

Models of Behavioural Economics

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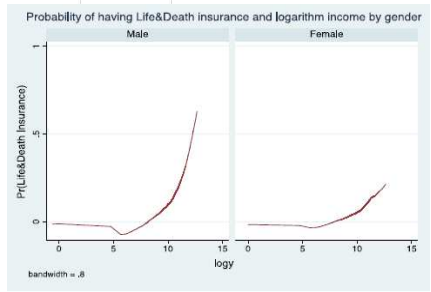
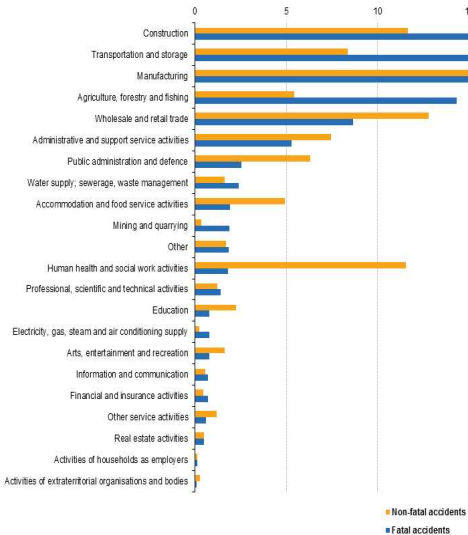
Rational decisions

- Traditional economics believes that people are rational, that is make decisions maximizing their utilities, that is their material gains.
- This view is inconsistent with evidence: people commit '*irrational*' actions, even when stakes are real and high.
- Behavioural economics models try to rationalize and explain these decisions using traditional economics approach: people maximize extended utility functions.

Example 1: Miners

Why people who take the most risky jobs are *not* among the most active buyers of insurance policies?



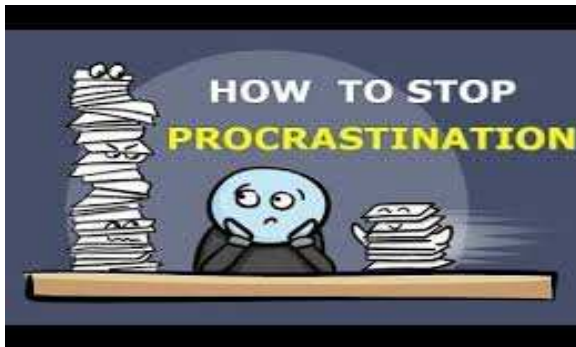


Source: Luciano, Outreville, Rossi, 2015

Note: Provisional.

Eurostat, 2014

Example 2: Procrastination



Can anything be done with it?

Behavioural Responses

- Life insurance**
1. Cognitive dissonance (Festinger, 1957)
 2. Self-image and self-identity (Akerlof and Dickens, 1982)
- Procrastination**
1. Multiple selves (Elster, 1985)
 2. Nudges (Thaler, 2015).

Мы и наши решения



Ultimatum and dictator games: results

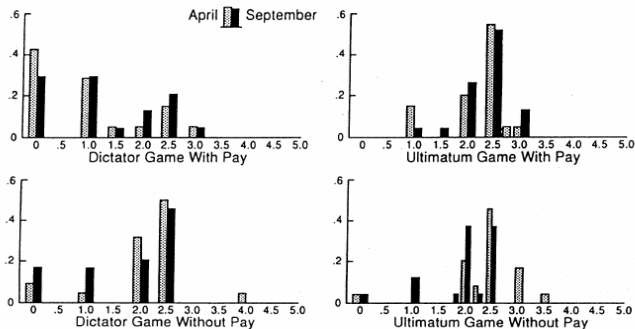


Figure 4.4. Offers in dictator and ultimatum games. *Source:* Forsythe, Horowitz, Savin, and Sefton 1994.

In practice, modal offers in UG are 40 to 50%, mean offers 30 to 40% and offers less than 20 are rejected 80% of the time, so there is almost no offers below 20 and above 50.

Ultimatum game: robustness

- Larger pie size does not affect salience, as the game is simple, but amount of rejection goes up and percentage of rejections decrease with stake (5 of 50 is more likely to be rejected than 10 of 50; 10 of 50 is more likely to be accepted than 1 of 10 — Camerer Hogarth, JRU 1999).
- Experience of subjects (repetitions) result in slight decrease of offers and rejections (Slonim Roth, Em 1998; List Cherry, EE 2000).
- Race matters: black people offer more and reject more (Eckel and Grossman, EI 2001).
- Culture matters: people in developing countries typically offer less (30 to 40%), but reject even less (Henrich e.a, AER 2002; Roth e.a., AER 1992).
- Dictator games: mean offer 10 to 30%, which implies that positive offers are not exclusively strategic (Forsythe e.a, GEB 1994)
- yet systematically lower offers than in ultimatum game suggests that both altruism and fear of rejection play role

How can this be explained?

An Experimentalist's digression

What causes deviations of behaviour from prediction in experimental games?

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Equilibrium People don't play Nash, esp. in single-shot games.

Utility People maximize not material payoffs, but true utility that we don't observe.

Inequity aversion (Fehr Schmidt, QJE 1999)

Inequity aversion theory stipulates that people, in addition to material gain, 1) dislike inequitable outcomes (both favourable and unfavourable, but 2) dislike inequity that is unfavourable to them to a higher extent than the one which favours them. Formally, for n players, utility of player i is:

$$u_i(x) = x_i - \frac{\alpha_i}{n-1} \sum_{j \neq i} \max(x_j - x_i, 0) - \frac{\beta_i}{n-1} \sum_{j \neq i} \max(x_i - x_j, 0) \quad (1)$$

where $\beta_i \leq \alpha_i, \beta_i \in [0, 1)$. The first term is monetary payoff, the second measures utility loss from disadvantageous inequality, the third one accounts for loss from advantageous inequality.

For two players, this is

$$u_1(x) = x_1 - \alpha_1 \max(x_2 - x_1, 0) - \beta_1 \max(x_1 - x_2, 0) \quad (2)$$

Explanation to ultimatum game

An inequity aversion equilibrium in games with known $\alpha_1, \beta_1, \alpha_2, \beta_2$ in dominant strategies is defined as follows:

- any offer $s \geq 0.5$ is accepted by the responder,
- offers $s < s'(\alpha_2) \equiv \alpha_2 / (1 + 2\alpha_2) < 0.5$ are rejected; offers $s > s'(\alpha_2)$ are accepted by the responder as well.
- Proposer who knows responder's preferences will offer
 - $s^* = 0.5$ if $\beta_1 > 0.5$,
 - any $s \in [s'(\alpha_2), 0.5)$ if $\beta_1 = 0.5$,
 - $s'(\alpha_2)$ if $\beta_1 < 0.5$.

The equilibrium is found following the usual logic of Nash equilibrium, assuming both players strive to maximize the utility function stipulated by (11), and that all parameters and solution concepts are common knowledge.

Proof for those interested: According to (11), utility for the sender (1) and receiver (2) is

$$u_1(1-s) = 1-s - \alpha_1 \max(s - (1-s), 0) - \beta_1 \max((1-s) - s, 0) \quad (3)$$

$$u_2(s) = s - \alpha_2 \max((1-s) - s, 0) - \beta_2 \max(s - (1-s), 0) \quad (4)$$

If $s \geq 0.5$, utility of Receiver who accepts (4) is $u_2 = s - \beta_2(2s - 1) > 0$ always, as long as, by assumption, $\beta_2 < 1$, so this is better than rejection with $u_2 = 0$. If $s < 0.5$, then (4) is $u_2 = s - \alpha_2(1 - 2s)$, which has to be greater than 0 if the receiver is to accept s . From this condition, the acceptance threshold s' is given by

$$s - \alpha_2(1 - 2s) = 0 \Leftrightarrow s'(1 + 2\alpha_2) = \alpha_2 \Leftrightarrow s' = \frac{\alpha_2}{1 + 2\alpha_2} < 0.5.$$

Sender, knowing that any offer $s \geq 0.5$ will be accepted, shall never offer $s > 0.5$, as this will strictly decrease (3). If $\beta_1 > 0.5$, then for any $s'' \leq 0.5$, $u_1 = 1 - \beta_1 + s''(2\beta_1 - 1)$ has the last summand positive, so (3) strictly increases in s'' , and it is optimal to set $s = 0.5$. In this case, high β implies the sender weights heavily receiver's welfare. By contrast, if $\beta_1 < 0.5$, the opposite is true for $s'' \leq 0.5$, but if $s'' \leq s'$, the sender knows the receiver is going to reject, hence to maximize own payoff, the sender sets $s'' = s'$. Finally, if $\beta_1 = 0.5$, then $u_1 = 0.5$ as long as the sender accepts, which is true for any $s \in [s', 0.5]$. \square

Tests of inequity aversion

List (JPE 2007) studies dictator game (Forsythe et al., 1994) in the following version. All players receive \$5 and are randomly split into pairs, and then Senders receive additional \$5 (in total, \$10) which they could divide with Receivers, so that the fair division would be \$7.5. The following treatments were implemented:

Baseline : Senders can split their extra \$5 at their discretion between themselves and their unknown match (receiver).

Take \$1: As above, plus Senders have an option to take \$1 off their Receiver's endowment.

Take \$5: As in the baseline, plus Senders may take from the Receivers anything from 0 to \$5.

Earning: Same as Take \$5, but both players have earned their amounts of \$10 and \$5, respectively, in a simple 30-min. job tasks (sorting mails).

Tests of inequity aversion: alternatives matter

Essentially, the four treatments are different frames which should not affect actions of inequity-averse Senders. The following table from List (2007) reports net (giving plus reducing, whenever available) sharing of the Senders.

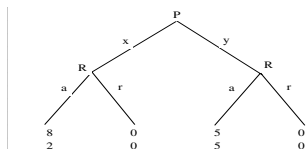
Treatment (<i>N</i>)	Rate of Positive Offers	Median Offer	Mean Offer	Average Positive Offer*
Baseline (24)	.71	\$1.00	\$1.33	.38
Take (\$1) (46)	.35	\$0.00	\$0.33	.31
Take (\$5) (50)	.10	-\$4.50	-\$2.48	.42
Earnings (47)	.06	\$0.00	-\$1.00	.40

* Reported as a percentage of the total amount available in the allocation decision (average positive offer ignores zero and negative offers).

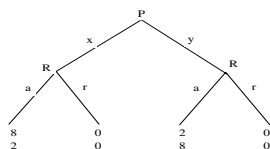
If inequity were the motive, there should be no difference between the treatments with and without deduction opportunity. Since it exists, there must be something beyond inequity.

Ultimatum games: reasons

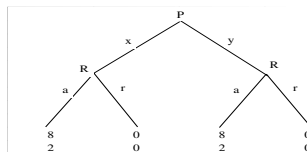
Falk Fehr Fischbacher, EI 2003 look at the rationale behind inequity aversion by comparing the following games:



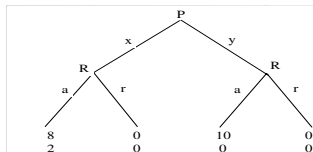
(a) (5/5)-game



(b) (2/8)-game

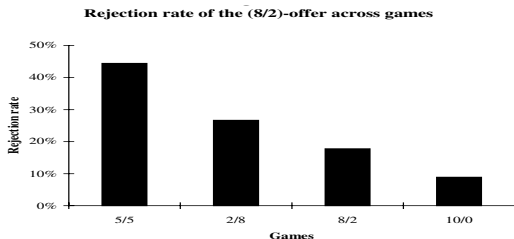


(c) (8/2)-game



(d) (10/0)-game

Ultimatum games: reasons



5/5 treatment: offer of 8/2 is rejected as unfair, revealing unduly selfishness of the Sender.

2/8 treatment: rejecting of 8/2 in this case reveals (perhaps too) high expectations of the Receiver.

8/2 treatment: canonical ultimatum with 20% rejection rate.

10/0 treatment: offer of 8/2 is generous in this case, so its rejection is exceptional.

Large rejections of unfair offers mean people don't like selfish intentions.

Critique: Binmore and Shaked, JEBO 2010

Ken Binmore and Avner Shaked, in a paper circulated since 2003, put under scrutiny this claim. The reasons were

- No (known) empirical way to estimate α and β
- Fitting these parameters to data, ad hoc to specific tasks (ultimatum, public goods with and without punishment etc).
- Original causal meaning of parameters was later (Em, 2007) interpreted as descriptive.
- Alleged insistence on descriptive validity which is not proven empirically.

Other behavioural theories

ERC (equity, reciprocity and competition — Bolton and Ockenfels, AER 2000) equilibrium in the fashion of inequity aversion but defined in relative rather than absolute payoffs.

Psychological games (Geanakoplos Pearce Stacchetti, GEB 1989) Generally, payoffs in the game depend not only on material gains but also, explicitly, on expectations of the other's behaviour, which in equilibrium have to be correct.

Fairness (Rabin, AER 1993) equilibrium is a constellation of fair outcomes defined in terms of what people expect from the other's actions.

Reciprocity (Falk and Fischbacher JEBO 2006) fair outcomes depend on perceived fairness and kindness, which in equilibrium must coincide with actions.

All these theories attempt to capture various features of attitudes towards others.

Behavioural Economics Approach to Decision Making

Rationality People are rational, but preferences for more money = maximum of individual *utility function*.

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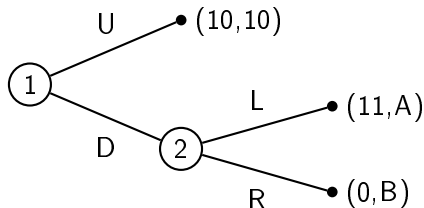
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Positive theory Assumptions of the theory do not matter: what matters is the quality of its predictions.

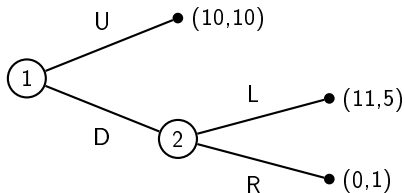
Psychological games: Geanakoplos Pearce Stacchetti, GEB 1989

They derive payoffs in games directly as function of beliefs that can be justified (or not). E.g., in a psychological trust game, player 1 cares only about physical outcomes, while utilities of player 2 also depend on her prior expectations:

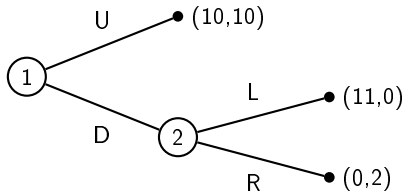


Psychological games

If player 2 expects player 1 to play D and this is what 1 really does, then expectations of player 2 are met, in which case $A = 5$, $B = 1$, and player 2 chooses the equilibrium (D, L) .



But if 2 believes 1 will play D, but player 1 chooses U, player 2 is disappointed, and has $A = 0$, $B = 2$, leading to the equilibrium profile (U, R) .



Lies in disguise (Dufwenberg and Dufwenberg, 2018)

People don't like to lie, esp. when they expect that other people will learn about that

$$U(y|x) = Ty - \theta \sum_{x' \neq y} p(x'|y) T|y - x'| \quad (5)$$

x — true outcome, y — reported outcome, T — gain per unit, $p(x|y)$ — perceived probabilistic belief of the reporter that his observer believes the true outcome is x given her report is y , θ — sensitivity to observer's opinion. In sequential equilibrium, the strategy $s(x)(y)$ is independent on x , and stipulates cheating over $y > x$ for all $\theta > \hat{\theta}$.

Size of lies model (Gneezy Kajaskaite Sobel 2017)

$t \in (0, T)$ — type of the player, or *constant* cheating costs

$i \in [1, \dots, N]$ — states of the world, independent of one's type

$s(j|i, t)$ — strategy, or reported state j given the true state i and type t .

v_j — personal gain of miscommunication of true j ($v_j > v_i$).

$C(j, i, t)$ — direct cheating costs, assumed linear $t + c(i, j)$.

$\gamma_{ij}(s)$ — social identity with weight β .

Utility function

$$U(s) = v_j - t - c(i, j) + \beta \gamma_{ij}(s) \quad (6)$$

Equity, Reciprocity, Competition (ERC): Bolton Ockenfels, AER 2000

ERC is a theory based on relative payoffs (instead of absolute, as in inequity aversion). Player's individual utility depends on

$$u_i(x) = u \left(x_i, \frac{x_i}{\sum_{k=1}^n x_k} \right) \quad (7)$$

and players strictly prefer the equal division: $u'_2(\cdot, \cdot) = 0$, $u''_{22} < 0$

Fairness: Rabin, AER 1993

Matthew Rabin (1999) models intentions explicitly by defining

- a_1 be the strategy of player 1 in two-player games (symmetrically for 2).
- b_2 be beliefs of 1 about what the opponent 2 will do.
- $\pi_2^{\max}(b_2)$ and $\pi_2^{\min}(b_2)$ be maximum and minimum payoffs player 2 can get, as judged by player 1.
- π_2^f be fair payoff of player 2, equal to the average between max and min payoffs of player 2, again judged by player 1.
- $\pi_2(a_1, b_2)$ be the payoff of player 2 if player 1 does a_1 and believes that player 2 will behave according to b_2
- c_2 be beliefs of 1 about what the beliefs of 2 are about 1's actions.

Then define kindness of 1 to 2 as

$$f_1(a_1, b_2) = \frac{\pi_2(b_2, a_1) - \pi_2^f(b_2)}{\pi_2^{\max}(b_2) - \pi_2^{\min}(b_2)} \quad (8)$$

and perceived (by 1) kindness of 2 to 1 as

$$\tilde{f}_2(c_1, b_2) = \frac{\pi_1(b_2, c_1) - \pi_1^f(c_2)}{\pi_1^{\max}(c_1) - \pi_1^{\min}(c_1)} \quad (9)$$

Fairness: model development

Social preferences of player 1 are

$$u_1(a_1, b_2, c_1) = \pi_1(a_1, b_2) + \alpha \tilde{f}_2(c_1, b_2) \cdot [1 + f_1(b_2, a_1)] \quad (10)$$

which captures preferences towards own monetary gain, perceived kindness of the other player, and interaction of this perception and own kindness, all taken with kindness weight against money, α .

In a fairness equilibrium, all $a_i = b_j = c_i$, and $a_i \in \arg \max_a u(a, b_j, c_i), \forall i, j$

For example, the prisoners' dilemma with fairness components, where

$$f(\cdot) = \tilde{f}(\cdot) = \frac{4 - (4-0)/2}{4-0} = \frac{1}{2}$$

1 \ 2	C	D
C	$4 + \alpha 0.75, 4 + \alpha 0.75$	$0 - 0.5\alpha, 6$
D	$6, 0 - 0.5\alpha$	$0, 0$

effectively becomes a coordination game.

Dufwenberg and Kirscheteiger (1998) extend this framework to extensive-form games.

Reciprocity: Falk Fishbacher, GEB 2006

Theory which conjectures preferences for reciprocity in terms of two related feelings: 1) perceived kindness of one's actions, ϕ , and 2) behavioural reaction to these actions of the opponent (reciprocation, σ). In turn, *kindness* as measure of generosity of player j as it is perceived by player i , depends on two factors: *outcome* Δ_j for the player j as perceived by the player i , and *intention* factor θ , which depends on the alternatives available to player i . Overall kindness of the action is set to be

$$\phi_j(n, s_i'', s_j') = \theta_j(n, s_i'', s_j') \cdot \Delta_j(n, s_i'', s_j')$$

where n is node in a game, s_j' is the belief of player i about the strategy of player j , and s_i'' is the belief of player i about the belief of player j as to which strategy player i will choose, i.e. i 's belief about s_j' . The other term is *reciprocation*, defined as

$$\sigma_i(n + f, r, s_i'', s_j') = \pi_j((n + f, r), s_i'', s_j') - \pi_j(n, s_i'', s_j')$$

where $n + f$ is terminal node and r is payoff at that node. Overall, the expected utility of an action is

$$U_i(n + f) = \pi_i(n + f, r) + \rho_i \sum_{n \rightarrow f} \phi_j(n, s_i'', s_j') \sigma_i(n + f, r, s_i'', s_j')$$

where $\pi_i(n + f)$ is the material payoff at the terminal node, the sum term captures the effects of kindness and reciprocation, and $\rho_i \in [0, 1]$ is a reciprocity parameter, fixed for a given individual.

Поведенческие модели

Несклонность к неравенству Fehr and Schmidt (1999)

$$u_i(x) = x_i - \frac{\alpha_i}{n-1} \sum_{j \neq i} \max(x_j - x_i, 0) - \frac{\beta_i}{n-1} \sum_{j \neq i} \max(x_i - x_j, 0) \quad (11)$$

Несклонность к чувству вины Battigali and Dufwenberg (2009)

$$u_1(z, \alpha_2) = \pi_1(z) - \theta_1 \max(0, E_{\alpha_2} \pi_2 - \pi_2(z)) \quad (12)$$

Взаимообразность Falk and Fischbacher (2006)

$$U_i(n+f) = \pi_i(n+f, r) + \rho_i \sum_{n \rightarrow f} \phi_j(n, s_j'', s_j') \sigma_i(n+f, r, s_j'', s_j') \quad (13)$$

Как тестировать такие теории? (Binmore and Shaked, 2003)

- Как оценивать параметры моделей?
- Что можем мы знать про связь *реальных мотивов* с их *названиями* .
- Для реальных людей *правила* принятия решений важнее *результатов* — но про последние мы знаем гораздо больше, чем про первые.
- *Простые* объяснения, как правило, точнее и надежнее сложных.

Спасибо за внимание!

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