$

Can explain results of dictator- as well as public goods game.

However: Public goods game with punishment (Fehr and Gaechter)

second stage of public goods game

g_i's made public

participants have costly opportunity to punish other player

Result: costly punishment quite frequent

Not compatible with altruism explanation.

2. Ultimatum Games - Envy

1-stage game (Gueth et all 1982)

Player 1 demands x_1 for himself, and player 2 accepts or rejects the demand

Payments:

$$\text{if the demand is accpeted:} \quad y_1 = x_1; y_2 = c - x_1$$
$$\text{if the demand is rejected} \quad : \quad y_1 = y_2 = 0$$

SPE, if both players are selfish:
player 2 accepts every demand since rejection gives him zero
player 1 demand $x_1 = c$ (or $c - \epsilon$)

Experimental Results (Güth, Schmittberger and Schwarze 1982, etc.)
On average player 2 rejects demand $x_1 > \frac{2}{3}c$.
On average player 1 demands $x_1 = 0.6c$ (Modus: $0.5c$).

Results hard to reconcile with altruism

2-stage ultimatum game with shrinking c (see Binmore et al., Güth and Tietz, Ochs and Roth, Thaler)

After player 2 rejects, he can make counterdemand x_2, and player 1 can accept or reject this counterdemand. Amount to be distributed given by dc, with $d < 1$.

SPE with selfish players:

2. stage:
player 1 accepts any demand x_2.
player 2 demands $x_2 = dc$ (oder $dc - \epsilon$)

1. stage:
player 2 accepts any demand x_1 with $x_1 \leq c - dc$
player 1 demands $x_1 = c - dc$

$\implies$ Equilibrium x_1 decreases in d.

Experimental results:

realized distribution more equal than in SPE

in both stages, too unequal proposols not accepted

x_1 decreases in d.

unfavourable counteroffers observed: $x_2 < c - x_1$

Possible interpretation of these results:

If the proposed division is too unfavorable for responder, he rejects (Bolton 1992)

Reason for rejection: Envy - earnings of others are a"bad"

A 2-players model of envy (Kirchsteiger 1994)

$$u_i(y_i, y_j), \text{ with } \frac{\partial u_i}{\partial y_i} > 0 \text{ and } \frac{\partial u_i}{\partial y_j} < 0$$

This implies:

$$u_i(0, y_j) < \; u_i(0, 0) \text{ for all } y_j > 0$$

Division where propsoser gets everything and responder nothing is worse for the responder than an allocation where both get nothing
$\Longrightarrow$ too unequal offers rejected and realized allocation more equal than with purely selfish players

'tradeoff' between own payment and preventing payment to other player $\Longrightarrow$ in 2-stage ultimatum game realized allocation depends on d.

Linear model of envy

$$u_i(y_i, y_j) = y_i - a y_j, \text{ with } 0 < a < 1$$

Stage 2: In order to make 1 accepting x_2

$$\begin{aligned} dc - x_2 - a x_2 &= 0 \quad \Longrightarrow \\ x_2 &= \frac{dc}{1+a} \end{aligned}$$

Stage 1: In order to make 2 accepting x_1

$$\begin{aligned} c - x_1 - a x_1 &= \frac{dc}{1+a} - a(dc - \frac{dc}{1+a}) \quad \Longrightarrow \\ x_1 &= \frac{c(1 - d + ad)}{1+a} \end{aligned}$$

Note that $x_2 < c - x_1$

$$\begin{aligned} \frac{dc}{1+a} &< c - \frac{c(1-d+ad)}{1+a} \iff \\ 0 &< a(1-d) \end{aligned}$$

$\implies$ Unfavorable counteroffer possible

However: Envy cannot explain results of dictator game

Results of ultimatum game can also be explained by fairness:

Responder rejects any too unfair allocation, and proposer forced to offer fair division.

Fairness also explanation for results of dictator game and public goods game

Further evidence for fairness: Investment game (Berg, Dickhaut, McCabe (1995))

3. Gift exchange game - Fairness

Fehr, Kirchsteiger, Riedl 1993, 1998, based on Akerlof 1982, and Akerlof and Yellen 1990.

3.1. Fairness and its impact on market clearing

2 stage gift exchange experiment (GEE)

STAGE 1 - ONE SIDED ORAL AUCTION MARKET

N Buyers, M sellers, $N < M$

Buyers can buy at most one unit, sellers can sell at most one unit

Market opens for three minutes. Buyers can make offers to sellers, and sellers can accept them.

If an offer is accepted, trade is conducted at proposed price p, and buyer and seller leave the market.

Unaccepted offers can always be revised.

After three minutes, market is closed.

STAGE 2

Those sellers, who sold in first stage, have to choose quality e of good. $e \in [0.1, 1]$

Quality connected with quality costs $c(e)$, with $c(0.1) = 0$, $\frac{\partial c(0.1)}{\partial e} = 0$ and $\frac{\partial c(e)}{\partial e} > 0$ for all $e > 0.1$

payments in case of trade

$$\begin{aligned} \text{seller:} \qquad & y_s = p - c(e) \\ \text{buyer:} \qquad & y_b = (100 - p)e \end{aligned}$$

in case of no trade

$$y_s = y_b = 0$$

Game played 12 (8) times (rounds)

Prediction for selfish players:

2. stage: all sellers choose $e = 0.1$

1. stage: no game theoretic solution for one sided oral auction, but market clearing equilibrium due to excess supply: $p^* = 0 \implies$

$$y_s^* = 0; \quad y_b^* = 10$$

Control experiment (CE)

only stage 1, i.e. one sided double auction, with same subjects

realized price p_c

payments in case of trade

$$\text{seller:} \quad y_s = p_c$$
$$\text{buyer:} \quad y_b = 36 - p_c$$

in case of no trade

$$y_s = y_b = 0$$

Market clearing equilibrium:

$$p_c^* = 0$$

To compare results of GEE with those of CE:

relative overpayment in GEE $r = \frac{p}{100}$

relative overpayment in CE $r_c = \frac{p_c}{36}$

Experimental results:

1) The realized prices are significantly above the market clearing level. Furthermore, relative overpayment larger in GEE than in CE.
Average relative overpayment

$$r = 0.45; \;\; r_c = 0.14$$

2) In all cases when a seller did not trade in a round of GEE, the lowest realized r_c he has accepted in CE was lower the average r realized in that round of GEE.

3) Quality is significantly above 0.1
average quality 0.37; $e > 0.1$ in 76% of all cases

4) Quality is strictly increasing in p.
Tobit regression:

$$e = a + bp + \epsilon$$

b significantly positive
Problem with this regression: Independence of Observations $\Longrightarrow$

Spearmans rank correlation test for individual sellers:
about 75% of the sellers show strictly positive correlation between p and e

5) Whenever $p < 25$, $e = 0.1$

Are the results an indication of fairness?

Are those sellers, who did not trade, worse off than trading sellers? Is there a failure of the market to clear?

3. 2. A fairness model

Basic Assumptions

A1) Preferences of subjects defined over $\mathbb{R}^2$ - Each subject has preferences not only over own payment, but also over payment to the other trader.

A2) Preferences are complete, transitive, and continuous. The resulting utility function $U_i(y_i, y_j)$ is differentiable (Differentiability just for ease of exposition)

A3) $\frac{\partial U_i(y_i, y_j)}{\partial y_i} > 0$

A4)
i) If $\frac{\partial U_i(y_i, y_j)}{\partial y_j} > 0$, then $\frac{\partial U_i(y_i', y_j')}{\partial y_j} > 0$ for all $y_i' > y_i$, $y_j' < y_j$.
ii) If $\frac{\partial U_i(y_i, y_j)}{\partial y_j} < 0$, then $\frac{\partial U_i(y_i', y_j')}{\partial y_j} < 0$ for all $y_i' < y_i$, $y_j' > y_j$

Under A1-A4, 4 types are possible:

S(elfish): $\frac{\partial U_i(y_i,y_j)}{\partial y_j} = 0$ for all (y_i, y_j)

A(ltruist): $\frac{\partial U_i(y_i,y_j)}{\partial y_j} > 0$ for all (y_i, y_j)

E(nvious): $\frac{\partial U_i(y_i,y_j)}{\partial y_j} < 0$ for all (y_i, y_j)

F(air): $\frac{\partial U_i(0,10)}{\partial y_j} \leq 0$ and $\frac{\partial U_i(100,0)}{\partial y_j} > 0$

Which type is consistent with data?

For S and E types it holds:

$$U_i(p, (100-p)0.1) > U_i(p - c(e), (100-p)e) \text{ for all } e > 0.1$$

$\implies$ S and E types not compatible with e > 0.1

For A types there exists an $\epsilon > 0$ such that for all p:

$$U_i(p - c(0.1 + \epsilon), (100 - p)(0.1 + \epsilon) > U_i(p, (100 - p)0.1)$$

$\implies e = 0.1$ when $r < 0.25$ is not compatible with A

F type compatible - results indication for fairness:
If own income high and that of other low, income of other regarded as good. If own income low and that of others high, income of other regarded as a "bad"

Is there involuntary rationing?

Define reservation overpayments r_r, r_{cr} as minimal $r's$ such that:

$$\begin{aligned} U_i(100r_r, 100(1 - r_r)0.1) &= U_i(0, 0) \\ U_i(36r_{cr}, 36(1 - r_{cr})) &= U_i(0, 0) \end{aligned}$$

Obviously, whenever $r_r > 0$,

$$\frac{\partial U_i(100r_r, 100(1-r_r)0.1)}{\partial y_j} < 0$$

Since $100r > 36r$ and $100(1-r)0.1 < 36(1-r)$, it holds that

$$U_i(100r_{cr}, 100(1-r_{cr})0.1) > U_i(36r_{cr}, 36(1-r_{cr})) = U_i(0,0)$$

Hence, $r_{cr} > r_r$: the reservation overpayment of in CE is an upper bound for the reservation overpayment of GEE. $\Longrightarrow$

If observed r strictly larger than observed r_c, i.e. if $r > r_c \geq r_{cr} > r_r$, then in GEE a non-trading seller would prefer to trade at r instead of non-trade. $\Longrightarrow$

observed non-trade implies involuntary rationing - non-market clearing.

Special case of this model of fairness for N-persons games:

Fehr, Schmidt 1999 (FS)

$$U_i = y_i - \frac{\alpha_i}{|N|-1}\sum_{j\neq i} max(y_j - y_i, 0) - \frac{\beta_i}{|N|-1}\sum_{j\neq i} max(y_i - y_j, 0)$$

with $\beta_i < \alpha_i, \beta_i < 1$.

This model special case of the F-type of previous model, when restricted to two person games

FS use this special utility function to estimate the distribution of parameters α_i, β_i.

Results of Ultimatum games, Public good games, Dictator games, GEE and some other games consistent with this estimation.

Similar model - Bolton, Ockenfels 2000 (BO)

$$
\begin{aligned}
U_i(y_i, \sigma_i) \text{ with } \sigma_i &= \frac{y_i}{\sum_{j \in N} y_j}, \\
\frac{\partial U_i(y_i, \sigma_i)}{\partial y_i} &> 0 \\
\frac{\partial U_i(y_i, \sigma_i)}{\partial \sigma_i} &> 0 \text{ whenever } \sigma_i < \frac{1}{|N|} \\
\frac{\partial U_i(y_i, \sigma_i)}{\partial \sigma_i} &< 0 \text{ whenever } \sigma_i > \frac{1}{|N|}
\end{aligned}
$$

BO show that a particular parametrisation of this model is consistent with the results of several experiments, including ultimatum games, dictator games, GEE and some other games

Personal opinion - Problematic approach because

not general models of human behavior (of course); easy to find experimental results that contradict pure fairness (see e.g. Lecture 4)

linear structure of utility has no meaning in terms of preferences

constancy of parameters even more questionable - why should 50-50 be always regarded as fair?

$\Longrightarrow$ Relevance of very specific and parametrized models for "real" world very questionable, even if such a specific model can replicate results of several experiments.

Basic question: What is the status of behavioral models?

2 possible answers:

general model of human behavior: in my view not feasible

modeling of specific behavioral phenomena in order to get a better understanding of particular economic phenomena.