Behavioral Economics, History of

Michiru Nagatsu*

July 20, 2014

Abstract

This article reviews the historical development of behavioral economics, with an emphasis on how it has become part of mainstream economics. First I describe the separation between economics and psychology as a historical background against which behavioral economics emerged. Then I introduce critiques of expected utility theory (EUT), and explain how behavioral decision research (BDR) developed using EUT as an experimental paradigm. I then distinguish "old", "new" and "second-wave" behavioral economics, and briefly discuss criticims of the last.

Keywords: Expected Utility Theory, Prospect Theory, preference reversals, framing effects, time discounting, economics and psychology, behavioral economics, Behavioral Decision Research

1 Introduction

Behavioral economics, an increasingly influential research program in economics, tries to improve economic theory and policy by drawing mainly on psychological or behavioral insights on how real people, as opposed to the idealistically rational agent, think and behave (Mullainathan and Thaler, 2001; Camerer and Loewenstein, 2004). Behavioral economics thus defined has now become part of mainstream economics, in terms of the numbers of behavioral economists hired in research institutions, journal articles and textbooks published, and prestigious prizes awarded to behavioral economists. Its practical relevance is increasing as both public and private sectors use more findings from behavioral economics to efficiently and effectively change people's behavior. Finally, several popular books

*TINT/Department of Political and Economic Studies, PO Box 24, 00014 University of Helsinki, Finland. Email: michiru.nagatsu@helsinki.fi Tel. +358 191 28344

(e.g. Ariely, 2008; Poundstone, 2010; Kahneman, 2013) made behavioral economics well known among the educated general public. Accordingly, an interest in its history has arisen as well. Sent (2004) is one of the earliest studies on this subject, and Angner and Loewenstein (2012) is an informative review. Heukelom (2014) gives a book-length treatment (see also Heukelom, 2011, 2012). One of the questions these authors explicitly and implicitly ask is why behavioral economics has been so successful. There are several contributing factors, and the reader is referred to the abovementioned literature to get a fuller account. In this article, I will highlight one important reason for the success of behavioral economics, namely that it adopted mainstream rational economic modeling tools such as utility maximization and equilibrium analysis of games, instead of denying them and proposing an altogether different approach.

The article proceeds as follows: Section 2 briefly introduces the historical background against which behavioral economics emerged, namely the separation of economics from psychology, and the birth of modern decision theory. Then Section 3 describes early criticisms of decision theory and "old" behavioral economics, and how they are distinguished from the "new" behavioral economics. Section 4 identifies Behavioral Decision Research (BDR) as a basis of behavioral economics, and describes two important results in BDR. Section 5 describes the new behavioral economics, and Section 6 "second-wave" behavioral economics, highlighting the use of standard economic modeling techniques. Section 7 mentions two contemporary directions in behavioral economics. Section 8 concludes.

2 The historical context

2.1 Economics as a separate science

If behavioral economics is characterised by the use of rich psychological insights, then its history has to go back at least to David Hume (1711–1776) and Adam Smith (1723–1790). In fact, Ashraf, Camerer, and Loewenstein (2005) argue that Smith's *Theory of Moral Sentiments* (Smith, 2002, first published in 1759) proposes what is now called a dural-process cognitive model, anticipates modern findings such as loss aversion, willpower and fairness, and even suggests new directions for research in behavioral economics. Even though these claims might well be true, it is important to remember that contemporary behavioral economics has emerged against a backdrop of the sharp separation of economics from psychology that had been gradually established over 200 years since Smith. This separation started from John Stuart Mill's (1806–1873) deductive and *a priori* methodology, and was achieved by successive neoclassical theoretical innovations such as marginal utility theory, indifference curve analysis, and revealed preference theory. As a

result, economists became able to model an agent's choice behavior in terms of her preference satisfaction without referring to the utility concept connected with psychological valence. Instead, the concept of utility was re-interpreted simply as a mathematically useful way of representing preference orderings as defined by preference theory.

2.2 Subjective expected utility theory

Preference theory made it possible to explain choice behavior in terms of preference orderings. In turn, the utility concept in economics became "ordinal", i.e., there was no need to talk about subjective and unobservable intensities of psychological utilities for different goods. This situation was somewhat complicated by the invention of expected utility theory (EUT). In general, desirability of a course of action depends not only on the value that action intends to deliver, but also on (one's belief about) the way the world is; for instance, the the desirability of an action of bringing or not bringing an umbrella depends on what (one thinks) the weather is going to be like. In order to model decision making under such uncertainty, the British philosopher Frank Ramsey (1903–1930) sketched, in 1926, a way of quantifying and operationalizing degrees of beliefs and desires solely from the observation of the agent's simple choices over lotteries, adopting an idealized folk psychological scheme in which "we act in the way we think most likely to realize the objects of our desires, so that a person's actions are completely determined by his desires and opinions"(Ramsey, 1931, 173). The mathematician John von Neumann (1903–1957), while working on the theory of strategic interactions and its application to economics, axiomatized this system as expected utility theory (Von Neumann and Morgenstern, 2004, originally published in 1944).[1] Von Neumann and Morgenstern (2004) proposed the objective interpretation of probability (i.e., as relative frequencies of events in the long run), but anticipated subjective EUT, admitting that the subjective view of probability also leads to a satisfactory numerical concept of utility (3.3.3, fn. 2). The mathematician Leonard Savage (1917–1971), a war-time assistant of von Neumann at the Institute for Advanced Study, Princeton, completed the subjective version of EUT, the foundation of modern decision theory (Savage, 1954).[2] As a result, it became possible to talk about the relative intensity of preferences in an operationally meaningful and principled way, bringing the "cardinal" utility back in economic models of decision making in a legitimate fashion. At the same time, Savage's theory made it possible to measure subjective beliefs *qua* probabilities in an equally rigorous manner. As we will

[1]The full axiomatization is given in the second edition published in 1947.

[2]The idea of expected utility itself was already proposed by the Dutch-Swiss mathematician Daniel Bernoulli (1700–1782) in 1738. Another important founder of subjective EUT is the Italian statistician Bruno de Finetti (1906–1985), whose work is acknowledged in Savage (1954).

see below, the birth of EUT proved to be crucial for the emergence of behavioral economics.[3]

3 Early criticisms of EUT

Savage's EUT is not behavioristic as preference theory presumably aspired to be, because the former explicitly refers to psychological constructs such as subjective beliefs and expected utility. Nevertheless, economists welcomed it because the axiomatic approach was thought to guarantee the operationally meaningful and non-arbitrary measurement of these quantities. Expected utility theory thus soon found its application in economics. As early as 1948, Milton Friedman (1912–2006) collaborated with Savage, putting forward EUT as an economic hypothesis to explain the co-existence of insurance and lotteries (Friedman and Savage, 1948). But no sooner than EUT was completed as an axiomatic system, several economists expressed serious doubts on its normative acceptability and empirical plausibility (Markowitz, 1952; Allais, 1953; Ellsberg, 1961), as well as on the plausibility of other important models of rational choice, such as the discount utility model of intertemporal choice (Strotz 1955) and game theory (Schelling 1960). These criticisms, however, were based on introspection and casual observations, rather than the rigorous experimental studies. This is only natural because back in the days experimental methods were not part of economists' toolbox yet. Instead, early experimental tests of EUT, with small but real monetary incentives, were conducted by the Harvard statistician Frederick Mosteller (1916–2006) and his student Philip Nogee (1951), and by the psychologist Sidney Siegel (1916–1961), philosophers Donald Davidson (1917–2003) and Patrick Suppes (1922–) at Stanford (Stanford Value Theory Project) (1955). Another student of Mosteller, Ward Edwards (1927–2005), played a particularly important role in the rise of behavioral economics, as we will see in the next section. Before discussing that, I will turn to the so-called "old" behavioral economics below.

3.1 "Old" behavioral economics

Herbert Simon (1916–2001), one of the earliest critics of models of rational choice in economics, was more radical than his contemporary critics of EUT. While these critics formulated problems as implausibility of specific axioms of EUT, such as the independent axiom, Simon offered a more programmatic critique, as part of the broader contribution he made to the so-called cognitive revolution: a paradigm shift in the post-war psychology from behaviorism to the computational modeling

[3]In what follows, I simply use the term EUT, but this should be read as a subjective version of the theory unless otherwise stated.

of internal cognitive processes. Simon argued that utility maximization models such as EUT, interpreted as representational models of cognitive processes of economic agents, are empirically unsound, drawing on the distinction between *substantive* and *procedural* rationality. The former concerns an intelligent system's adjustment or adaptation to its outer environment (e.g. an economic agent's reaction to the market), whereas the latter concerns the system's ability determined by its inner knowledge and computation that constrains the former (Simon, 1996, 25). A key idea is that we need only consider substantive rationality to predict behavior of the system *if* both its goal and environment are simple; but since these factors and their interaction are in fact complex, Simon argued, we have to explicitly consider the procedural rationality of the system. From this *bounded rationality* perspective, economic models of choice are deficient because they assume substantive rationality (individuals' utility maximization and organizations' profit maximization in the market environment) when in fact these conditions are not satisfied, requiring the explicit modeling of the inner workings of the agent, be it a human being or a firm.

Simon's impact on mainstream economics, however, was limited. Although he received the Nobel Memorial Prize in Economics in 1978 "for his pioneering research into the decision-making process within economic organizations", his proposal that *individual* procedural rationality should be explicitly modeled was not accepted by mainstream economics. Neither was his contemporary economists' alternative methods and theories that drew on psychology and other social sciences. Although already in the 1960s the term "behavioral economics" was used to refer to these economists' rather heterogeneous research programs (Sent, 2004), their efforts did not have much impact on mainstream economics, despite the launch of *The Journal of Behavioral Economics* in 1972 (continued as *The Journal of Socio-Economics* since 1991) and such publications as Katona and Morgan (1980); Gilad and Kaish (1986) (but see Hosseini, 2003). For this reason, Sent (2004) calls these lines of research "old" behavioral economics.[4]

In retrospect, one reason why "old" behavioral economics never caught on in the mainstream is that it started from the dismissal of the main methodological tenets of mainstream economics, such as positivism, deductivism, static equilibrium analysis, and optimizing models of economic agency (see Hosseini, 2003, 394). In contrast, as we will see below, "new" behavioral economics has its deep root in behavioral decision research, which exploited maximization models such as EUT as experimental paradigms.

[4]Given contemporary research conducted along this line such as Altman (2006), perhaps it is more appropriate to call it heterodox rather than old behavioral economics.

4 Behavioral decision research

Ward Edwards was among the first psychologists to notice the relevance of EUT for psychology. He introduced it to psychologists as *behavioral decision theory* (Edwards, 1954, 1961; Edwards et al., 1963), a rational model of individual probability judgement (subjective Bayesianism) and choice under risk. Edwards, the son of an economist, studied psychology at Harvard under the influence of Mosteller, who introduced Edwards to EUT (Phillips and von Winterfeldt, 2007). In 1958 Edwards moved to the psychology department at the University of Michigan, Ann Arbor, a then-rapidly expanding research centre in mathematical psychology and decision making (see Heukelom, 2010). But it was the following younger generation, including his former students at Michigan, who developed a subfield in cognitive psychology called *behavioral decision research*, or BDR, by demonstrating systematic violations of the predictions of EUT in a series of experiments, and by proposing alternative models of individual judgement and decision making. Mainstream economic rational choice models such as EUT were crucial for the development of BDR, since these models provided "clear and crisp" predictions to be experimentally explored (Sent, 2004; Angner and Loewenstein, 2012); the deviations from the predictions could then be exploited to develop alternative models. In particular, two developments in BDR are important for the rise of "new" behavioral economics.

4.1 Preference reversals and the construction of preferences

One of the first systematic violations of EUT was demonstrated by Sarah Lichtenstein (1933–) and Paul Slovic (1938–), Edwards's former students, then working at the Oregon Research Institute. They conducted a series of experiments on people's risk assessments of hypothetical gambling, and discovered a serious anomaly for EUT called *preference reversal* (Lichtenstein and Slovic, 1971) (Another former student of Edwards', Harold Lindman (1971), reported essentially the same result). Preference reversal is a phenomenon in which the decision maker's preference over a pair of lotteries seem to be flipped depending on the method of preference elicitation. For example, when asked to choose one bet from two, many subjects in Lichtenstein and Slovic's experiments chose a low-payoff, high-probability bet (so-called P bet, e.g., 35/36 chance of winning \$4) over a high-payoff, low probability bet (\$ bet, e.g., 11/36 chance of winning \$16); but when asked to state how much they were willing to pay, the subjects priced the \$ bet higher than the P bet. The subjects seemed to have violated the axiom of transitivity (as their responses suggested they prefer A to B, and B to A at the same time), but the problem was deeper than that since it challenged the *procedural invariance* principle, a fun-

damental assumption of rational choice that preferences over an identical set of alternatives shouldn't change depending on how you measure them (e.g., letting subjects rate, choose between, or state reserve prices for options). This result was replicated in a field experiment using real gamblers incentivized with high-stake money in the Four Sisters Casino in Las Vegas (Lichtenstein and Slovic, 1973).

Preference reversals caught economists' attention: two Caltech experimental economists challenged this result, with an explicit attempt to make the phenomenon go away, only to find it persisted (Grether and Plott, 1979). This paper was published in *The American Economic Review*, stimulating economists to produce alternative models to EUT that abandon or modify axiom(s) of EUT. In contrast, Slovic and other behavioral decision researchers proposed procedural models in which preferences are constructed in the process of decision making (see articles collected in Section III of Lichtenstein and Slovic, 2006).

4.2 Framing effects and Prospect Theory

Another series of serious challenges to EUT came from a team of Israeli American psychologists Amos Tversky (1937–1996) and Daniel Kahneman (1934–). Tversky completed his PhD at Michigan in 1965 under the supervision of Clyde Coombs (1912–1988) and Edwards. Tversky's early research was on both the representational theory of measurement in mathematical psychology and empirical investigation into subjective EUT (Heukelom, 2009, 48). In the late 1960s Tversky went back to Israel to teach at Hebrew University, where Daniel Kahneman had been establishing himself as a leading researcher in the field of mental effort. Tversky's faith in subjective Bayesianism was "severely shaken" by conversations with Kahneman (Kahneman, 2003). The first series of their collaborative work thus studied individual probability judgement under uncertainty, how individuals use mental shortcuts called "heuristics" such as representativeness, availability, and anchoring and adjustment, and how these heuristics lead to "biases," i.e., deviations from the subjective Bayesian model, part of subjective EUT. This research programme, known as "heuristics and biases", was launched with their first collaborative paper (Tversky and Kahneman, 1971), and further developed in their *Science* paper (Tversky and Kahneman, 1974) and other papers collected in Kahneman et al. (1982) and Gilovich et al. (2002).

Another, perhaps even more important programme by Tversky and Kahneman comprises a series of experiments that demonstrated *framing effects* (Tversky and Kahneman, 1981, 1986), and *Prospect Theory* (Kahneman and Tversky, 1979) as an alternative to EUT (other important papers are collected in Kahneman and Tversky, 2000). Broadly speaking, framing effects refer to another type of preference reversals, in which an individual's preference over an identical set of alternatives seems to be flipped depending on how they are described, in particular

as a gain or loss. Framing effects are as serious an anomaly to EUT as Lichtenstein and Slovic's preference reversals, because they challenged another invariance principle in rational choice called the *descriptive invariance*, which states that the agent's preferences over an extensionally identical set of alternatives should not be affected by how they are intensioinally described. An innovation of Prospect Theory consisted in its introduction of the concept of *reference points* to explain framing effects and other related anomalies *within the framework of utility theory*. One of the central ideas of Prospect Theory is that an individual evaluates gains and losses relative to a certain reference point, not absolute quantities, an application of psychophysics to the perception of money and other goods. Different frames with different reference points shift the perception of alternatives as a gain or loss, and affect individuals' choice. With the assumptions that people are risk-averse toward unlikely loss and likely gain, and risk-seeking toward likely loss and unlikely gain, Prospect Theory explained not only framing effects but other early problems such as Allais's paradox, and people's simultaneous purchasing of lotteries and insurances that had been discussed earlier by Friedman and Savage (1952) and Markowitz (1952).[5]

Tversky and Kahneman's 1979 *Econometrica* paper[6] and their 1981 *Science* paper were hailed as having "altered the intellectual history of economics; they brought the behavioral economics research program into the mainstream." (Laibson and Zeckhauser, cited in Angner and Loewenstein, 2012, 662) This reputation of Prospect Theory is due not only to its empirical success but to its unique hybrid nature: on the one hand, it is a psychologically informed cognitive process model in which alternatives are mentally 'edited' as gains and losses before choice; on the other, it is presented as a utility maximization model with a peculiar utility curve, representing different subjective valuations of likely and unlikely outcomes in gain and loss domains. Unlike "old" behavioral economics and other BDR, Prospect Theory demonstrated an appealing, paradigmatic way of incorporating insights from cognitive psychology into economic models of choice.

5 "New" behavioral economics

The success of Prospect Theory encouraged a number of young economists to challenge the standard models of rational choice. In 'Toward a Positive Theory of

[5]For a critical assessment of Prospect Theory and related models of risky choice, see Friedman et al. (2014)

[6]Kahneman (2003) recalls: "The choice of venue turned out to be important; the identical paper, published in *Psychological Review*, would likely have had little impact on economics. But our decision was not guided by a wish to influence economics. *Econometrica* just happened to be the journal where the best papers on decision-making to date had been published, and we were aspiring to be in that company."

Consumer Choice' (1980), for example, Richard Thaler (1945–) discussed, drawing on Tversky and Kahneman's work, various aspects of consumer behavior (e.g., underweighting of opportunity costs, failure to ignore sunk costs, regret and self-control) that would become central themes in behavioral economics. Thaler spent the 1984-85 academic year visiting the University of British Columbia to work with Kahneman, who recalls that "That was the year that behavioral economics began." (Poundstone, 2010, ch. 17). Thaler also contributed to the dissemination of empirical findings challenging economic models of choice, and helped mainstream economists to see the relevance of these results, through publishing, in collaboration with psychologists and economists, 'Anomalies' columns in the *Journal of Economic Perspectives*, between 1987–1991 (later collected in Thaler, 1992), and 1995–2001 (see Heukelom, 2012, fn. 16).

Two private foundations, the Sloan Foundation and Russell Sage Foundation, also played a key role in developing behavioral economics as a thriving subfield of economics, through financially supporting the behavioral economics program (1984–1992), including projects such as non-residential working groups, the visiting researchers program, and the Russell Sage Foundation Behavioral Economics Books Series (Heukelom, 2012). Eric Wanner (1942–), a former Harvard cognitive psychologist, who had a clear goal to apply cognitive science to economics, played a pivotal role as a director of the behavioral economics program at both foundations. Wanner involved Tversky, Kahneman, and Thaler from early on at the preparatory stage of the program. Although Wanner initially understood the program as a development of Simon's behavioral economics that was highly critical about the mainstream neoclassical economics, he quickly adopted several strategies to bring new behavioral economics to the mainstream. For example he emphasized applications of behavioral insights to the study of economically important domains such as financial markets. Wanner also solicited prominent and promising economists for applications, including Kenneth Arrow (1921–), Vernon Smith (1927–), George Akerlof (1940–), and Robert Shiller (1946–)(Heukelom, 2012).[7] Simon, one of Wanner's 40 invitees in 1985, criticized Wanner's program for taking "too seriously the premises of contemporary economic methodology that theories ('models') come first and empirical work afterwards"; for Simon the problem was that "mainline economists continue to ignore vast bodies of relevant evidence in their preferred pursuit of armchair model building." (Simon's 1986 letter to Wanner cited in Heukelom, 2012). Wanner and his advisors, however, seem to have been aware that a key to the success of behavioral economics was to accommodate psychological findings *without* giving up economists' way of model building.

[7]Smith, who shared the 2002 Nobel prize with Kahneman, however, was critical about the direction of the behavioral economics programme by the 1990s; his prize was awarded for a distinct research program called experimental economics.

6 The "second-wave" behavioral economics

Matthew Rabin (2002, 658) observed the rise of "second-wave behavioral economics", which "moves beyond pointing out problems with current economic assumptions, and even beyond articulating alternatives, and on to the task of systematically and formally exploring the alternatives with much the same sensibility and mostly the same methods that economists are familiar with." As examples, he mentions the models of time preferences and social preferences.[8] In the following two subsections I illustrate these models in turn, and in the last subsection I briefly discuss recent criticisms of these "second-wave" models.

6.1 Modeling dynamically inconsistent preferences

Since important economic behavior such as saving concerns consumption that are to be made over an extended period of time, economic theory needs to explicitly model how consumers value delayed as well as immediate consumptions. Paul Samuelson (1915–2009) proposed the discounted utility model (DUM), which had become the standard model of time discounting (Samuelson, 1937). One of the fundamental assumptions of DUM is that "[d]uring any specified period of time, the individual behaves so as to maximise the sum of all future utilities, they being reduced to comparable magnitudes by suitable time discounting." (p. 156) As a "suitable time discounting" function, Samuelson proposed, without any commitment to its empirical or normative plausibility, the following exponentially-declining discount function:

$$d(t) = \delta^t \tag{1}$$

where $0<\delta<1$. An exponential discount function is characterized by a *constant discount rate* for all future events. Thaler (1981), however, using a survey method, showed that the per-period discount factor δ declined over time. Later studies have confirmed this result (see Frederick et al., 2002, for a review). Intuitively put, this is because people value the present and future very differently. People obviously value present consumption (at time t) more than future consumption at $t + 1$, but an exponential discount function suggests that the discount rate between t and $t + 1$ is the same as that between $t + 1$ and $t + 2$. But since the former case is a comparison between the present event and a future one, while the latter between two future events, the former should show more pronounced discounting. To capture this feature of time discounting, Laibson (1997) adopted a "quasi-hyperbolic" discount function, which had been used in a model of intergenerational

[8] In the domain of risk preferences, Tversky and Kahneman's (1992) Cumulative Prospect Theory can be seen as a "second-wave" upgrade of their original Prospect Theory.

altruism by Phelps and Pollak (1968):

$$d(t) = \beta\delta^t \tag{2}$$

where $0<\delta<1$, and $0<\beta<1$. Hyperbolic discount functions imply discount rates that decline as the discounted event is moved further away in time, capturing familiar problems of impulsive behavor and procrastination. Note that hyperbolic discounting generalizes the standard assumption of exponential discounting, i.e., (1) reduces to (2) if $\beta=1$, while retaining Samuelson's assumption about the existence of a time-additive utility function. Laibson (1997) adopted a discrete, rather than continuous, version of a hyperbolic discount function (hence the "quasi" qualification), in order to "mimics the qualitative property of the hyperbolic discount function, while maintaining most of the analytical tractibility of the exponential discount function." (450) This is the kind of "sensibility" and the methods that economists are familiar with.

6.2 Modeling prosocial preferences

Another growing domain of research in behavioral economics is the study of prosocial behavior. Although the default assumption in the theory of public goods since Samuelson (1954) had been selfish individuals, *viz.*, that individuals care only about self-interest narrowly defined in terms of own material gains and losses, the field evidence such as successful voluntary provision of public goods and charitable giving prompted economists to propose alternative models of non-selfish preferences that better explain the observations (e.g., Becker, 1974; Sugden, 1984). Experimental economists and psychologists have also tested since 1980s so many different variations of prisoner's dilemma and public goods games that there is now substantial body of evidence against the selfishness assumption (see Ladyard, 1995; Chaudhuri, 2011).

However, the business of modeling prosocial preferences boomed with the inventions of other games from which one can more straightforwardly infer players' beliefs and preferences. The *ultimatum game* (Güth et al., 1982) is a game in which one player (the Proposer) makes a take-it-or-leave-it offer, as a division of a sum of money between herself and another player. If the second player (the Responder) accepts the division, then both players earn the specified amounts. If the Responder rejects it, they both get nothing. The standard prediction (rational play plus selfish preference) is that the Proposer will offer a minimum divisible sum of the money, which will be accepted by the Responder: for the Responder, any positive sum is better than zero (money maximization); since the Proposer knows this, she proposes the smallest amount to maximize her own money. Evidence from experiments shows (i) that Proposers offer on average 30–40% of the money

(modal and median offers are 40–50%); and (ii) that Responders reject small offers below 20% about half the time. These results clearly falsify the standard prediction. Even in the game in which the Responder has no choice but to accept the offer (the *dictator game*, Kahneman et al. (1986)), the Dictator offers on average about 20% of the sum (see Camerer, 2003).

Models of *social preferences* try to accommodate the data across these experimental games, as well as prisoner's dilemma and public goods games. Rabin (1993), employing *psychological game theory*, proposed a model of *reciprocal fairness*, where one player matches another's 'intention', which is inferred from the payoff structure of the game. For example, a responder in an ultimatum game may act 'mean' (reject) if she thinks the proposer to be 'mean' for offering, say 20%, because he could have offered her 40%, if not 50%. Fehr and Schmidt (1999) offerred another model of *inequality aversion*, in which players have a preference for egalitarian distribution of the payoffs. For example, an inequality-averse player may give a substantial portion of the pie to the second player in a dictator game.

6.3 Recent criticisms of the "second wave" models

In recent years, these models of "second wave" behavioral economics attracted mainly two types of methodological criticism. The first concerns its single-minded modification of functional forms instead of explicitly modeling plausible psychological *processes* (e.g., Rubinstein, 2003). In particular, social preference theorists' conviction that "[f]or modeling purposes, behaviorally relevant emotions can be captured by appropriate formulations of the utility function" (Camerer and Fehr, 2004, 80) have been challenged on several conceptual and methodological grounds (Heap and Varoufakis, 2004; Guala, 2006; List, 2007). Accordingly, models that draw more directly on cognitive and social psychology have been proposed (e.g., Bicchieri, 2006).

The second type of criticism concerns the specific ways in which behavioral economists interpret the data from experiments. In particular, Ross (2014) criticizes their strategy to identify central tendencies in a small sample and explain them in terms of common psychological dispositions of individuals, or utility functions that represent such tendencies (pp. 156, 233, 250). Ross instead advocates the approach to econometrically estimate the structure of *heterogeneity* in the data-generating processes in the large data set, in order to predict how such heterogeneity respond to policy interventions at the population level (see Andersen et al., 2008).

7 Conclusion

In this review, I briefly sketched the historical development of behavioral economics, which is nicely summarized as what Camerer and Loewenstein (2004, 7) call a "recipe" of behavioral economics:

> First, identify normative assumptions or models that are ubiquitously used by economists, such as Bayesian updating, expected utility and discounted utility. Second, identify anomalies—i.e., demonstrate clear violations of the assumption or model, and painstakingly rule out alternative explanations (such as subjects' confusion or transactions costs). And third, use the anomalies as inspiration to create alternative theories that generalize existing models. A fourth step is to construct economic models of behavior using the behavioral assumptions from the third step, derive fresh implications, and test them.

My narrative has along the way emphasized a key to the academic success of behavioral economics, namely its adoption of standard economic modeling techniques such as utility maximization and equilibrium analysis. But the prominence of behavioral economics might not be as stable as it appears now, for it faces challenges from *both* psychology and economics, as briefly discussed in section 6.3: one the one hand, the psychological critique suggests the limits of modeling *individual psychological processes* using existing economic methods; on the other, the economic (or econometric, to be more specific) critique points to the limits of modeling *aggregate-level data-generating processes* using a single representative functional form. It remans to be seen how behavioral economists will address these distinct challenges, and how their disciplinary identity will be affected as a consequence.

References

Allais, M. (1953). Le comportement de l'homme rationnel devant le risque: Critique des postulats et axiomes de l'ecole americaine. *Econometrica 21*(4), pp. 503–546.

Altman, M. (2006). *Handbook of contemporary behavioral economics: foundations and developments*. Armonk, N.Y.: M.E. Sharpe.

Andersen, S., G. W. Harrison, M. I. Lau, and E. E. Rutström (2008). Eliciting risk and time preferences. *Econometrica 76*(3), 583–618.

Angner, E. and G. Loewenstein (2012). Behavioral economics. In U. Mäki (Ed.), *Philosophy of Economics*, Volume 13 of *Handbook of the Philosophy of Science*, pp. 641–689. Elsevier.

Ariely, D. (2008). *Predictably irrational: the hidden forces that shape our decisions* (1st ed ed.). New York, NY: Harper.

Ashraf, N., C. F. Camerer, and G. Loewenstein (2005). Adam smith, behavioral economist. *Journal of Economic Perspectives 19*(3), 131–145.

Becker, G. S. (1974). A theory of social interactions. *The Journal of Political Economy 82*(6), 1063–1093.

Bicchieri, C. (2006). *The Grammar of Society*. Cambridge, England: Cambridge University Press.

Camerer, C. F. (2003). *Behavioral Game Theory*. Princeton, NJ: Princeton University Press.

Camerer, C. F. and E. Fehr (2004). Measuring social norms and preferences using experimental games: A guide for social scientists. In J. Henrich, R. Boyd, S. Bowles, C. Camerer, E. Fehr, and H. Gintis (Eds.), *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*, Chapter 3, pp. 55–95. Oxford: Oxford University Press.

Camerer, C. F. and G. Loewenstein (2004). Behavioural economics: past, present, future. In C. F. Camerer, G. Loewenstein, and M. Rabin (Eds.), *Advances in Behavioral Economics*, Chapter 1, pp. 3–51. Princeton, NJ: Princeton University Press.

Chaudhuri, A. (2011). Sustaining cooperation in laboratory public goods experiments: a selective survey of the literature. *Experimental Economics 14*(1), 47–83.

Davidson, D., S. Siegel, and P. Suppes (1955). Some experiments and related theory on the measurement of utility and subjective probability. Technical report prepared for office of naval research, Stanford University, Stanford.

Edwards, W. (1954). The theory of decision making. *Psychological Bulletin 41*, 380–417.

Edwards, W. (1961). Behavioral decision theory. *Annual Review of Psychology 12*, 473–498.

Edwards, W., H. Lindman, and L. J. Savage (1963). Bayesian statistical inference for psychological research. *Psychological Review 70*, 193–242.

Ellsberg, D. (1961). Risk, ambiguity, and the savage axioms. *The Quarterly Journal of Economics 75*(4), pp. 643–669.

Fehr, E. and K. M. Schmidt (1999). A theory of fairness, competition, and cooperation. *The Quarterly Journal of Economics 114*(3), 817–868.

Frederick, S., G. Loewenstein, and T. O'Donoghue (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature 40*(2), pp. 351–401.

Friedman, D., R. M. Isaac, D. James, and S. Sunder (2014). *Risky curves: on the empirical failure of expected utility*. New York: Routledge.

Friedman, M. and L. J. Savage (1948). The utility analysis of choices involving risk. *Journal of Political Economy 56*(4), pp. 279–304.

Friedman, M. and L. J. Savage (1952). The expected-utility hypothesis and the measurability of utility. *Journal of Political Economy 60*(6), pp. 463–474.

Gilad, B. and S. Kaish (1986). *Handbook of behavioral economics*. Greenwich, Conn.: JAI Press.

Gilovich, T., D. W. Griffin, and D. Kahneman (2002). *Heuristics and biases: the psychology of intuitive judgement*. Cambridge, U.K.: Cambridge University Press.

Grether, D. and C. R. Plott (1979). Economic theory of choice and the preference reversal phenomenon. *American Economic Review 69*, 623–638.

Guala, F. (2006). Has game theory been refuted? *The Journal of Philosophy 103*(5), pp. 239–263.

Güth, W., R. Schmittberger, and B. Schwarze (1982). An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior & Organization 3*(4), 367–388.

Heap, S. H. and Y. Varoufakis (2004). *Game theory: a critical text* (2nd ed., rev. ed ed.). London: Routledge.

Heukelom, F. (2009). *Kahneman and Tversky and the Making of Behavioral Economics*. Ph. D. thesis, University of Amsterdam.

Heukelom, F. (2010). Measurement and decision making at the university of michigan in the 1950s and 1960s. *Journal of the History of the Behavioral Sciences 46*(2), 189–207.

Heukelom, F. (2011). Building and defining behavioral economics. In J. E. Biddle and R. B. Emmett (Eds.), *Research in the History of Economic Thought and Methodology*, Volume 29, pp. 1–29. Emerald Group Publishing Limited.

Heukelom, F. (2012). A sense of mission: The alfred p. sloan and russell sage foundations' behavioral economics program, 1984-1992. *Science In Context 25*, 263–286.

Heukelom, F. (2014). *Behavioral economics: a history*. Cambridge: Cambridge University Press.

Hosseini, H. (2003). The arrival of behavioral economics: from michigan, or the carnegie school in the 1950s and the early 1960s? *Journal of Socio-Economics 32*(4), 391–409.

Kahneman, D. (2003). Biographical. Nobelprize.org.

Kahneman, D. (2013). *Thinking, fast and slow* (1st pbk. ed ed.). New York: Farrar, Straus and Giroux.

Kahneman, D., J. L. Knetsch, and R. H. Thaler (1986). Fairness and the assumptions of economics. *The Journal of Business 59*(4), pp. S285–S300.

Kahneman, D., P. Slovic, and A. Tversky (1982). *Judgment under uncertainty:*

heuristics and biases. Cambridge: Cambridge University Press.

Kahneman, D. and A. Tversky (1979). Prospect theory: An analysis of decision under risk. *Econometrica 47*(2), pp. 263–292.

Kahneman, D. and A. Tversky (2000). *Choices, values, and frames*. New York: Russell sage Foundation.

Katona, G. and J. N. Morgan (1980). *Essays on behavioral economics*. Ann Arbor, Mich.: Survey Research Center, Institute for Social Research, University of Michigan.

Ladyard, J. (1995). Public goods: a survey of experimental research. In J. H. Kagel and A. E. Roth (Eds.), *Handbook of Experimental Economics*, pp. 111–194. Princeton University Press.

Laibson, D. (1997). Golden eggs and hyperbolic discounting. *The Quarterly Journal of Economics 112*(2), 443–478.

Lichtenstein, S. and P. Slovic (1971). Reversals of preferences between bids and choices in gambling decisions. *Journal of Experimental Psychology 89*, 46–55.

Lichtenstein, S. and P. Slovic (1973). Response-induced reversals of preference in gambling - extended replication in las-vegas. *Journal of Experimental Psychology 101*, 16–20.

Lichtenstein, S. and P. Slovic (2006). *The construction of preference*. Cambridge: Cambridge University Press.

List, J. A. (2007). On the interpretation of giving in dictator games. *Journal of Political Economy 115*(3), 482–493.

Markowitz, H. (1952). The utility of wealth. *Journal of Political Economy 60*(2), pp. 151–158.

Mosteller, F. and P. Nogee (1951). An experimental measurement of utility. *Journal of Political Economy 59*(5), pp. 371–404.

Mullainathan, S. and R. H. Thaler (2001). Behavioral economics. In N. J. Smelser and P. B. Baltes (Eds.), *International Encyclopedia of the Social and Behavioral Sciences*, pp. 1094–1100. Elsevier.

Phelps, E. S. and R. A. Pollak (1968). On second-best national saving and game-equilibrium growth. *The Review of Economic Studies 35*(2), pp. 185–199.

Phillips, L. D. and D. von Winterfeldt (2007). Reflections on the contributions of ward edwards to decision analysis and behavioral research. In W. Edwards (Ed.), *Advances in Decision Analysis: From Foundations to Applications*, Chapter 5, pp. 71–80. Cambridge University Press.

Poundstone, W. (2010). *Priceless: the myth of fair value (and how to take advantage of it)* (1st ed ed.). New York: Hill and Wang.

Rabin, M. (1993). Incorporating fairness into game theory and economics. *The American Economic Review 83*(5), pp. 1281–1302.

Rabin, M. (2002). A perspective on psychology and economics. *European Economic*

Review 46(4â“5), 657 – 685.

Ramsey, F. P. (1931). Truth and probability. In R. B. Braithwaite (Ed.), *The foundations of mathematics and other logical essays*, Chapter 7, pp. 156–198. K. Paul, Trench, Trubner & co., ltd.

Ross, D. (2014). *Philosophy of Economics*. New York: Palgrave Macmillan.

Rubinstein, A. (2003). "economics and psychology"? the case of hyperbolic discounting. *International Economic Review 44*(4), 1207–1216.

Samuelson, P. A. (1937). A note on measurement of utility. *The Review of Economic Studies 4*(2), 155–161.

Samuelson, P. A. (1954). The pure theory of public expenditure. *The Review of Economics and Statistics 36*(4), pp. 387–389.

Savage, L. J. (1954). *The foundations of statistics*. New York: Wiley.

Sent, E.-M. (2004). Behavioral economics: how psychology made its (limited) way back into economics. *History of Political Economy 36*(4), 735–760.

Simon, H. A. (1996). *The sciences of the artificial* (3rd ed ed.). Cambridge, Mass.: MIT Press.

Smith, A. (2002). *The Theory of Moral Sentiments*. Cambridge, UK: Cambridge University Press.

Sugden, R. (1984). Reciprocity: The supply of public goods through voluntary contributions. *The Economic Journal 94*(376), pp. 772–787.

Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization 1*(1), 39–60.

Thaler, R. (1981). Some empirical evidence on dynamic inconsistency. *Economics Letters 8*(3), 201 – 207.

Thaler, R. H. (1992). *The winner's curse: paradoxes and anomalies of economic life*. Princeton, N.J.: Princeton University Press.

Tversky, A. and D. Kahneman (1971). Belief in the law of small numbers. *Psychological Bulletin 76*(2), 105–110.

Tversky, A. and D. Kahneman (1974). Judgement under uncertainty: Heuristics and biases. *Science 185*, 1124–1131.

Tversky, A. and D. Kahneman (1981). The framing of decision and the psychology of choice. *Science 211*, 453–458.

Tversky, A. and D. Kahneman (1986). Rational choice and the framing of decisions. *The Journal of Business 59*(4), S251–S278.

Tversky, A. and D. Kahneman (1992). Advances in prospect theory: Cumulative representation of utility. *Journal of Risk and Uncertainty 5*, 297–323.

Von Neumann, J. and O. Morgenstern (2004). *Theory of games and economic behavior* (60th anniversary ed.). Princeton, N.J.: Princeton University Press.