

BEHAVIORAL ECONOMICS

REFERENCES

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INTRODUCTION

WHY BEHAVIORAL ECONOMICS?

The workhouse of economic modelling is *homo-economicus*; that is, an agent who is characterized by an infinite ability to make rational decisions. Rationality means that agents

- ① update their beliefs correctly, in the manner described by Bayes' Law when they receive new information, and
- ② given their beliefs, make choices that are normatively acceptable in the sense that they are consistent with the expected utility framework.

This traditional framework is appealing and simple hence it would be very comforting if its predictions were confirmed in the data. But they are not!

MOTIVATION BEHIND BEHAVIORAL ECONOMICS

- Are people *homo-economicus*?
- If not, how do they behave?
- What are the implications of their behavior to mechanism design?

WHAT BEHAVIORAL ECONOMICS DOES?

It adds to the standard model of economics some reality about how humans behave. In particular, it adds

- bounded rationality,
- biases in interpreting information,
- interdependent preferences,
- emotions,
- learning, and
- ...

WHAT BEHAVIORAL ECONOMICS IS NOT?

- It is not about throwing away the economics textbook to start from scratch.
 - Behavioral economists fully recognize the crucial role played by models based on homo-economicus.
 - Behavioral economists want to work with and adapt these models to take account of human behavior in those instances where it seems important to do so.

WHAT BEHAVIORAL ECONOMICS IS NOT? (CONT.)

- It is not about reinventing psychology.
 - Behavioral economists do and should draw on psychology but focus on different questions while retaining the methodology and mathematical rigor of economics and game theory.
- It is not about the mindless economic debate on how much neuroscience and evolutionary psychology, and the like, really add to economics.

THE BASIC NATURE OF BEHAVIORAL ECONOMICS

- ① We can find that people do behave as if *homo-economicus*.
- ② We can find that people have interdependent preferences and emotions, but are behaving rationally relative to these.
- ③ We can find that people are biased in choices and how they interpret information.

THE METHODS OF BEHAVIORAL ECONOMICS

- Experiments
 - Laboratory/Artefactual
 - Internet
 - Field
 - Natural
 - Neuroscience
- Theory
 - Game theory
 - Decision theory
 - Evolutionary theory
- Simulations
 - Agent-based simulations

WHAT ABOUT POLICY?

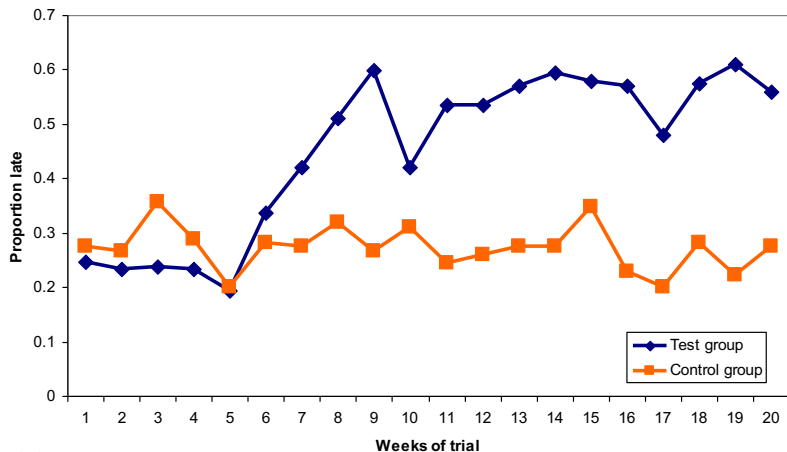
- By its nature, behavioral economics should be relevant in all areas of economic policy.
- If policy is about influencing individuals (even if they are within a corporate or other structure), then, behavioral economics is crucial to get things right.

EXAMPLE

- A problem for primary schools and nurseries is parents picking their children up late. The school must play the role of a babysitter.
- Suppose that we fine parents for picking their children up late?
- What do you think will happen to the number of children that are picked up late?

EXAMPLE (CONT.)

- Gneezy and Rustichini (2000) report an experiment in 10 day care centres in Haifa, Israel in 1998. In week 4, a fine was introduced, and, in week 17, it was removed.



HISTORY SKETCH

- Behavioral economics naturally emerged with game theory in the 50s and 60s. Researchers like Vernon Smith, Kahneman, Tversky, and Selten showed its power.
- From the 80's onwards, behavioral economics has been the fastest growing area in economics: partly due to dissatisfaction with the standard model and partly due to the breadth of talent that has worked in the area.
- But note that behavioral economics is not new. Historically, economists, including Adam Smith, Keynes and Marshall talked a lot about behavioral tendencies.

INTERPRETING NEW INFORMATION

MOTIVATION

- How do you think people behave in a set of hypothetical scenarios?
- Would you expect any biases in judgements?
- We discuss next some of the systematic biases that arise when people form *beliefs*.
- For guidance on this, economists turn to the extensive experimental evidence compiled by cognitive psychologists.

BELIEFS

- A crucial component of any model of markets is a specification of how agents form expectations.
- We summarize next what psychologists have learned about how people appear to form beliefs in practice.

OVERCONFIDENCE

- Extensive evidence shows that people are overconfident in their judgments.
- First, the confidence intervals people assign to their estimates of quantities are far too narrow.
- As Alpert and Raiffa (1982) show the people's 98% confidence intervals, for example, include the true quantity only about 60% of the time.
- Second, people are poorly calibrated when estimating probabilities.
- Events that people think certain to occur actually occur only around 80% of the time and events that people deem impossible occur 20% of the time (Fischhoff, Slovic and Lichtenstein (1977)).

OPTIMISM AND WISHFUL THINKING

- Most people display unrealistically rosy views of their abilities and prospects as Weinstein (1980) indicates.
- Typically, over 90% of those surveyed think they are above average in such domains as driving skill, ability to get along with people and sense of humor.
- They also display a systematic planning fallacy: they predict that tasks (such as writing papers) will be completed much sooner than they actually are (Buehler, Griffin and Ross (1994)).

BELIEF PERSEVERANCE

- Lord, Ross and Lepper (1979) indicate that once people have formed an opinion, they cling to it too tightly and for too long.
- First, people are reluctant to search for evidence that contradicts their beliefs.
- Second, even if they find evidence, they treat it with excessive skepticism.
- Some studies have found an even stronger effect, known as **confirmation bias**, whereby people misinterpret evidence that goes against their hypothesis as actually being in their favor.

REPRESENTATIVENESS

- Kahneman and Tversky (1974) show that when people try to determine the probability that a data set A was generated by a model B , or than an object A belongs to a class B , they often use the representativeness heuristic.
- This means that they evaluate the probability by the degree to which A reflects the essential characteristics of B .
- Consider the next experiment.

EXPERIMENT

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Which is more probable?

(a) Linda is a bank teller.

(b) Linda is a bank teller and is active in the feminist movement.

FINDINGS

- Subjects typically assign greater probability to (b).
- Bayes' Law states that:

$$P(statement(b)|description) = \frac{P(description|statement(b))P(statement(b))}{P(description)}$$

- Assume “Linda is a bank teller” is statement (a), and “Linda is a bank teller and is active in the feminist movement” is statement (b).
- People apply the law incorrectly, putting too much weight on $P(description|statement(b))$, which captures representativeness and too little weight on $P(statement(b))$.

AVAILABILITY BIAS

- When judging the probability of an event, people often search their memories for relevant information.
- While this is a perfectly sensible procedure, it can produce biased estimates because not all memories are typically retrievable or available.

ANCHORING

- Kahneman and Tversky (1974) argue that when forming estimates, people often start with some initial (possibly arbitrary) value and then adjust away from it.
- Experimental evidence shows that the adjustment is often insufficient. Put differently, people “anchor” too much on the initial value.

THE ENDOWMENT EFFECT

- The idea behind exchange asymmetries is that ownership confers a psychic benefit or an endowment effect.
- Kahneman et al. (1991) motivate the endowment effect through the following example.

A wine-loving economist we know of purchased some nice Bordeaux wines years ago at low prices. The wines have greatly appreciated in value, so that a bottle that cost only \$10 when purchased, would now fetch \$200 at auction. This economist, now drinks some of his wine occasionally, but would neither be willing to sell the wine at the auction price nor buy an additional bottle at that price.

- Neoclassical economics predicts that depending on his valuation, either the seller would like to sell at a price of \$200 or buy at \$200.

WTA VERSUS WTP

- Let us term the amount of money that owners of an object are willing to accept in exchange for the object as the *willingness to accept* (WTA). Specifically, WTA is the minimum price, $p = p_s$ that the seller is willing to accept in order to sell the item.
- The *willingness to pay* (WTP) for the object is the amount of money that individuals are willing to pay to buy an extra unit of the object. Specifically, WTP is the maximum price, $p = p_b$ that the buyer is willing to pay in order to buy the item.
- Thaler (1980) noted the presence of *exchange asymmetries* i.e., $WTA > WTP$, a phenomenon known as the *endowment effect*.

WTA VERSUS WTP (CONT.)

- The effects of ownership need not be immediate, but could be gradual, increasing over time as the duration of ownership increases (Strahilevitz and Loewenstein (1998)).
- Endowment effect is present in Duke basketball tickets as Ariely shows (see <https://www.youtube.com/watch?v=drEVEextrUgQ>).
- Ariely and Simonson (2003) also demonstrate a similar pattern for the case of bidding in auctions. The highest bidder at any stage (who has not won the auction yet) becomes partially attached to the object (a pseudo-endowment effect).
- Is there an endowment effect in operation when you visit a yard to buy a car? Sales people know about this ...

LOSS AVERSION

- Thaler (1980) invoked *loss aversion* to explain the endowment effect.
- The act of giving up the object is coded as a loss by the owner, so loss aversion applies to sale of items or perceived entitlements. For instance, sellers might be reluctant to sell their house at a time of falling prices because they perceive that they are entitled to a previously prevailing higher price.
- The endowment effect does not apply to money i.e., loss aversion does not apply to the buyer's act of giving up cash.

LOSS AVERSION (CONT.)

- Notice that higher loss aversion impedes sales.
- The coefficient of loss aversion is simply the ratio of WTA to WTP; that is, $\frac{WTA}{WTP} = \frac{p_s}{p_b} = \lambda$.
- In Kahneman et al. (1990), $WTA = 7.12$ and $WTP = 2.87$, so we get that $\lambda \approx 2.5$. Across 45 studies surveyed in Horowitz and McConnell (2002), the median estimate of $\frac{WTA}{WTP} = 2.6$.

WHAT SORT OF FACTORS DOES THE LOSS AVERSION DEPEND ON?

Loss aversion is reduced when:

- the owned good and the unowned good are close substitutes (Chapman (1998)),
- the duration of ownership is shorter (Strahilevitz and Loewenstein (1998)),
- subjects are older or more educated and are more knowledgeable as to the attributes of the product,
- there is reduced ambiguity with respect to the value of the good and a reduction in the cost of acquiring information (Kolstad and Guzman (1999)).

LOSS AVERSION AND FRAMING

- If the same choice is framed as a loss rather than as a gain, different decisions will be made.
- Consider the next experiments of Kahneman and Tversky (1981) ...

EXPERIMENT

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Choose a program to address the problem.

(a) In this program, 200 people will be saved.

(b) In this program, there is $\frac{1}{3}$ chance that 600 people will be saved, and $\frac{2}{3}$ chance that no people will be saved.

EXPERIMENT

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Choose a program to address the problem.

(a) In this program, 200 people will be saved. 72%

(b) In this program, there is $\frac{1}{3}$ chance that 600 people will be saved, and $\frac{2}{3}$ chance that no people will be saved. 28%

EXPERIMENT

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Choose a program to address the problem.

(a) In this program, 400 people will die.

(b) In this program, there is $\frac{1}{3}$ chance that nobody will die, and $\frac{2}{3}$ chance that 600 will die.

EXPERIMENT

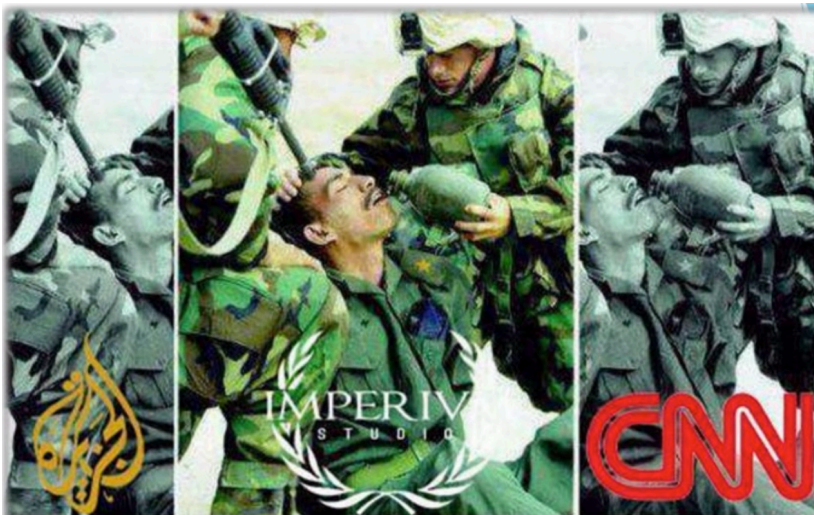
Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Choose a program to address the problem.

(a) In this program, 400 people will die. 22%

(b) In this program, there is $\frac{1}{3}$ chance that nobody will die, and $\frac{2}{3}$ chance that 600 will die. 78%

LOSS AVERSION AND FRAMING (CONT.)

- People take great risks to avoid a loss. Reframing the same option as a loss changes the choices.
- How about gambles?
- Does loss aversion cause investors to hold losing stocks longer than winning stocks? When an investor sells a losing stock, he is committing to the loss.
- In the study of Odean (1998) tracking 10,000 brokerage accounts from 1987-1993 including 162,948 trades, 9.8% of losing stocks were sold while 14.8% of gaining stocks were sold.



How the Media can manipulate our viewpoint

PROSPECT THEORY

JUDGEMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (1974)

- People rely on a limited number of heuristics to reduce complexity in assessing probabilities.
- These heuristics although quite useful might lead to severe and systematic errors.
- Clarity is a heuristic to determine distance. However, if the lights are dim or there is fog, it is likely that you might underestimate the distance away from some object or person.

PROSPECT THEORY: AN ANALYSIS OF DECISION UNDER RISK (1979)

The Expected Utility framework has been a dominant force in the analysis of decision-making under risk. The framework assumes that all reasonable people would wish to obey its axioms and that most people actually do, most of the time. The present paper describes several classes of choice problems where preferences systematically violate the axioms of Expected Utility framework.

Given these inadequacies, an alternative account of choice under risk is proposed. Prospect Theory assigns value to gains and losses rather than to final assets, and replaces probabilities with decision weights. The value function is normally concave for gains, commonly convex for losses, and is generally steeper for losses than gains.

WHAT ABOUT NEGATIVE PROSPECTS?

Problem 3: $(\$4,000, 0.80) < (\$3,000)$

Problem 4: $(\$4,000, 0.20) > (\$3,000, 0.25)$

Problem 5: $(\$3,000, 0.90) > (\$6,000, 0.45)$

Problem 6: $(\$3,000, 0.002) < (\$6,000, 0.001)$

Problem 3': $(-\$4,000, 0.80) > (-\$3,000)$

Problem 4': $(-\$4,000, 0.20) < (-\$3,000, 0.25)$

Problem 5': $(-\$3,000, 0.90) < (-\$6,000, 0.45)$

Problem 6': $(-\$3,000, 0.002) > (-\$6,000, 0.001)$

THE REFLECTION EFFECT

The preference between negative prospects is the mirror image of the preference between positive prospects. Thus, the reflection of prospects around \$0 reverses the preference order.

This is called the Reflection Effect.

This effect implies that risk aversion in the positive domain is accompanied by risk seeking in the negative domain.

WHAT ABOUT STAGE PROBLEMS?

Problem 10: Consider the following two-stage game. In the first stage, there is a probability of 0.75 to end the game without winning anything, and a probability of 0.25 to move into the second stage. If you reach the second stage you have a choice between

Alternative A: (\$4,000, 0.80)

Alternative B: (\$3,000)

Please indicate your choice.

THE ISOLATION EFFECT

Problem 10 in terms of final outcomes is identical to Problem 4 where subjects preferred $(\$4,000, 0.20)$ over $(\$3,000, 0.25)$. Yet, subjects ignored the first stage and treated the game as Problem 3 where $(\$3,000)$ is preferred over $(\$4,000, 0.80)$.

Subjects often disregard components that the alternatives share, and focus on the components that distinguish them.

This is called the Isolation Effect.

PROSPECT THEORY

Prospect theory distinguishes two phases in the choice process: an early phase of **framing** and a subsequent phase of **evaluation**.

The framing phase consists of a preliminary analysis of the offered prospects, which often yields a simpler representation of these prospects. In the second phase, the edited prospects are evaluated and the prospect of highest values chosen.

π AND v

The overall value of an edited prospect, denoted V , is expressed in terms of two scales, π and v .

The first scale, π , associates with each probability p a decision weight $\pi(p)$, which reflects the impact of p on the overall value of the prospect. However, π is not a probability measure, and it will be shown later that $\pi(p) + \pi(1 - p)$ is typically less than unity. The second scale, v , assigns to each outcome x a number $v(x)$, which reflects the subjective value of that outcome. Recall that outcomes are defined relative to a reference point, which serves as the zero point of the value scale. Hence, v measures the value of deviations from that reference point, i.e., gains and losses.

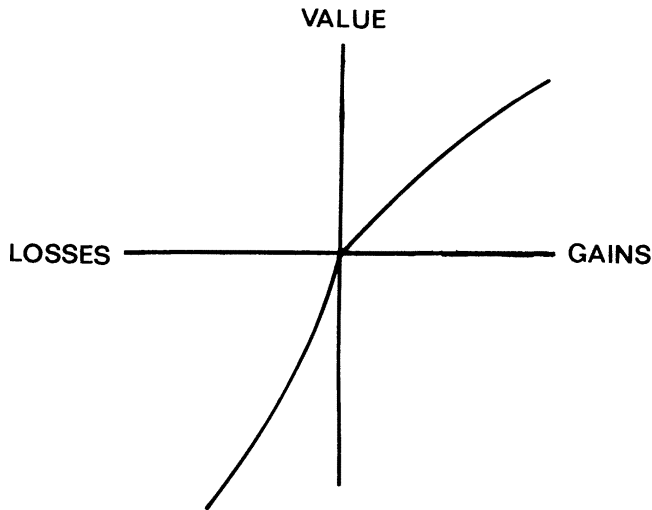
THE VALUE FUNCTION

The value function for changes of wealth is normally concave above the reference point ($v''(x) < 0$ for $x > 0$) and often convex below the reference point ($v''(x) > 0$ for $x < 0$).

In summary, the value function is:

- defined on deviations from the reference point,
- generally concave for gains and commonly convex for losses, and
- steeper for losses than for gains.

A HYPOTHETICAL VALUE FUNCTION

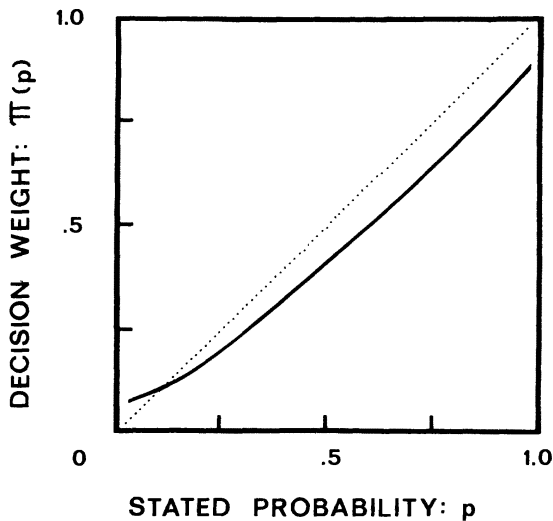


THE WEIGHTING FUNCTION

The value of each outcome is multiplied by a decision weight. Decision weights are not probabilities and should not be interpreted as measures of degree or belief. Decision weights measure the impact of events on the desirability of prospects, and not merely the perceived likelihood of these events.

- $\pi(\cdot)$ is an increasing function of p , with $\pi(0) = 0$ and $\pi(1) = 1$.
- Low probabilities are generally overweighted. That is, $\pi(p) > p$ for small p .
- High probabilities are generally underweighted. That is, $\pi(p) < p$ for high p .

A HYPOTHETICAL WEIGHTING FUNCTION



ADVANCES IN PROSPECT THEORY: CUMULATIVE REPRESENTATION OF UNCERTAINTY (1992)

A new version of prospect theory is presented that incorporates the cumulative functional and extends the theory to uncertain as well to risky prospects with any number of outcomes. The resulting model, called Cumulative Prospect Theory, combines some of the attractive features of both developments.

WHY CUMULATIVE PROSPECT THEORY?

The weighting scheme used in the original version of prospect theory is a monotonic transformation of outcome probabilities.

- ❶ Such scheme does not always satisfy stochastic dominance.
- ❷ It is hard to extend it to prospects with a large number of outcomes.

Both problems can be solved by the rank-dependent or cumulative functional where instead of transforming each probability separately, the new model transforms the entire cumulative probability distribution function and applies it separately to gains and losses.

FUNCTIONAL FORMS

On one hand, the value functions for gains or losses are given by

$$\tilde{v}(x) = \begin{cases} x^\alpha & \text{if } x \geq 0 \\ -\lambda(-x)^\beta & \text{if } x < 0, \end{cases}$$

and on the other hand, the weighting functions for gains or losses are given by

$$w(p) = \begin{cases} \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{\frac{1}{\gamma}}} & \text{if } x \geq 0 \\ \frac{p^\delta}{(p^\delta + (1-p)^\delta)^{\frac{1}{\delta}}} & \text{if } x < 0. \end{cases}$$

EXAMPLE

Assume the following parameters:

$$\alpha = 0.88, \beta = 0.88, \lambda = 2.25, \gamma = 0.61, \delta = 0.69.$$

Calculate the cumulative prospect theory value for the prospect where the first outcome is £300 and the second outcome is -£100; the probability is 0.3 for the first outcome and 0.7 for the second outcome. Assume the reference point is 0.

The answer is -27.93.