

Behavioural economic methods

Handbook of Research Methods in Behavioural Economics

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2. Behavioural economic methods

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INTRODUCTION

Behavioural economics has been defined as ‘the combination of psychology and economics that investigates what happens in markets in which some of the agents display human limitations and complications’ (Mullainathan and Thaler, 2001, p. 1094). This definition focuses on the contribution of psychology to the economic analysis of human behaviour, thus excluding socioeconomics, economic anthropology and neuroeconomics as possibly relevant disciplines, overviews of which can be found in Hellmich (2017), Carrier (2012) and Glimcher and Fehr (2013), respectively. The main human limitations distinguished in Mullainathan and Thaler (2001) are bounded rationality, bounded willpower and bounded self-interest – factors causing deviations from predictions of the standard economic model of behaviour. Although such human characteristics of economic agents are not recognised in the current standard economic model, this has not always been the case in economic theory. For example, Adam Smith and Jeremy Bentham referred to human emotions (see Kahneman, Wakker and Sarin, 1997; Ashraf, Camerer and Loewenstein, 2005), which were later abandoned in neoclassical economic theory (see Angner and Loewenstein, 2012).

The development of economic theory roughly followed similar developments in psychology, i.e., introspection (e.g., Wilhelm Wundt) and psychoanalysis (e.g., Freud) at the turn of the 19th century, then behaviourism in the early 20th century and the cognitive revolution in the 1950s and 1960s. Economic theory paralleled these developments with the emergence of postwar neoclassical theory (or ordinalism), followed by some early behavioural economic insights in the 1960s (e.g., Herbert Simon, George Katona) and the onset of contemporary behavioural economics (e.g., Daniel Kahneman, Amos Tversky). Angner and Loewenstein (2012) provide a more detailed overview of the history of behavioural economics.

Together with the rise of contemporary behavioural economics, the discipline of economic psychology emerged, in which psychological theory was applied to economic behaviour (Van Raaij, 1999). Although behavioural economics frequently uses experimental methods in research, the field of experimental economics is generally associated with testing the standard economic model rather than the application of psychological insights in economic theory (Antonides, Bolger and Trip, 2006; Angner and Loewenstein, 2012).

Here, we aim at describing the methods used in behavioural economics and distinguishing these methods from those used in standard economic practice. We also describe the contributions of psychological insights to economics. Since behavioural economics has started by showing a number of anomalies – essentially deviations from standard economic predictions – we will first explain these results in the second section. In the third section, we deal with different types of utility than are usually defined in economics. The fourth section deals with measures of economically relevant concepts – utility, well-being, preferences and the different methodologies used. The fifth section shows a number of ways in which psychological insights have been integrated into economic theory. The sixth section concludes.

ANOMALIES

The standard economic model assumes rationality as observed by revealed preferences, resulting in some weird types of decision-making as in Frank and Cartwright's crank oil example (2015). The example describes a man who drinks crank oil and then dies in agony. The conclusion from the standard model would be that the man must have liked the crank oil very much, otherwise, he would not have preferred drinking it to living. Rationality also assumes optimal thought processes in which actors obtain their best possible outcomes, given their preferences and opportunities. The assumption of optimal thought processes can be disconfirmed easily, for example by letting people either choose between two different lotteries or make a bid for each lottery, one with high probability and low prize, and one with low probability and high prize, both with an equal expected outcome (Lichtenstein and Slovic, 1971). In choosing, the high probability lottery is preferred, whereas, in bidding, the high prize lottery is preferred. The results hold up under a variety of conditions (Grether and Plott, 1979), thus violating procedure invariance (Tversky and Thaler, 1990), according to which different procedures (i.e., choosing or bidding) should lead to similar outcomes.

The standard model assumes stable preferences, which also has been found not to hold true in a number of experiments on dynamic choices, offering people exactly the same choices at different points in time. Thaler (1981, p. 202) offered the following thought experiment: 'Choose between one apple today or two apples tomorrow', then 'Choose between one apple in one year or two apples in one year plus one day'. Some people would choose one apple today, but everyone offered the option would wait one more day to obtain the two apples in one year plus one day. This result reflects the dynamic inconsistency of preferences. In a similar way, actual choices involving real money show a higher preference to forego the receipt of a certain amount of money in favour of a higher future amount if the choices are offered in the distant future rather than in the near future (e.g., Antonides and Wunderink, 2001). For an overview of research on dynamic inconsistency, see Frederick, Loewenstein and O'Donoghue (2002).

Another assumption concerns intransitive preferences, i.e., the violation of the preference ordering $A > B > C$ in making pairwise choices. Tversky (1969) identifies intransitive choices between lotteries varying in probabilities, prize amounts and expected values, and between college applicants varying in intellectual ability, emotional stability and social facility. Guadalupe-Lanas et al. (2020) describe substantial intransitivity of consumer preferences for edible goods.

The aforementioned violations of important economic assumptions have become known as anomalies.¹ Often, such anomalies indicate the construction of preference (Slovic, 1995), either caused by external influences from the environment or by the calculation of preferences in the decision process (Warren, McGraw and Van Boven, 2011). Such anomalies have also been characterised as heuristics and biases, a large number of which have been catalogued.² A large volume of research projects has been devoted to the discovery and validation of anomalies in the economic model, thus casting doubt on the realism of economic theory. In fact, behavioural economics has often given the impression of being a science of anomalies. We argue that the discovery of anomalies has only been the first step in the process. Further steps include showing the occurrence of such anomalies in daily life and business practices, and the integration of these discoveries into economic theory.

In order to show the existence of anomalies in daily life, behavioural economics has made efforts to facilitate the study of psychological factors in economic behaviour. These efforts

include a distinction between different types of utility and the development of direct measures of economic concepts, to be considered next.

DIFFERENT TYPES OF UTILITY

The standard economic model appears to be concerned with decision utility only, capturing the utility inferred from choices (as in the crank oil example earlier). But other measures of utility are arguably important both to well-being and to an accurate understanding of decisions. Decision utility is possibly influenced by both remembered utility and predicted utility (Kahneman, Wakker and Sarin, 1997). Remembered utility captures the memories related to some experience, e.g., consumption. Obviously, nice memories may lead to decisions to repeat experiences. Alternatively, predicted utility consists of perceptions or expectations about experiences. Kahneman and Snell (1992) showed that people generally predicted a declining satisfaction with repeated experiences (e.g., enjoyment of consuming ice cream or listening to short music pieces), whereas their actual satisfaction did not decline with repetitions. Furthermore, Read and Loewenstein (1995) showed that people's simultaneous choices (in advance of their experiences) yielded more variety than their sequential choices (after experiencing them consecutively), indicating another difference between predicted utility and experienced utility (see also Read et al., 2001). Differences between predicted and experienced utility may be explained by projection bias – the inability to empathise with experiences different from the here and now (Loewenstein, O'Donoghue and Rabin, 2003). Alternatively, predicted satisfaction may be instigated by other consumers' experiences, as frequently reported on hotel or restaurant websites (Mauri and Minazza, 2013).

Experienced utility consists of instantaneous utility – a flow of immediate hedonic and affective experiences over time. One might conceive of temporally integrating the instantaneous utility flow to obtain the total utility of an episode (Kahneman, Wakker and Sarin, 1997). But it does not appear to be the case that such a temporally integrated total utility is what people recall in daily life. Rather, recollections are explained better by the so-called peak-and-end rule, i.e., by both the most extreme and the final instant utility of an experience, and duration neglect, indicating that the duration of the experience does not matter in conceiving one's total utility. Kahneman et al. (1993) showed that the total utility for patients undergoing a painful colonoscopy procedure was explained by both the most extreme pain during the procedure and the pain experienced at the end of the procedure. By adding a little less painful experience at the end, the global evaluation of the entire procedure was improved, thus demonstrating duration neglect. Ross and Simonson (1991) showed that the total utility of playing two computer games – one interesting game and one boring game – was reported higher if the interesting game was played last than if it was played first, thus demonstrating the end effect. Verhoef, Antonides and De Hoog (2004) found both peak-and-end effects in the evaluation of agent–client conversations at a call centre.

A different dimension of distinction in utility relative to those referenced earlier is between outcome utility and procedural utility. The term procedural utility refers to the non-instrumental pleasures and displeasures of processes. Frey, Benz and Stutzer (2004) contend that people frequently prefer fair procedures to beneficial outcomes because they contribute to a positive sense of self, autonomy, relatedness and competence. Examples include tax compliance being correlated with respectful treatment of taxpayers, democratic participation being correlated with life satisfaction and higher job satisfaction for self-employed people than

employees (*ceteris paribus*), among others. Kahneman, Knetsch and Thaler (1986a, 1986b) provide evidence of procedural fairness affecting people's preferences for the allocation of football match tickets, generally showing preference for standing in a queue rather than selling the tickets to the highest bidder. Other evidence is related to transaction costs in purchasing the same beer at the grocery store or at a fancy resort (Thaler, 1985). People appear to find a high price at the resort fairer than a high price at the grocery store. Another famous example comes from experimental studies of the ultimatum game (Güth, Schmittberger and Schwartz, 1982), in which player A distributes a sum of money, say \$10, between themselves and player B. If player B agrees with the offer the sum will be allocated as player A proposed, otherwise both get nothing. In contrast with the game-theoretic prediction – A leaving the smallest possible amount to B – many offers are of the 60–40 per cent type. In all these examples, procedural fairness turns out more important than economic benefits (i.e., outcomes) in people's decision-making.

A somewhat different process than described earlier is adaptive preference formation, holding that preferences for goods may be adapted to the possibilities of obtaining those goods, resulting in sour grapes (Elster, 1982).³ For example, a consumer with a small budget may prefer a small car to a large car, reasoning that a large car is environmentally unfriendly, rather than admitting that the budget is too small to obtain the large car. Such a process may be explained by a motivation to reduce cognitive dissonance (Festinger, 1957), caused by the incompatibility of wanting the large car and the impossibility to buy it. Elster (1982) also gives an example of maladaptive preference formation, characterised by 'forbidden fruit is sweet', which is caused by the instantaneous infeasibility to obtain a certain good.

So far, we have considered relatively short-term preference changes, but what can behavioural economics contribute to explaining long-term changes? In one view, preference changes may be non-existent because preferences are demonstrably stable and similar across people (Stigler and Becker, 1977). Instead, long-term changes in behaviour may be explained from different Z-production technologies, based on time and human capital inputs. An example of a Z-commodity is the appreciation of music, which can be more efficiently produced and consumed by previous time spent on listening and musical education while doing so, leaving the actual utility of musical appreciation unchanged. This view of stable and uniform preferences has been challenged on the basis of parsimony, in that behaviours can often be explained more directly as involving changes in utility (Hirschman, 1984) on the basis that changes in personality over time justify the use of different utility functions (Caplan, 2003) and on the basis that variations in the demand for Z-commodities lack explanation (Cowen, 1989). The fifth section includes several ways in which economic theory may explain preference changes, e.g., with respect to the influence of personal identity and income evaluation.

MEASURES OF ECONOMICALLY RELEVANT CONCEPTS

In addition to showing the existence of anomalies in the standard economic model, frequently in laboratory experiments, other attempts at gaining more insight into human decision-making have been based on measuring economically relevant concepts directly, including well-being and preferences. Such measures then may be related to a broad range of economic behaviours outside of the laboratory. Such endeavour contributes to the scaling-up of small-scale laboratory findings to larger markets and settings, as advocated in List (2021). We include measures

that are either based on laboratory tasks or verbal questionnaires. We focus on the most frequently used concepts in economic research.

Loss Aversion

Loss aversion implies that a loss is evaluated as more unpleasurable than a commensurate gain is evaluated as pleasurable (Kahneman and Tversky, 1979). An indication of loss aversion is the endowment effect, holding that preventing the loss of an object in possession is worth more than the acquisition of that object not in possession (Kahneman, Knetsch and Thaler, 1990, 1991). Loss aversion has been shown to be related to selling stock (Shefrin and Statman, 1985), default options in organ donations (Johnson and Goldstein, 2003), brand switching (Hartman, Doane and Woo, 1991) and spending income framed as either a bonus or a rebate (Epley, Mak and Idson, 2006), among many other applications.

Gächter, Johnson and Herrmann (2007) have developed a measure of loss aversion in both riskless and risky choices, based on monetary values of willingness to accept the loss of an object in possession (WTA) and willingness to pay to acquire the object (WTP), as previously used in laboratory experiments. The riskless choices comprised WTP and WTA for a miniature car; the risky choices comprised choices to play lotteries with a fixed gain (6 euros) and various amounts of losses (2–7 euros). The ratio of WTA and WTP in the riskless choices, and the lottery which was just acceptable, served as the measures of loss aversion. All choices were made ‘for real’, using the mechanism described in Becker, De Groot and Marschak (1964). Significantly more loss aversion was observed at higher ages, lower levels of schooling and higher levels of income and wealth. Loss aversion measures for riskless and risky choices were highly correlated (Spearman’s $\rho = 0.635$).

De Baets and Buelens (2012) developed an 18-item verbal questionnaire (Cronbach’s $\alpha = 0.82$) to measure loss aversion, including items such as ‘I would feel very emotional if my car (bike) would be stolen’ and ‘I get easily attached to material things (my car, my furniture)’. Significantly higher loss aversion was associated with lower education, younger age and higher measured anxiety. The education effect is consistent with Gächter, Johnson and Herrmann (2007), but the age effect is not.

Risk

Holt and Laury (2002) measured risk aversion on the basis of lottery choices with either low (up to \$3.85) or high monetary stakes (up to \$346.50, i.e., 90 times the low stakes). Using responses from university student and staff samples, they made estimates of the Pratt-Arrow measure of relative risk aversion. They observed significantly more risk aversion at higher stakes. They ran similar lotteries both hypothetical and ‘for real’ and observed significantly lower risk aversion in the hypothetical case relative to the ‘real’ case. Using this same lottery procedure with a sample of farmers, Vollmer, Hermann and Musshof (2017) showed that farmers who took less production risk in their regular work exhibited higher risk aversion in the lotteries.

In their seminal paper introducing prospect theory, Kahneman and Tversky (1979) made the case that risk preferences differ between positive and negative outcomes under uncertainty, reflecting a value function that takes a different shape in the domain of losses relative to the domain of gains. Typically, people tend to be risk averse with respect to positive changes relative to their reference point and risk-seeking with respect to negative changes.

Kahneman and Tversky (1979) also showed overweighting of small probabilities and underweighting of moderate probabilities. More evidence for this phenomenon was obtained by Van de Stadt, Antonides and Van Praag (1984), who offered people a survey question involving an income gamble with equal chances of losing and winning (50 per cent). If their income would fall by 5 per cent, they had to state what percentage increase would lead them to just accept the game (similar questions were asked with 10 per cent, 20 per cent and 30 per cent of loss). They estimated people's perceived probability of 50 per cent that best explained their answers at 45 per cent (for a logarithmic function), resp. 47 per cent (for a lognormal function). Note that the lognormal utility function is convex for small incomes and concave for larger incomes.

Falk et al. (2016) adapted the lottery task for use in large surveys, presenting respondents with only five questions organised progressively – each successive question adapted based upon responses to the previous one – their risk aversion measure derived based on the response at which the respondent changed from preferring the lottery to the safe alternative. In addition, they asked: 'In general, how willing are you to take risks?', providing an 11-point scale for the response. Then, the answers to the two categories of questions were averaged with roughly equal weights, with the weights determined based on their effectiveness in explaining different types of behaviour. A small subsample answered the same questions one week later, showing a test–retest correlation of 0.35. Falk et al. (2018) reported the results of the questions in 76 countries with over 80,000 respondents, showing higher risk aversion for women than men, for those with lower mathematical skills and for elderly people. Low risk aversion, or risk-taking, was associated with smoking behaviour and being self-employed. Also, controlling for other factors, risk-taking was associated with respondents in countries with higher GDP.

The risk measures described here were conceived as being applicable to a large range of behaviours, although they were based mainly on financial risks. Weber, Blais and Betz (2002) showed that both risk perceptions and risk preferences are domain-specific: they tend to differ across financial, health/safety, social, ethical and recreational risks. They developed a 40-item domain-specific risk-attitude scale (DOSPERT), consisting of verbal items with respect to both the likelihood of engagement in different behaviours and how risky each behaviour was perceived. For example, they asked respondents to indicate on a seven-point scale the likelihood that they would engage in 'investing 10 per cent of your annual income in a moderate growth mutual fund' (financial domain) and 'taking some questionable deductions on your income tax return' (ethical domain). Cronbach's alphas were 0.88 for the risk-behaviour scale and 0.89 for the risk-perception scale. Despite the high internal consistency, the correlations of the risk-behaviour scales across domains were moderate, and in some instances even negative. Correlations indicating one-month test–retest reliabilities varied between 0.44 and 0.80 for the risk behaviour scales and between 0.42 and 0.67 for the risk-perception scales. Men and women differed both in their perceptions and likelihood to engage in different behaviours. Men had lower risk perceptions than women in all domains except for gambling and social risk, where differences were not significant. Men were also more likely to engage in risky behaviours than women, except for the social domain, in which women were more likely to take risks. Blais and Weber (2006) refined DOSPERT and reduced it to 30 items, showing Cronbach's alphas ranging from 0.71 to 0.86 for risk behaviours and from 0.74 to 0.83 for risk perceptions. Most individuals showed negative correlations between risk perceptions and risk behaviours, suggesting that they were perceived-risk averse.

Time

The economic concept of time preference indicates how future outcomes are valued in the present and has implications for saving and borrowing behaviour. Standard economic models typically use the interest rate to calculate present values of future outcomes. However, much larger subjective discount rates have been found in consumer decision-making, indicating high impatience (Hausman, 1979; Gately, 1980). Moreover, subjective discount rates have been found to be higher in the near than in the far future, for smaller as opposed to larger outcomes and for losses as distinct from gains (Thaler, 1981). Time preference has been measured by so-called time-tradeoff questions of the type ‘Do you prefer \$100 today or \$150 in a year?’ (Harrison, Lau and Williams, 2002) and appears to be higher for older individuals and for individuals with lower levels of education and income.

To measure time preference, Falk et al. (2016) adapted their risk preference measurement approach of asking five questions organised progressively, in addition to one verbal question: ‘In comparison to others, are you a person who is generally willing to give up something today in order to benefit from that in the future?’ The two categories of questions were averaged using weights of 0.71 and 0.29, respectively (Falk et al., 2018). The one-month test–retest correlation was 0.67. Impatience appeared to be somewhat higher for women than for men, and lower for those with better math skills. Both the young and old people were more impatient than the middle-aged, in line with Read and Read (2004).

Time preference can be related to the psychological concept of willingness to delay gratification (Mischel, 1974). It has been observed in experiments that children vary with respect to their willingness to defer a reward (e.g., a certain amount of candy) in order to receive a larger reward (e.g., a larger amount of candy) at some later point in time. Delay of gratification has a very pervasive and stable effect on behaviour. It was observed, for example, that a preschool child’s ability to delay gratification for pretzels or marshmallows is related to her socially competent behaviour some 12 years later (Mischel, 1984). Since delay of gratification can be a highly consequential personal trait, in psychology this concept has been measured by means of a verbal scale indicating the respondent’s level of consideration of future consequences (Strathman et al., 1994).⁴ Twelve survey questions were initially employed, such as: ‘I consider how things might be in the future and try to influence those things with my day-to-day behaviour’ (Strathman et al., 1994, p. 752); later, the survey battery was reduced to eight questions (Petrocelli, 2003). Typically, the answers to the scale items are factor-analysed, then used to explain behaviour. The time orientation scale has been shown to vary with different types of behaviour. Future time orientation was related to less smoking, drinking and gambling behaviour; more environmental preservation (Joireman et al., 2001); higher academic achievement and cooperation (Wolf et al., 2009); fewer bank account overdrafts (Gattig, 2002); less saving and credit card debt (Joireman, Sprout and Spangenberg, 2005); and more pension saving (Howlett, Kees and Kemp, 2008).

Several authors have used the consideration of future consequences scale to categorise responses into short-term and long-term time orientations (Joireman et al., 2008; Crockett et al., 2009; Hevey et al., 2010; Toepoel, 2010). This distinction may be relevant in explaining the dynamic inconsistency indicated earlier. Van Beek, Antonides and Handgraaf (2013) showed that time orientation may also be domain-specific, meaning that the general version of the questionnaire does not explain differences in behaviour across different domains.

Social Preference

In many situations, cooperative behaviour is more efficacious or otherwise appropriate than the pursuit of immediate advantage for oneself. In social relationships, such as the family, individuals benefit from a range of interpersonal influences. In many instances, such as blood donation, people behave selflessly in the interest of others. These modes of behaviour are examples of altruistic behaviours the strength of which may vary across people and across situations. In economics, social preferences have been formally accounted for by including the utility of others in the utility function of an individual (Becker, 1991).

Murphy and Ackermann (2014) provide an overview of measurement methods for social preferences, based on a task in which (mostly) two-person outcome distributions are presented to participants. The most popular type of task is the nine-item triple-dominance measure (Van Lange et al., 1997) which presents nine triples of outcome distributions between the participant and an arbitrary other person, e.g., 480–480, 540–280 and 480–80. A participant's preference for the first distribution would indicate a cooperative motivation (joint outcome is the highest), preference for the second an individualistic motivation (own outcome is the highest), and preference for the third a competitive motivation (difference between own and other's outcome is the highest). An individual's motivational type is assessed by counting the choices of each type. An even simpler procedure allowing a continuous measure of social preference is the circle-test (Sonnemans, Van Dijk and Van Winden, 2006), which asks an individual to point somewhere on the circle presented on a computer screen. The screen then shows a vector running from the origin of the circle to the corresponding outcome distribution on the arc of the circle and the individual can then adjust the vector angle. Murphy, Ackermann and Handgraaf (2011) developed yet another continuous measurement method, a slider, for assessing social preferences. By adjusting the slider, individuals choose a point on a continuous outcome distribution lying on a straight line running from one ideal type (e.g., altruistic) to another (e.g., competition). Since there are four economically relevant types, the slider measure contains six slider items (connecting outcomes for all ideal types), resulting in a point estimate for social preference.

Charness and Rabin (2002) have studied a number of individual choices with respect to outcome distributions and developed a social preference model in which the parameters (weights given to own and other's outcomes) are different in situations where the own outcome is higher or lower than the other's outcome, and whether the other person has behaved unfairly (i.e., not choosing a mutually beneficial division hoping to receive a higher outcome herself). Analysing a large number of different outcome distribution choices, a model of 'reciprocal charity' performed best. This model yielded a weight of 0.425 for the other's outcome (on the [0, 1] scale) if the other person's outcome was low compared to the individual, and a weight of -0.089 if the other person had acted unfairly (indicating negative reciprocity). The weight for the other's outcome, if the other's outcome was relatively high, was not significant, indicating no concern for the other if the other was ahead.

In economics and psychology, altruism has been related to public good contributions (Offerman, Sonnemans and Schram, 1996), helping behaviour (Fischer et al., 2011), voluntarism (Unger, 1991), gifts and charitable donations and behaviour in social dilemma situations and negotiations.

Falk et al. (2016) measured altruistic preferences by both asking respondents to make a donation to charity and asking: 'How willing are you to give to good causes without expecting

anything in return?’ The answers were weighted by 0.64 and 0.36, respectively. The one-month test–retest correlation of the weighted average measure was 0.42. The altruism measure, together with measures of reciprocity, correlated significantly with the dollar value of a country’s donations and volunteering activities as a share of GDP. Furthermore, altruism was significantly related to helping strangers and sending money or goods to other people in need (Falk et al., 2016).

Well-being

Since the standard economic model essentially centres on the concept of revealed preference, it tends to be agnostic to the direct measurement of utility. However, in behavioural economics, numerous revelatory findings, often deviating from standard economic predictions, have emerged from direct measures of utility and well-being. Easterlin (1974), using repeated cross-section data from the US on simple happiness questions, discovered a remarkably stable across-cross-section level of happiness, despite substantial increases in real income. However, he found within-cross-section significantly positive relationships between income and happiness. The paradoxical findings were explained from rising aspiration levels over time, due to increased possibilities of spending (Easterlin, 2001). The global happiness question ‘Taken all together, how would you say things are these days – would you say that you are very happy, pretty happy, or not too happy?’ typically indicates remembered utility, as described earlier. Despite the general finding of a marginally decreasing level of happiness with higher income (Stevenson and Wolfers, 2013), not all happiness measures have yielded the same result. Kahneman and Deaton (2010) have showed a generally positive relationship between income and scores on a (global) happiness ladder question. However, for several measures of emotional well-being (positive affect, feeling blue and stress), the positive relationship only held up to a certain income level, then became insignificant. Emotional well-being referred to ‘experiences of yesterday’, suggesting more relationship with experienced utility of today than remembered utility from global happiness ratings, possibly influencing the differences in results. An attempt at measuring experience utility has been made by Kahneman et al. (2004) using the Day Reconstruction Method (DRM). The DRM asks people to report what they did during the previous day and how they felt during different episodes. Surprisingly, individuals reported the most positive and least negative feelings during episodes spent with intimate relations, socialising and relaxing – activities on which they spent the least amount of time.

(Remembered) subjective well-being – global happiness – has been positively related to people’s income in relation to the average income in their social reference group (Ferrer-i-Carbonell, 2005), having sought information and taken precautionary measures in case of an income decline (Antonides, 2007), green consumption and conservation (Welsch and Kühling, 2010), and negatively with experiencing airport noise (Van Praag and Baarsma, 2005) and nitrogen dioxide air pollution (Welsch, 2007), for example.

There has been some discussion about the extent to which people may adapt to life events influencing their well-being (Lucas, 2007). Brickman, Coates and Janoff-Bulman (1978) found evidence of surprising adaptation in quadriplegics, but their results have been challenged by Mehnert et al. (1990). Easterlin (2003) agrees that happiness may recover after life events but states that setpoint theory – assuming a rather constant level of happiness over one’s lifetime – makes too strong assumptions of full adaptation. Yet, it may be useful to investigate more objective indicators of well-being based on experienced utility, as proposed by Kahneman (1999).

An especially economically relevant measure of happiness is income evaluation, in which people report how good or bad they evaluate each of a number of incomes, including their own. On the basis of the answers, Van Praag and Frijters (1999) estimated a lognormal income evaluation function, the location of which was found to depend on respondents' own income (poor people being happier with the same income than rich people), family size (smaller families being happier with the same income than larger families) and the average income of the respondent's social reference group (Kapteyn, Van Praag and Van Herwaarden, 1978). Yet, income evaluation is not fully adjusted after changes in these factors, indicating incomplete adaptation – consistent with findings in the well-being literature.

Other Behavioural Economic Measures

A number of other scales have been developed in behavioural economics, including positive and negative reciprocity and trust (Falk et al., 2016, 2018), mental accounting (Soman, 2001; Antonides, De Groot and Van Raaij, 2011; Olsen et al., 2019), scarcity (Van Dijk, Van der Werf and Van Dillen, 2020) and financial stress (De Bruijn and Antonides, 2020).

INTEGRATION OF ECONOMIC AND PSYCHOLOGICAL MODELS AND INSIGHTS

In addition to showing anomalies of the standard economic model in both experiments and surveys and developing measurement scales, economic theory has made several adaptations in order to accommodate behavioural insights. These adaptations focus on the main deviations from the standard economic model, as described earlier, in addition to utility based on characteristics of goods and technical efficiency models.

Loss Aversion

The idea of asymmetric utilities for gains and losses has been applied in economic demand theory in different ways. Putler (1992) showed loss aversion by adding differences between (logarithmic) purchase prices and reference prices for eggs, separately for positive and negative differences. Prices of the previous week served as reference prices. If the purchase price was higher than the reference price, demand tended to decrease more than it tended to increase if the purchase price was lower than the reference price, indicating loss aversion caused by price increases. Similar results with different specifications of demand equations were found in Talukdar and Lindsey (2013) for broccoli, grapes and raisins and Yan et al. (2016) for low-sugar biscuits and low-fat cream. In contrast to findings for healthy food, reverse loss aversion effects have been found in Talukdar and Lindsey (2013) for relatively unhealthy foods such as beef, soft drinks and potato chips; in Krisnamurthi, Mazumdar and Raj (1992) for coffee when it was out of stock; and in Maynard and Subramaniam (2015) for cheese, butter and margarine. The difference in findings may be due to different perceptions of palatability for healthy and unhealthy food (Raghunathan, Maylor and Hoyer, 2006) and to stockpiling behaviour for goods that can keep fresh for several weeks (Maynard and Subramaniam, 2015).

Time Preference

In order to accommodate dynamic inconsistency, Laibson (1997) proposed a quasi-hyperbolic discount function capturing the consumer's impatience in the short run. The function equals

the standard exponential discount rate δ for later periods, multiplied by a constant for the immediate future, i.e., $\beta^{\delta t}$, with $\beta = 1$ in the first period.

Angeletos et al. (2001) showed that US consumers' financial data concerning saving and borrowing are more consistent with hyperbolic than exponential discount rates. Laibson, Repetto and Tobacman (2007) estimate the short-run discount rate at 39.5 per cent and a long-run discount rate at 4.3 per cent. The estimated short-run discount rate is of similar magnitude as estimated discount rates in explaining consumer investments in energy-efficient equipment (Hausman, 1979; Gately, 1980). The evidence of separate short-run and long-run discount rates is consistent with the short-term and long-term time orientation scales in Joireman et al. (2008) although they have never been related empirically.

Risk Preference

The standard economic model already captures risk preferences by means of concave utility functions exhibiting diminishing marginal utility, on the basis of which relative risk aversion can be assessed. Gandelman and Hernández-Murillo (2015) estimate risk aversion from income (as a proxy for consumption) and well-being measures (as a proxy for utility) in the World Gallup Poll for 75 countries. They find an average value close to 1, associated with a logarithmic utility function of consumption.

O'Donoghue and Somerville (2018) argue that concave utility functions cannot explain the phenomenon of risk aversion for small stakes, as contrasted with risk acceptance in gambles in which the individual may lose a small amount but win an extremely large amount. They state that the asymmetric value function is better able to explain individuals' preferences in this respect.

Social Preference

Charness and Rabin (2002) developed a utility function of two-player outcomes in a two-person distribution game. Utility was based on the outcomes of each player, moderated by whether the outcome of one player was higher or lower than the outcome of the other player, and whether the other player had behaved unfairly. They then observed whether the players' actual behaviours were in agreement with strategies of narrow self-interest, competitiveness, difference aversion or social welfare, and estimated the utility parameters from these observations. Their model of simple-altruism model successfully explained most of the variation in the players' choices.

The household economic model (Becker, 1991) assumes a household utility function based on the outcomes of both household partners, thus capturing social preferences. Later, household bargaining models were developed incorporating altruistic preferences in the utility function of each household partner by assuming that one household partner valued the other partner's outcomes (Manser and Brown, 1980; McElroy and Horney, 1981; Lundberg and Pollak, 1993). Finally, the collective household model assumes that the household maximises the weighted sum of the partners' utility functions, each of which partially depends on their own and the other's outcomes, subject to constraints (Apps and Rees, 1997; Chiappori, 1997).

Characteristics

A popular psychological model explaining behaviour is the theory of planned behaviour (Ajzen, 1991, 2012). The theory explains behavioural intentions from attitudes, social norms

and perceived behavioural control. Attitudes consist of the weighted sum of beliefs (b) about the relevant attributes of an object, weighted by the perceived importance of the attributes (e), i.e., $\sum b_i e_i / I$ ($i=1, \dots, I$), with I the number of relevant attributes. The concept of psychological attitude is similar to the economic concept of utility (Antonides, 1989). Lancaster (1979) defines utility on the basis of objective characteristics of goods, in a similar way as in the theory of planned behaviour, although the importance weights usually are replaced by estimated parameters in empirical models. Ratchford (1979) defines utility as $U = \sum z_i w_i + w_{i+1} y$ with z characteristics, w weights and y the quantity of a composite of other goods. Although utility may be defined on a good's characteristics, the latter may also be transformed into subjective values, more efficiently capturing the carriers of utility. A common transformation of objective into subjective values is the power function, called the power law in Stevens (1957), i.e., $c\varphi^b$ with φ the objective value of the characteristic, b and c the coefficients of transformation. The power function resembles the well-known Cobb-Douglas function in economics. The characteristics model has been applied in consumer choice models (Deaton and Muellbauer, 1980; McFadden, 1973) and marketing (Wierenga, 1984).

Other Applications

Several other applications of integrating psychological factors into economic models exist, notably Akerlof and Kranton's (2000) identity or self-image factor as an argument in the utility function; Nagler's theory of motivated preference (2021), showing how preferences are adapted due to cognitive effort spent on reconciling attitudes which are discrepant with current outcomes or behaviours; and Ali (2020) and Qian, Antonides and Heerink (2021), who considered unfavourable personality characteristics as causing deviations from optimal economic behaviour in technical efficiency models.

CONCLUSION

Behavioural economics has developed from its initial efforts in showing anomalies of the standard economic model into a behavioural science measuring psychological phenomena and incorporating psychological insights into economic models. However, much effort still has to be done in order to better explain economic behaviour and in reconciling economic anomalies with standard economic models.

The measurement scales based on both economic and psychological research show the existence of anomalies in the economic model and offer opportunities to apply the resulting insights to a much wider range of behaviours than usually studied in the laboratory. They also are feasible for use in surveys, and in this sense are complementary to field experiments. Most measurement scales are quite general, thus neglecting domain specificity, except for some specific time preference and risk preference scales. In this respect, the verbal scales seem to have better external validity than the more specific economic questionnaires, at the expense of the precise economic interpretation, for example with respect to the magnitude of discounting or risk aversion. Ideally, the verbal scales could be calibrated with the more quantitative scales in order to clarify their economic meaning.

With respect to the integration of psychological insights in economic models, it appears that this development is still in its infancy stage. Several theoretical attempts have been made to model psychological factors or processes in the utility function but still lack empirical support. Promising exceptions are the theories on good characteristics and loss aversion in

the theory of consumer demand, the household economic model dealing with altruism and the technical efficiency model capturing non-economic factors.

NOTES

1. 'Anomalies' refers to a series of articles (co-)edited by Richard Thaler in the *Journal of Economic Perspectives*.
2. See the Cognitive Bias Index (2016).
3. According to Aesop's fable of the fox and the grapes, a fox that cannot reach grapes from a vine subsequently states that they are undesirable.
4. The term 'time orientation' is typically used in psychology in lieu of 'time preference', the preferred term in economics. The concepts have somewhat different interpretations in the two disciplines (cf. Nyhus and Webley, 2006).

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