(Behavioral) Decision Making

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Bojos per l'Economia! 2024

Introduction

- Economics is built on the basis of a model of individual behavior
  - The atom in economics is the individual
  - Starting from a model of individual behavior, economics studies topics as diverse as industrial organization, financial markets, the monetary system, economic development, social choice, political economy, etc.

Outline

Part I: Rational model of choice

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- It should be falsifiable
  - We should be able to empirically falsified its predictions

Rational model of choice

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$$\max_{x \in A} U(x)$$

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- A: set of available alternatives at the time of deciding
- U: utility function, $U : X \to \mathbb{R}$, represents the preferences of the individual over all the possible alternatives X

$$U(x) \geq U(y) \Leftrightarrow xPy$$

- max: the individual seeks the best interests that she can attain, given her own view on them

Rational model of choice (2)

$$\max_{x \in A} U(x)$$

- It respects the preferences of the individual (U), and it is difficult to conceive a simpler, more practical and operational mathematical representation of individual preferences
- It guides on how choices should be optimally made (max), given the preferences of the individual and the restrictions
- It has sound mathematical foundations, as we will discuss next
- Is it a good description of actual individual behavior? This is an empirical question we will address in the second part of this lecture

Principles of rationality

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Transitivity:

IF [xPy and yPz] THEN

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Principles of rationality

Transitivity:

IF $[xPy$ and $yPz]$ THEN $[xPz]$

Completeness:

For every $x, y \in X$ either $[xPy]$ or $[yPz]$ or both

A representation theorem

A representation theorem

Theorem:

Let X be a finite set of alternatives. Preferences P on X satisfy Transitivity and Completeness if and only if there exists a utility function U that represents P.

Prominent Economic Domains

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- Time: $x = (t_1, \ldots, t_n; y_1, \ldots, y_n)$
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    $U_{ed}(y, t) = \delta^{t_1} u(y_1) + \cdots + \delta^{t_n} u(y_n)$

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- Others: strategic situations, distributive preferences, ambiguity, etc.

Wrap up Part I: Rational model of choice

- Elegant, simple model of individual decision-making
- Well founded mathematically
- Portable to very diverse situations
- Positive and normative considerations
- Empirically valid?

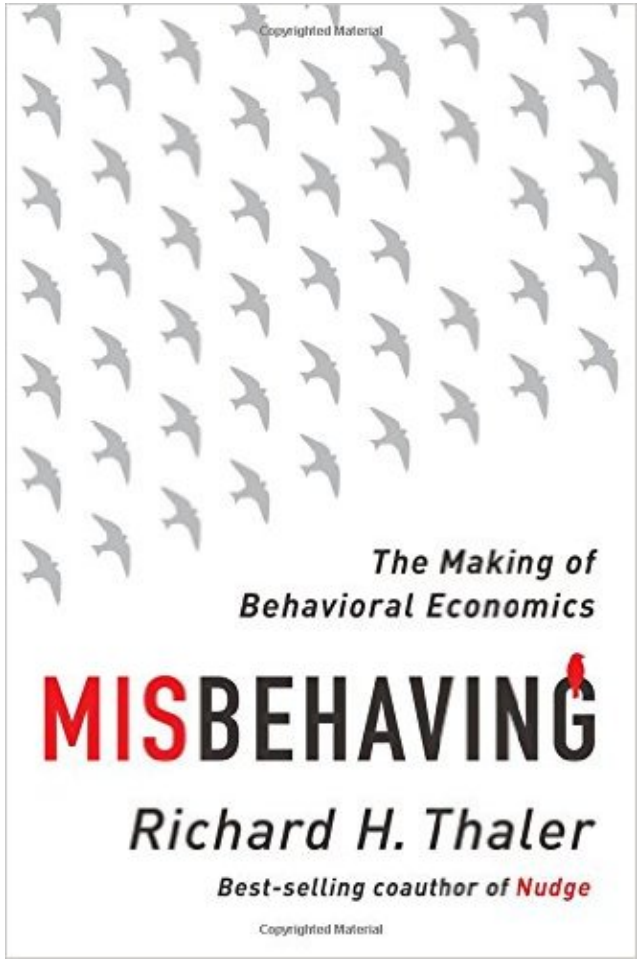
Part II: Behavioral economics

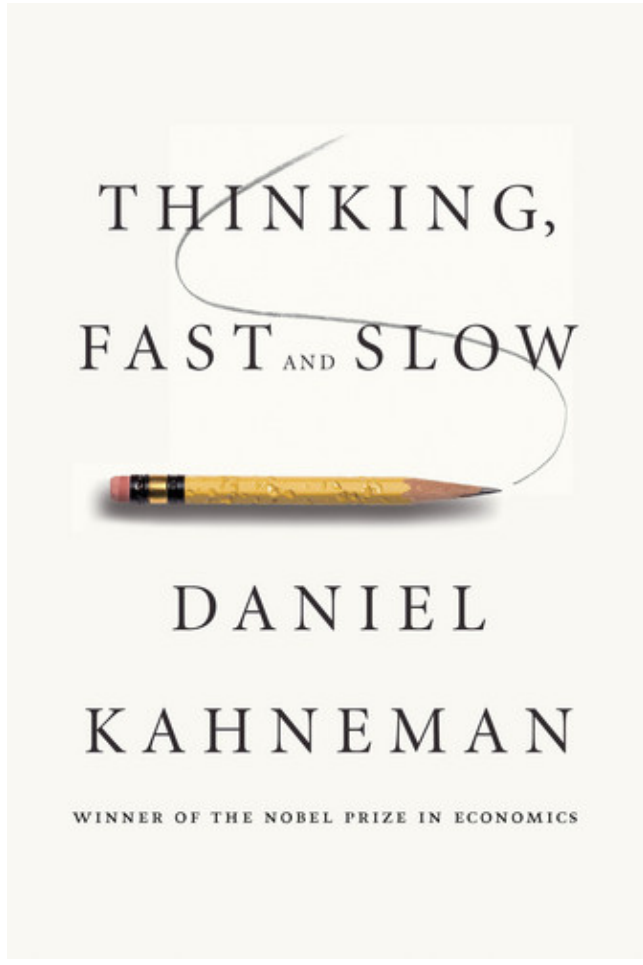
Psychology and Economics

$$\max_{x \in A} U(x)$$

- There is very little psychology in this model
- The three main elements of the model, U, A, and max, are being challenged empirically
- Ultimate aim: to offer operational models of individual behavior, with sound psychological foundations
- Tools, approaches:
  - As in the rational economic model of choice: sound mathematical foundations
  - Empirical and experimental approaches
  - Learn from neighboring sciences: (Cognitive) Psychology, Sociology, Neurosciences, Biology, Computer Science,...

Recommended readings





Experimental Economics

Experimental Economics

- A controlled situation in which individuals take actions according to some pre-specified rules which determine their payoffs.
- Random assignment to treatment and control: causality
- Treatment and control should differ in just one dimension: avoid confounds
- Voluntary participants, economically incentivized

Prospect Theory

Prospect Theory

- Kahneman and Tversky (1979, Econometrica): one of the most cited papers in the history of all the social sciences
- One of the very first models that incorporates psychological phenomena into a model of decision-making, in the spirit of economic modelling
- Represents the start of behavioral economics
- Still today a very active research topic, both theoretically and empirically

Asian disease

Asian disease

- Imagine the Government is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.
  - Program A: 200 people will be saved.
  - Program B: there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved.

Asian disease (2)

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- Imagine the Government is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed.
  - Program A: 400 people will die.
  - Program B: there is 1/3 probability nobody will die, and 2/3 probability that 600 people will die.

Asian disease (3)

- Results
  - Presentation 1: program A chosen by 72% of subjects (out of 152).
  - Presentation 2: program A chosen by 22% of subjects (out of 155).

Experiment: Lottery choices

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- Scenario 1: In addition to whatever you own, you have been given 1000. You are now asked to choose between receiving 500 for sure or 1000 with probability 0.5.

Experiment: Lottery choices (2)

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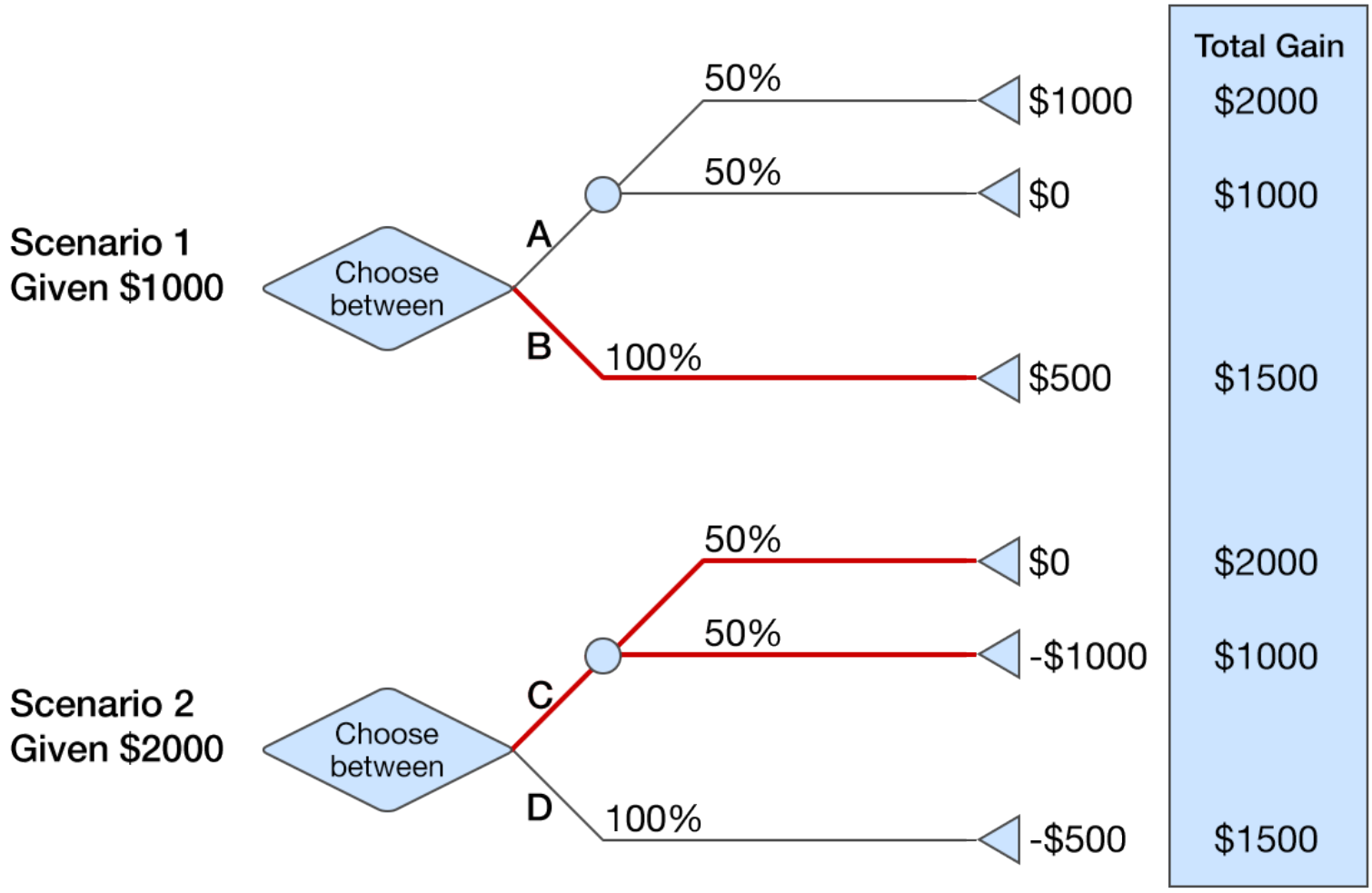
- Scenario 2: In addition to whatever you own, you have been given 2000. You are now asked to choose between losing 500 for sure or 1000 with probability 0.5.

Experiment: Lottery choices (3)

- Scenario 1: In addition to whatever you own, you have been given 1000. You are now asked to choose between receiving 500 for sure or 1000 with probability 0.5. [16% choose the lottery]
- Scenario 2: In addition to whatever you own, you have been given 2000. You are now asked to choose between losing 500 for sure or 1000 with probability 0.5. [69% choose the lottery]

Experiment: Lottery choices (3)



Behavioral concept 1: Framing

- The precise presentation of the decision problem may matter, to a large degree.
- Framing the situation in terms of either gains or losses affect behavior in very particular ways:
  - Gains: induce risk aversion
  - Losses: induce risk loving

Behavioral concept 2: Loss aversion

- People are much more sensitive to losses than to gains of the same magnitude, and are willing to take more risks to avoid losses
  - Experiments with monkeys

Experiment: Valuation of goods

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- 50% of subjects are randomly allocated an object, a coffee mug
- The other half is allocated no object
- Ask for their evaluation of subjects (WTP/WTA)

Experiment: Valuation of goods (2)

- 50% of subjects are randomly allocated an object, a coffee mug
- The other half is allocated no object
- Ask for their evaluation of subjects (WTP/WTA)
- Results:
  - First group, with the coffee mug (WTA): \$5.25
  - Second group (WTP): \$2.25

Experiment: 401(k) plans

- Most important retirement income after social security in the US
- Variation of enrollment into a plan in a given company:
  - Automatic, by default, to a given plan
  - Active choice of plan, from a menu of possible plans

Experiment: 401(k) plans (2)

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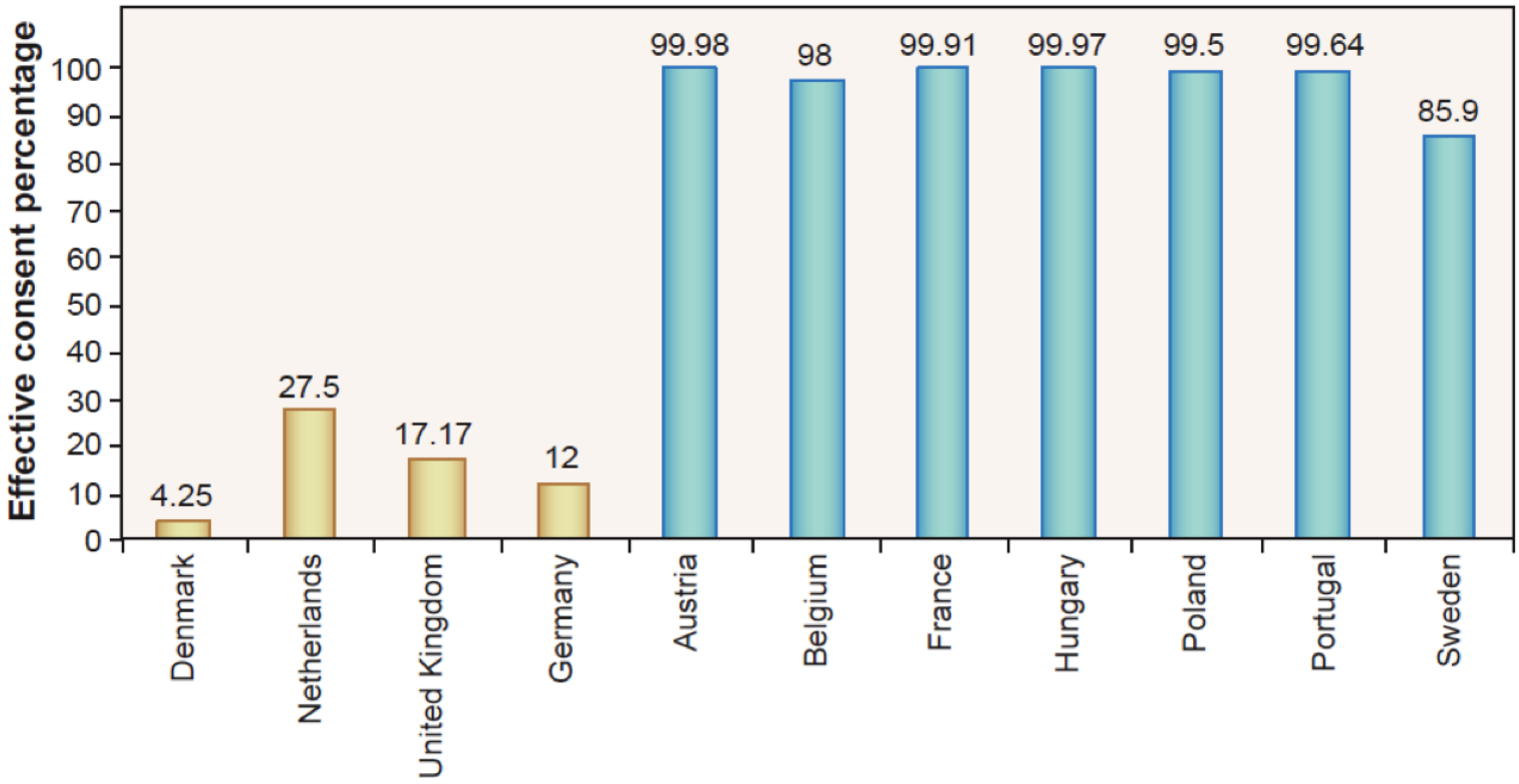
- Variation of enrollment into a plan in a given company:
  - Automatic, by default, to a given plan
  - Active choice of plan, from a menu of possible plans
- Results: automatic enrollment has a 50% higher enrollment rate

Empirical finding: Organ donations



Effective consent rates, by country. Explicit consent (opt-in, gold) and presumed consent (opt-out, blue).

Behavioral concept 3: Default Effects/Status Quo Bias

- The default option is the option the chooser will obtain if he or she does nothing
  - (e.g., the coffee mug, the pension plan, automatic organ donation)
- Defaults affect human choice:
  - People tend to evaluate more highly default options than other options, even when the default has been randomly allocated
    - Experiments with monkeys

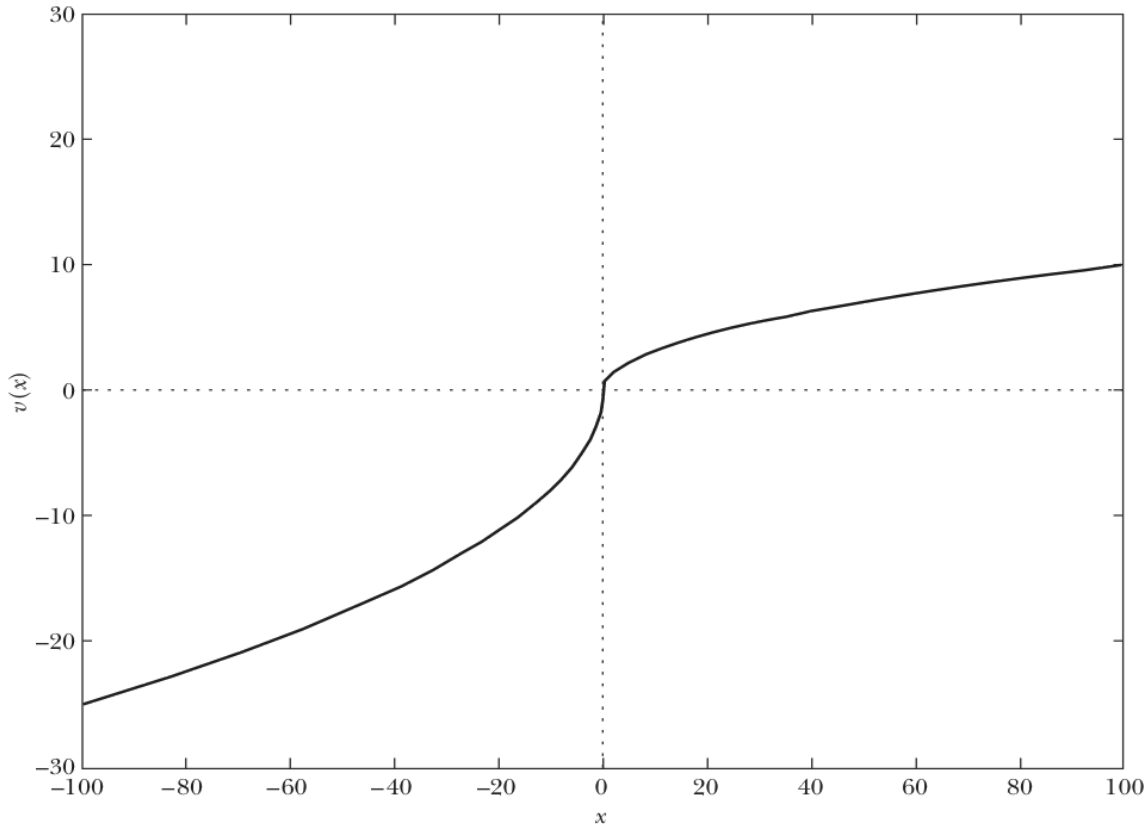
Behavioral concept 3': Reference points

- The default option acts as a behavioral reference point to which the other options are compared:
  - What matters are local comparisons with respect to the reference point, not global comparisons
  - People care about changes not levels

Behavioral concept 4: Diminishing sensitivity

- People's sensitivity to further changes in an outcome is smaller for outcome levels that are further away from the reference point.
- Diminishing sensitivity reflects a fundamental feature of human cognition.
  - For example, a change from getting $0 to getting $10 feels greater than a change from getting $1,000 to getting $1,010.
  - Similarly, a change from getting $0 to getting $-10 feels greater than a change from getting $-1,000 to getting $-1,010.

Behavioral Concepts 1-4: The Value Function



Notes: The graph plots the value function proposed by Tversky and Kahneman (1992) as part of cumulative prospect theory, namely $v(x) = x^{\alpha}$ for $x \geq 0$ and $v(x) = -\lambda(-x)^{\alpha}$ for $x < 0$, where x is a dollar gain or loss. The authors estimate $\alpha = 0.88$ and $\lambda = 2.25$ from experimental data. The plot uses $\alpha = 0.5$ and $\lambda = 2.5$ so as to make loss aversion and diminishing sensitivity easier to see.

More Lottery Choices

- Choose one of the following two lotteries:
  - A: A .001 probability of winning $5000.
  - B: A 100% chance of winning $5.
- Choose one of the following two lotteries:
  - A: A .001 probability of -$5000.
  - B: A 100% chance of -$5.

More Lottery Choices (2)

- Choose one of the following two lotteries:
  - A : A .001 probability of winning \$5000. [72%]
  - B : A 100% chance of winning \$5. [28%]
- Choose one of the following two lotteries:
  - A : A .001 probability of -\$5000. [17%]
  - B : A 100% chance of -\$5. [83%]

Overweight of low probability effects: people like both lotteries and insurance

Behavioral Concept 5: Probability weighting

- Measuring how people weight probabilities:
  - Steepness at 0: overweighting of small probabilities.
  - Steepness at 1: certainty effect.
  - Flatness in the middle: unresponsiveness to intermediate probabilities

Probability weighting

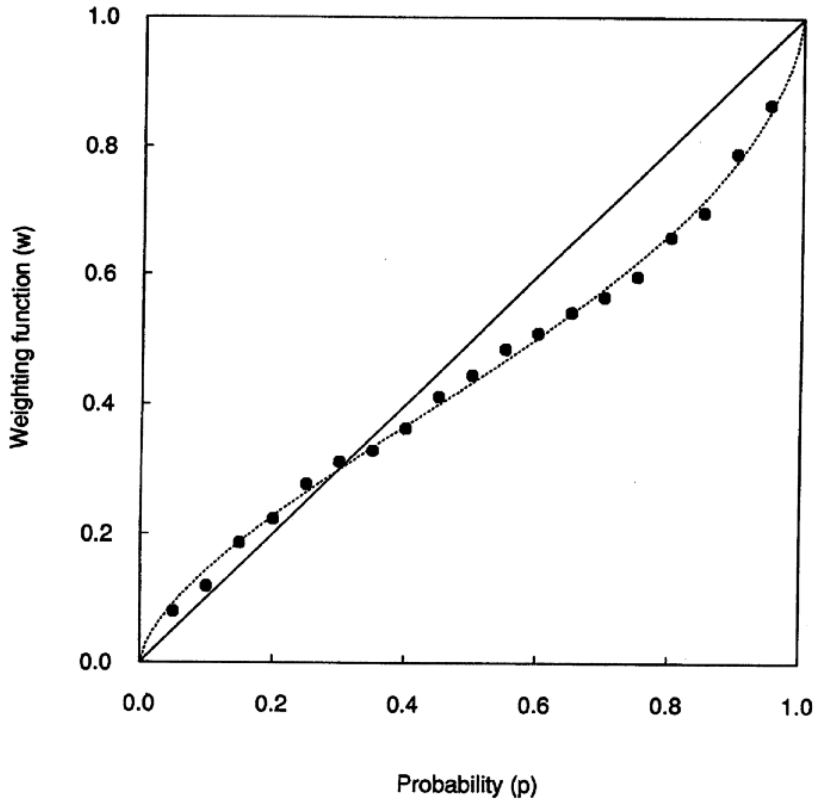


FIGURE 1.—The points represent median estimates, across subjects ($N = 40$), obtained in Tversky and Fox (1994). The smooth curve is obtained by fitting the parametric form $w(p) = \delta p^{\gamma}/(\delta p^{\gamma} + (1-p)^{\gamma})$, suggested by Lattimore, Baker, and Witte (1992). The estimated values of the parameters are $\gamma = .69$, $\delta = .77$.

Expected utility and Prospect theory

- Given wealth w and a lottery $x = (p_1, \ldots, p_n; y_1, \ldots, y_n)$

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- Expected utility:

$$U_{eu}(x) = p_1 u(w + y_1) + \cdots + p_n u(w + y_n)$$

Expected utility and Prospect theory

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$$U_{eu}(x) = p_1 u(w + y_1) + \cdots + p_n u(w + y_n)$$

- Prospect theory:

$$U_{pt}(x) = \pi(p_1) v(y_1) + \cdots + \pi(p_n) v(y_n)$$

Prospect theory in the field

- Labor supply: aspirations on daily earnings affect labor supply of taxi drivers, bike messengers, stadium vendors, etc
- Housing prices: people unwilling to sell house below purchase price (reference point)
- Tax compliance: +/- balance (reference point 0) triggers more claiming deductions
- Marathon runners: round numbers as goals (reference points) affect running effort when behind the goal, but still reachable
- Expectations on the quality of goods affect willingness to pay after enjoyment of goods
- Domestic violence and sports events
- ...

Preferences over time

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https://www.youtube.com/watch?v=QX_oy9614HQ

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- Mischel et al (1989, Science):
  - 32 preschoolers from Stanford
  - .57*** correlation between seconds to wait to eat the marshmallow and SAT scores

Experiments: Present bias

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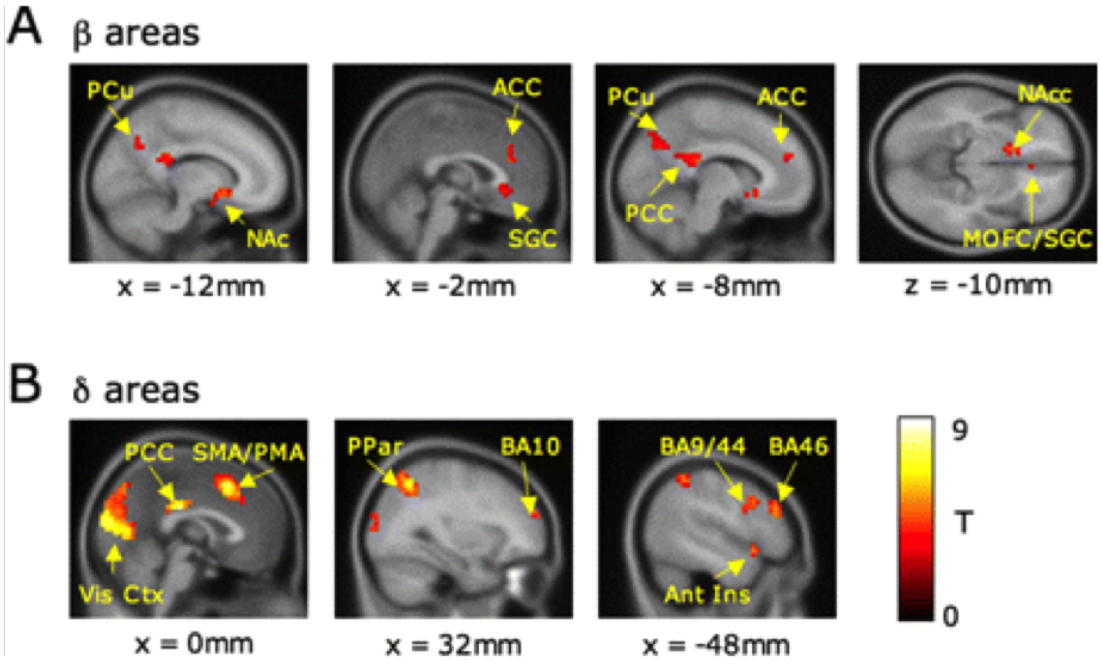
  but prefer \$105 in one year and a day to \$100 in one year
  - Inconsistent with Exponential discounted utility:

$$U_{ed}(\$100, 0) = u(\$100) > \delta u(\$105) = U_{ed}(\$105, 1)$$

$$\Leftrightarrow$$

$$U_{ed}(\$100, 365) = \delta^{365} u(\$100) > \delta^{366} u(\$105) = U_{ed}(\$105, 366)$$

Neuroexperiment: McClure et al (2004, Science)



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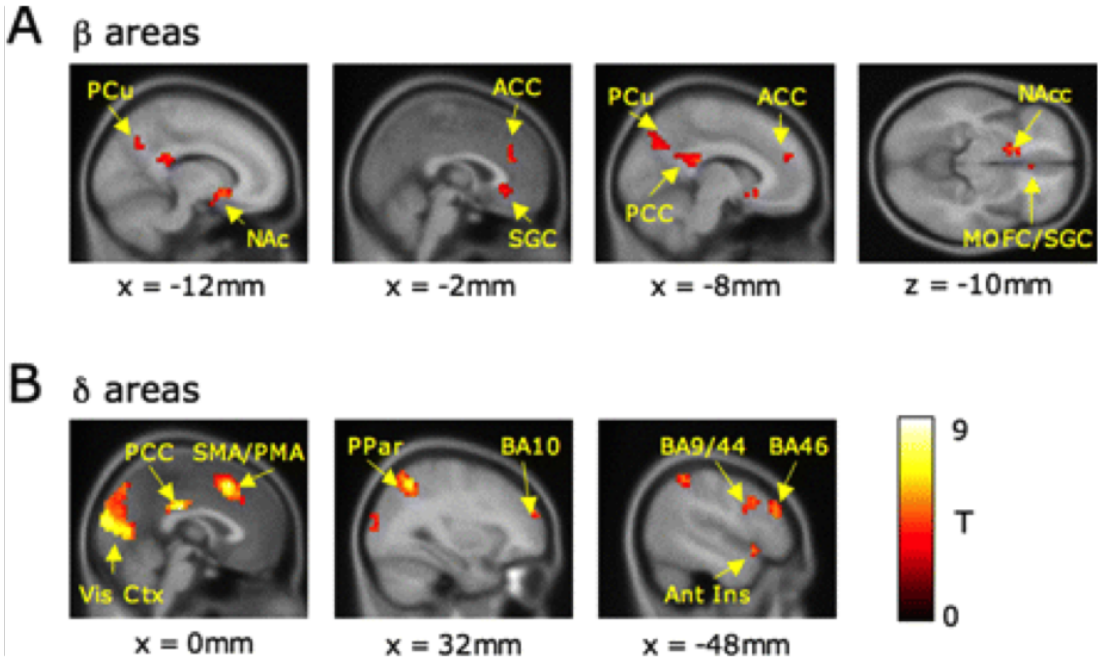

- β areas respond only to immediate rewards
- δ areas respond equally to all rewards

Experimental evidence

- When choosing today between having chocolate or fruit as dessert in a lunch next week, 74% of people choose fruit

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- When choosing today between having chocolate or fruit as dessert in a lunch next week, 74% of people choose fruit
- however, when choosing today between having chocolate or fruit as dessert in today's lunch, 30% of people choose fruit

Evidence: Commitment Devices

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  - they increased their savings by 81%, as compared to a control group.

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- Other settings: exercising, quitting smoking, job productivity, etc.

Behavioral Concept 6: Present-Bias

- Over-discounting of the future when compared to the present
- Generates time inconsistent behavior, as compared to the exponential discounting model
- With crucial consequences for:
  - Retirement plans
  - Savings
  - Labor productivity
  - Health
- A behavioral model: $\beta - \delta$ discounted utility:

$$U_{\beta,\delta}(y, 0) = u(y)$$

$$U_{\beta,\delta}(y, t) = \beta\delta^t u(y)$$

when $\beta = 1$ we have the standard exponential model, when $\beta < 1$ we have present bias

Social preferences

Social preferences

- Narrow view: $U_i(x_i) = U_i(x_i, x_j)$
- However:
  - Billions of dollars donated to charity every year
  - Welfare state
  - We are all aware of instances of:
    - altruism: being oneself better off when someone else is made better off
    - reciprocity: being oneself better off when someone who has been kind to oneself is better off
    - aversion to inequity: we dislike inequalities in our reference group, and appreciate fairness

Ultimatum Game Experiments

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- Player 1 offers an allocation (x_{self}, x_{other}), such that $x_{self} + x_{other} = 5$
- Player 2 accepts or rejects
  - If accepts: (x_{self}, x_{other}) is implemented
  - If rejects: $(0, 0)$

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- Standard prediction:
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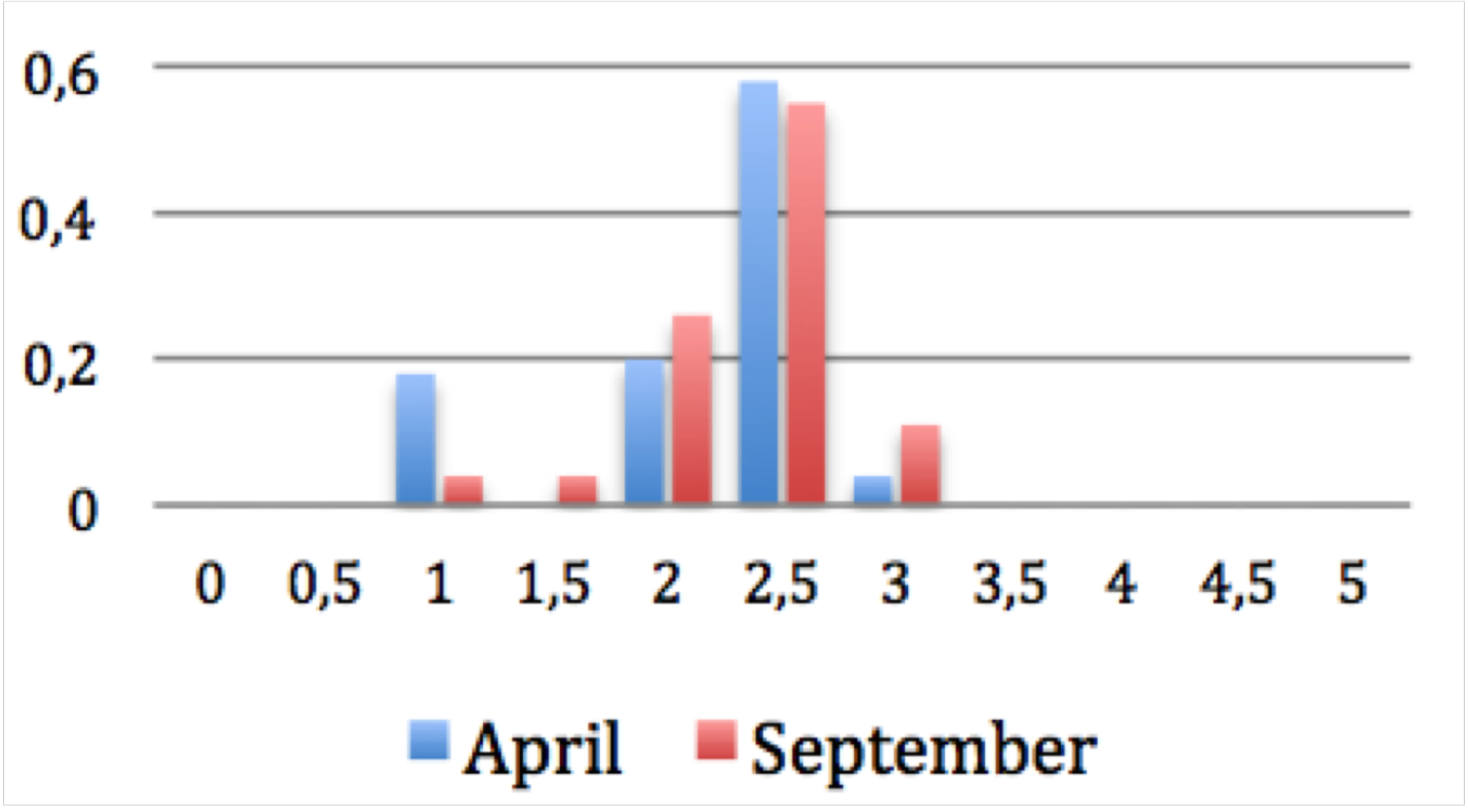
  - And if for whatever reason $x_{other} > 0$, this is never rejected
- Typically in experimental studies:
  - About 25% of the offers are rejected
  - Average acceptance cutoff is at $1/4$ of the endowment

Ultimatum Game Experiments



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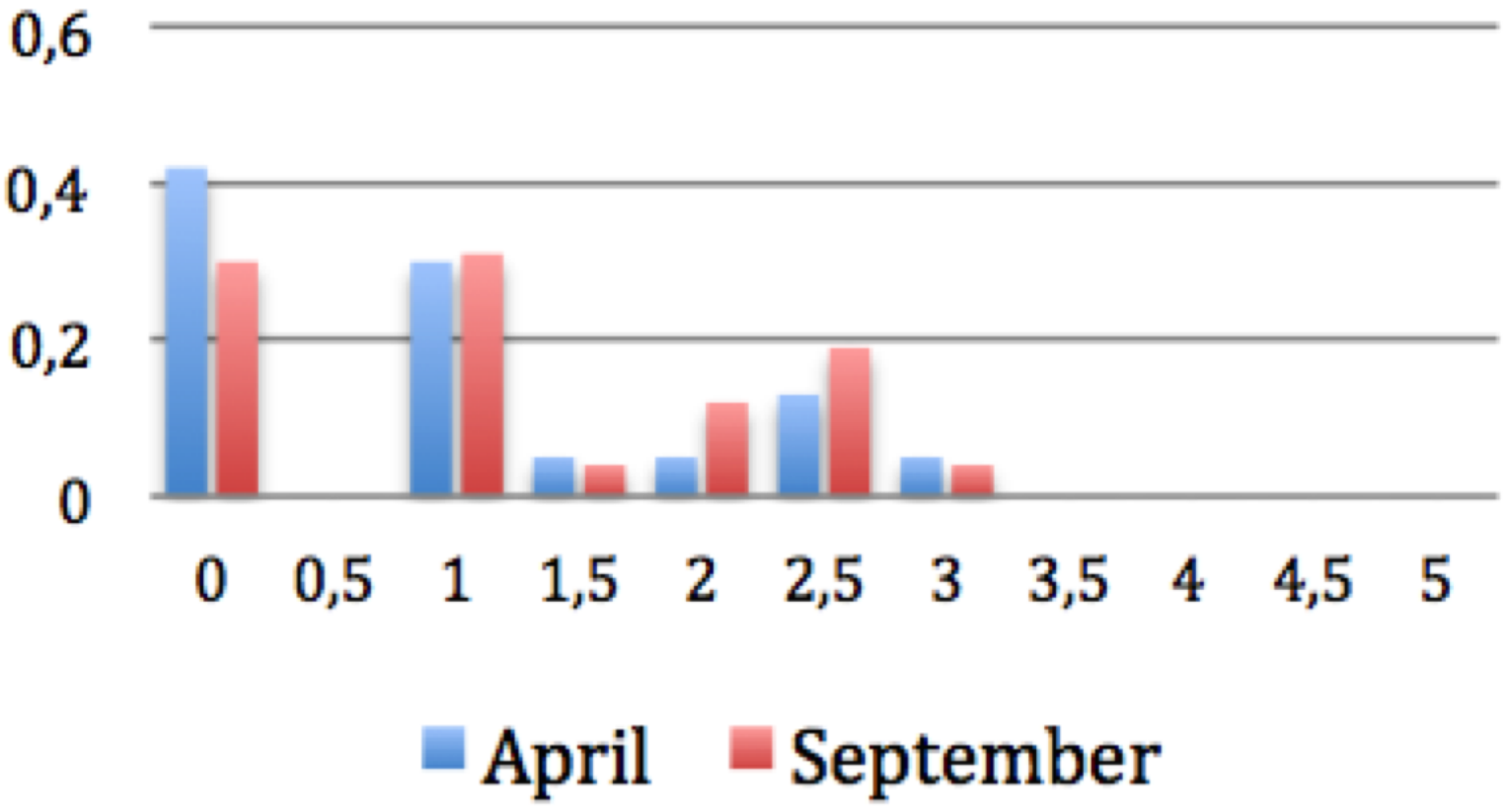

Trust Game Experiments

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- Player 1 decides how much from the 10 Euros to transfer to Player 2
- Transfer is multiplied by 3
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- Standard Prediction:
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  - Player 1 anticipates this and transfers zero too
- Experimental Results:
  - Player 1 makes transfers (altruism or trust)
  - Player 2 sends back money (unconditional kindness or trustworthiness)
  - On average, Player 1 gets back the amount that is sent

Trust Game Experiments

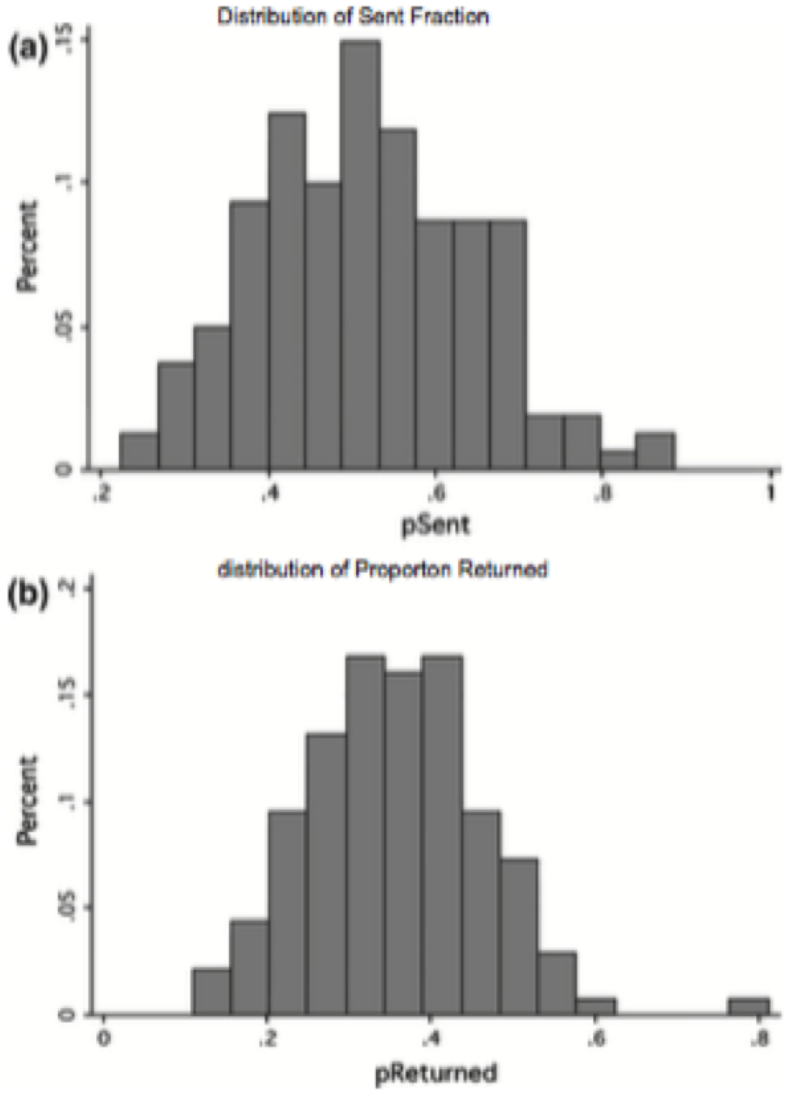

Fig. 1. Distribution of dependent variables. *Notes*: pSent and pReturn refer to the untransformed amount sent as a proportion of amount available by senders and the amount returned as a proportion of amount available by receivers respectively.

Public Good Experiments

Public Good Experiments

- Private endowments e_i, $i = 1, \ldots, n$
- Each player chooses how much to contribute c_i to the public good, and how much to keep $e_i - c_i$
- Contributions to the public good benefit all players, at a rate of $\alpha < 1$
- Payoffs: $\pi_i = e_i - c_i + \alpha \sum_j c_j$

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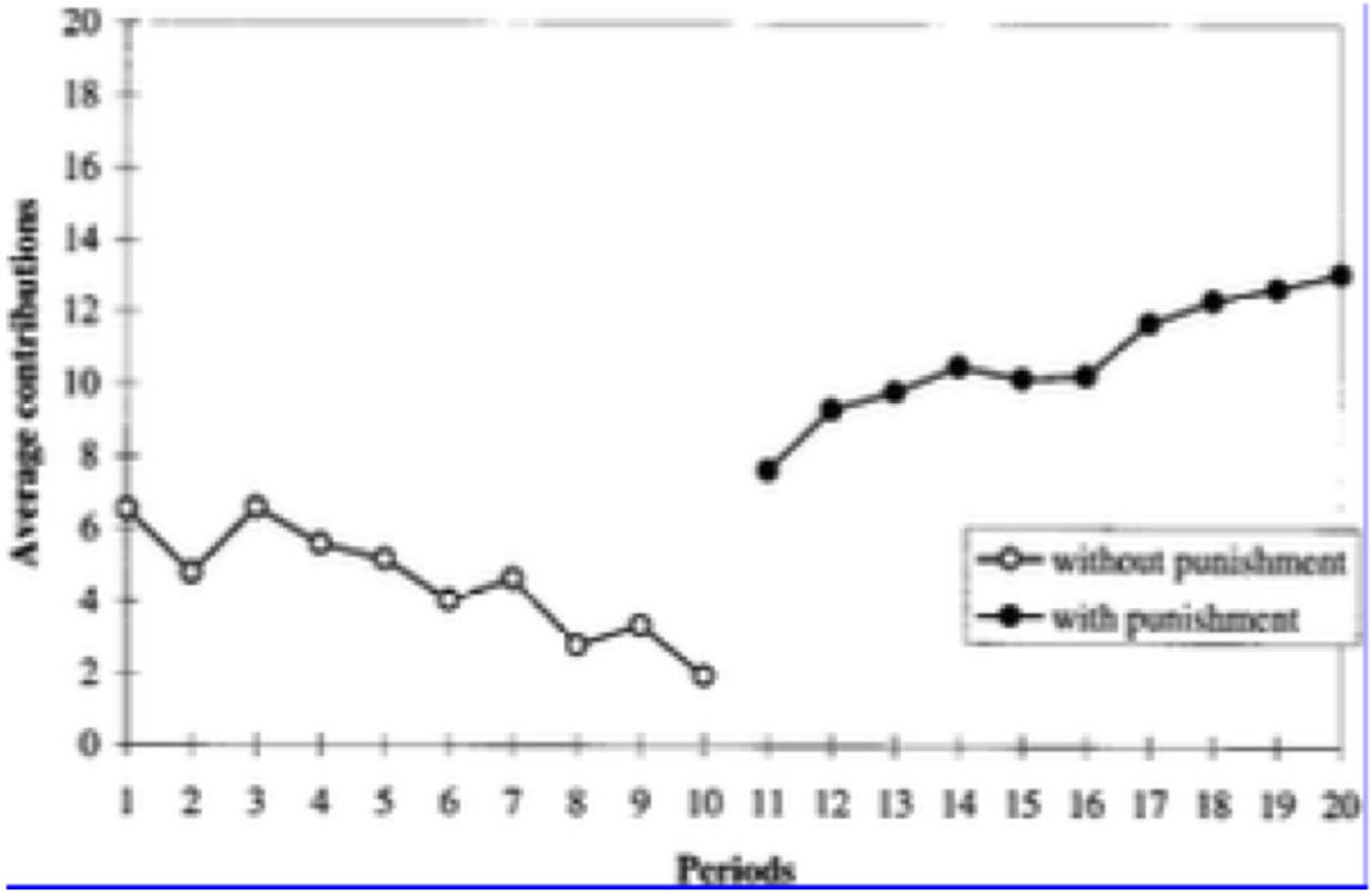
  - Social optimum: all players contribute everything
- Experimental results
  - There is a lot of heterogeneity, with many people contributing significant parts of their endowents
  - There is a clear downwards trend
  - If allow to punish others at a cost, people punish others, and cooperation is sustained

Public Game Experiments



Models of Social Preferences

- Altruism (Andreoni, 1989):

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$$U = u(x_{self}) + \alpha u(x_{other})$$

- Inequity aversion (Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000):

$$U_i = x_i - \alpha_i \frac{\sum_{j \neq 1} \max\{x_j - x_i, 0\}}{n-1} - \beta_i \frac{\sum_{j \neq 1} \max\{x_i - x_j, 0\}}{n-1}$$

with α_i representing envy and β_i guilt

Wrap up Part II: Behavioral economics

- Aims at making economic decision-making models more realistic, with better psychological foundations,
- while trying to keep the models tractable and versatile
- Very active research area, with contributions coming from economic theory, cognitive psychology, neuro-sciences, etc