

The psychology of uncertainty in economic theory: a critical appraisal and a fresh approach

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Experimental testing of theories of choice under uncertainty has revealed a range of phenomena which, as yet, no single theory can accommodate. This article attempts to trace the apparent difficulty in developing a general descriptive model to a common misperception about the nature of choice under uncertainty: that individuals act as if guided by some underlying preference function. An alternative approach is proposed which draws on the theory of cognitive dissonance. On this account, choice is to be viewed as a creative act which emerges out of rationalization strategies adopted with a view to reducing dissonance. It is argued that, by departing from the standard assumption of utility maximization subject to given preferences, it is possible to provide a general framework for incorporating a variety of plausible insights which alternative theories currently offer.

I Introduction

In this article I am concerned with how to model the behaviour of individuals faced with choices among actions with uncertain outcomes. The dominant model of choice under uncertainty in economics is expected utility theory (EUT). There is a considerable volume of evidence which shows that individual behaviour often does not conform to the predictions of EUT. Much of this evidence has emerged from experimental testing of the theory and, in response, a variety of alternative models has been suggested in the literature. I shall argue that, while several of these models offer useful insights into the nature of the decision processes used by individuals, none provides an adequate account of the way that individuals actually make choices under uncertainty. I shall suggest that the root of the problem is the assumption that choice under uncertainty can be modelled as a problem of utility maximization. A central claim will be that choices

* This article was completed while working on a project supported by the Economic and Social Research Council of the UK ('The foundations of rational choice theory', award R000232269). The idea for this article evolved out of numerous discussion with Robert Sugden. I would also like to thank Fiona Carmichael, Robin Cubitt, Shaun Hargreaves Heap, Martin Hollis, Judith Mehta, Angus Ross, David Young and participants at the Third Annual Review of Political Economy for helpful comments on an earlier draft. I, of course, retain full responsibility for any remaining shortcomings.

made under uncertainty should be viewed as essentially imaginative and creative acts, rather than as a 'response to stimulus' governed by well defined preferences. Accepting this view does not imply that the task of modelling choice under uncertainty is hopeless, and I shall propose a fresh way of understanding of the psychological motivation of individuals in uncertain choice situations.

I shall focus primarily on a particular class of uncertain choice situation: choices among 'prospects', where a prospect constitutes a well defined set of outcomes with associated probabilities. What I have to say then, relates directly to what we might call 'risky choices', the class of problem to which mainstream theories of 'choice under uncertainty' typically apply. I shall not deal explicitly with situations of more fundamental uncertainty where the full range of possible consequences of an action and/or their associated probabilities may not be known to the chooser. However, I would argue that much of what I have to say does apply in the case of more fundamental uncertainty, although the choice problem confronting the individual here is indeed compounded by the need for the chooser to form conjectures about the possible consequences of action and expectations of their likelihood.

II Expectational models of choice under uncertainty

Most theories of choice under uncertainty assume that individuals choose among uncertain prospects by using some sort of 'expectational calculation'. The most widely applied theory of choice under uncertainty is expected utility theory (EUT). The expected utility of some prospect P which has a range of possible outcomes $(x_1, \dots, x_i, \dots, x_n)$ with associated probabilities $(p_1, \dots, p_i, \dots, p_n)$ is given by the expression.

$$EU(P) = \sum_i p_i U(x_i)$$

In this theory, individuals are assumed to act as if they calculated expected utilities for every prospect under consideration and chose the one with highest expected utility. The 'utility function' $U(\cdot)$ in the above expression can be interpreted in a number of different ways. In the original version of the theory put forward by Bernoulli (1954), $U(x_i)$ was interpreted as representing the satisfaction derived from the outcome x_i . In the modern version of the theory, due to von Neumann and Morgenstern (1947), the utility numbers have no direct interpretation in terms of 'satisfaction' or 'inner glow'. What von Neumann and Morgenstern show is that given certain axioms individuals will behave as if maximizing the expected value of some function which attaches 'utility numbers' to outcomes.

Despite the dominance of EUT in Economics, there is plenty of evidence from laboratory experiments to show that individuals may express patterns of preference which violate EUT in a systematic or predictable way. The most famous example is the so called Allais paradox

(Maurice Allais, 1953). Consider this version of the paradox from Kahneman and Tversky (1979). An individual is asked to make two (hypothetical) pairwise choices between four alternative options labelled A, B, C and D. The choices are presented in a state/payoff matrix with three states of the world, S1, S2 and S3 whose associated probabilities are 0.33, 0.01 and 0.66. In choice 1, an individual who chooses option A 'gets' £2400 for sure¹ whereas if they choose B, they enter a gamble which gives £2400 with probability 0.66 and £2500 with probability 0.33, otherwise nothing. Options C and D should be interpreted in a similar way.

Table 1

| | S1 0.33 | S2 0.01 | S3 0.66 |
|-----------------|------------|------------|------------|
| <i>Choice 1</i> | | | |
| A: | 2400 | 2400 | 2400 |
| B: | 2500 | 0 | 2400 |
| <i>Choice 2</i> | | | |
| C: | 2400 | 2400 | 0 |
| D: | 2500 | 0 | 0 |

It is easy to show that EUT implies that an individual who prefers A to B must also prefer C to D (and likewise, a preference of B over A entails a preference of D over C).² However, numerous experiments have revealed that the modal responses of subjects in situations like these is typically to choose A then D in violation of EUT (in addition to Kahneman and Tversky, 1979; see Slovic and Tversky, 1974; Moskowitz, 1974; and more recently Keller, 1985).

Proponents of EUT (such as Morgenstern, 1979) have often dismissed such behaviour on the grounds that it is irrational (because it violates the axioms of EUT). One purpose of this article is to raise a doubt about whether EUT provides an appropriate benchmark against which to test the

¹ In the original example the units of the payoffs are Israeli pounds.

² Applying EUT to choice 1 and assuming $U(0) = 0$, we derive the decision rule:

$$A \underset{<}{\overset{>}{\sim}} B \Leftrightarrow U(2400) \underset{<}{\overset{>}{=}} 0.66 U(2400) + 0.33 U(2500) \quad (1)$$

where $>$ and \sim represent the relations of strict preference and indifference. Rearranging gives:

$$A \underset{<}{\overset{>}{\sim}} B \Leftrightarrow 0.34 U(2400) \underset{<}{\overset{>}{=}} 0.33 U(2500) \quad (2)$$

But notice that the right-hand side of (2) is the decision rule that results from application of EUT to choice 2. Hence

$$A \underset{<}{\overset{>}{\sim}} B \Leftrightarrow C \underset{<}{\overset{>}{\sim}} D.$$

rationality of individual behaviour. It has also been common for supporters of EUT to attempt to trivialize counter examples to the theory by suggesting that they are rare exceptions to an otherwise robust theory. This response now looks very weak. In recent years there has been a growth of interest in experimental economics and this has revealed the existence of a whole range of systematic violations of EUT. These include the 'common ratio effect', the 'common consequence effect', 'preference reversals', the 'utility evaluation effect' and 'regret effects'. (For a review of some of this material see Weber and Camerer, 1987.)

The existence of this well documented collection of counter examples to EUT has stimulated the development of several new theories which attempt to explain observed patterns of behaviour. Among the best known of these are prospect theory (Kahneman and Tversky, 1979), generalized expected utility theory (Machina, 1982), anticipated utility theory (Quiggin, 1982; Yaari, 1987), regret theory (Loomes and Sugden, 1987a; Fishburn, 1982), disappointment theory (Bell, 1985) and the list is still growing.

These theories are similar to EUT in so far as there is some objective function which individuals are assumed to be attempting to maximize and as in EUT, this objective function consists of a weighted average of some utility function defined over the outcomes of prospects. Each of these theories contains EUT as a special case but departures from EUT are accommodated in a variety of different ways. For example, prospect theory assumes that in addition to a utility function over outcomes, there is a function which assigns values to probabilities. The latter values then provide the weights in the expectational calculation. Hence individuals are assumed to be maximizing the function:

$$EU'(P) = \sum_i \pi(p_i) U(x_i).$$

Kahneman and Tversky show that by making various assumptions about the functional form of $\pi(\cdot)$ and $U(\cdot)$ it is possible to generate predictions consistent with the observed violations of EUT. Anticipated utility theory extends this idea a stage further by assuming that the decision weights attached to the probability of a given outcome may depend on the relative size of that outcome within the prospect. Other theories (like disappointment and regret) retain the idea that it is 'raw' probabilities which are used to weight the utility function, and account for violations of EUT by assuming that the utilities attached to outcomes of prospects may not be independent of each other. In disappointment theory, the utility attached to the outcome of a given prospect is a function of the other outcomes of that prospect. Regret theory is primarily a model of pairwise choice and assumes that the utilities attaching to the outcomes of one prospect may depend on the outcomes of the alternative prospect.

Many of these theories produce similar predictions in certain situations,

in particular, each predicts at least some of the well-known violations of EUT. This is hardly surprising since these are precisely the phenomena which the theories were designed to explain. But because of this, the evidence generated from the testing of EUT does not really enable us to discriminate between these theories on the basis of predictive ability. Nevertheless each theory has general implications for behaviour beyond the class of phenomena they were designed to explain, and it is here that their predictions generally diverge. Recently experiments have been conducted in an attempt to test the novel predictions of new theories of choice under uncertainty with a view to establishing which provides the best characterization of individual preferences under uncertainty. It seems to me that the following general comments go some way to summing up the current state of play:

- 1) Comparisons across different experiments confirm that there are numerous regularities in behaviour which EUT cannot explain.
- 2) Some novel predictions of some theories have been confirmed.
- 3) As yet there is no theory which can accommodate the broad spectrum of behaviour observed in these experiments.

The existence of numerous predictable violations of EUT suggests that it ought to be possible in principle to provide a more general theory. The fact that novel predictions of some theories – perhaps most notably regret theory (see Loomes, 1988; Loomes and Sugden, 1987b; Loomes *et al.*, 1989; 1991) – have been confirmed indicates that there may be some validity in the central intuitions which such theories embody. Work is continuing in this field and new theories are appearing regularly in the literature. However, I doubt whether the current research programme is progressing. The problem is that the discovery of new phenomena seems to be outpacing the attempts to account for them. I shall offer reasons why this may be so after considering a rather different approach to choice under uncertainty, that pioneered by Shackle.

III The Shacklean approach

Shackle (1962) provides a theory of how individuals choose in situations of what I have called fundamental uncertainty, that is situations where there is no clearly defined probability distribution governing the possible consequences of action and their likelihood. If the outcomes are uncertain in this sense how is the chooser to make up his or her mind about what to do? This is a problem which none of the above theories address. It is simply assumed that the individual knows all the possible outcomes of potential actions and their probabilities then carries out some expectational calculation. Shackle argues that in most uncertain situations the choices individuals have to make are not typically between prospects with well defined

outcomes. But, even when we are faced with such choices (as we are in, say, a casino), there is no reason why some weighted average of our valuations of outcomes should necessarily provide a meaningful guide to action.³

Shackle characterizes the process by which individuals evaluate the desirability of any potential course of action in the following way. The chooser uses her imagination to explore the conceivable outcomes of an action. She then assesses the desirability of each hypothesized outcome and attaches to it a measure of 'potential surprise'. The potential surprise attributed to any outcome represents her own private assessment of the likelihood of the event in question and is not a probability in the conventional sense.

Shackle then assumes that the individual, by means of a what he calls a 'power function' focuses on two of the hypothesized outcomes, one of them relatively good (in terms of the range of hypothesized outcomes), one of them relatively bad. These outcomes, so selected (which Shackle refers to as 'desired' and 'undesired' primary focus outcomes) are assumed to command the attention of the chooser because they represent, subjectively, the most prominent couplings of desirability (positive or negative) and potential surprise. Shackle then shows that the individual can translate these two primary focus outcomes, via the power function, into 'standardized focus outcomes'. This operation converts the primary focus outcomes into points on a common scale of measurement (possibly money).

However, thus far, the theory does not tell us what the individual actually chooses. It tells us how an individual with this psychology could translate a profoundly hazy uncertain-choice situation into a sharply focused problem of choice between actions each of which has two dimensions, let us call them a 'winning dimension' and a 'losing dimension'. But to make a choice between alternative actions, the individual must perform some kind of tradeoff between winning and losing dimensions. Precisely how the individual does this is left as something of an open question by Shackle. However, he does suggest that this tradeoff might be handled via standard indifference curve analysis. I shall argue below that to turn back to conventional analysis at this point leaves an essential question about the nature of choice under uncertainty unanswered.

Although Shackle's theory of choice under uncertainty is not really

³ For Shackle, the (frequentist) probability of a chance event only provides meaningful information in the context of a game played many times. It allows you to predict with some confidence what the long-run outcome will be. For example, if a fair coin is tossed 1000 times, you can predict that approximately 500 heads will occur. However, this tells us nothing about what the outcome will be 'next time' we toss the coin. Hence knowledge of long-run frequencies are of little purchase in what Shackle (1955) calls nondivisible, nonserial experiments. I take a line somewhere between Shackle and the hard-nosed frequentist. I will argue that even in a one-off situation expectations may provide a useful guide to action but they are by no means the only relevant factor.

intended as an account of risky choices, it is easy to see how this kind of theory could be applied to choices between prospects. In fact, Ford (1987) argues that any satisfactory theory of choice under uncertainty should apply to risky choices and constructs a model (perspective theory) along Shacklean lines which does apply directly to choices among prospects. In this model objective probabilities take the role played by potential surprises in Shackle's theory. However, the theory is clearly Shacklean in style in the sense that Ford assumes that individuals attempt to maximize a 'perspective index' which is determined solely by the 'best' and 'worst' aspects of a choice option.

The Shacklean approach is clearly different from any of the other theories we have so far considered because no expectational calculation is involved in choices under uncertainty. Choices in these models are determined by preferences governing (two) aspects of the problem, which, for some reason, the individual takes to be particularly prominent to the choice. However, in at least one respect, these two Shacklean models share a common foundation with expectational models. In both types of model it is assumed at the outset that individuals already have some kind of well defined risk-preferences which, at some stage, 'determine' the individual's action. At this point I want to raise some questions about whether this is a plausible assumption to make.

IV An alternative conception of the psychology of choice under uncertainty

Theories of choice under uncertainty in economics employ the same basic mode of explanation used to account for choices made in an environment of perfect certainty: utility maximization. Explanations based on utility maximization embody a particular conception of the psychology of the individual. We assume that agents have well defined preferences over the objects of choice and that action is driven by these preferences. The behaviour of individuals is then understood as action undertaken to get them what they most want given the constraints that they face. This kind of explanation is sometimes referred to as 'rational/intentional explanation' (see, for example, Hargreaves Heap, 1989) and it has the same basic structure as that well-known chicken joke. In answer to the question 'why did the chicken cross the road', we say 'to get to the other side!' This form of explanation may provide a coherent account of behaviour when it is clear what lies on the other side of the road, but I want to argue that it does not extend naturally to an uncertain environment.

The problem is that the objects of choice are different in certain and uncertain environments. In an environment of complete certainty any action taken by the individual results in a well defined 'state of affairs'. To decide upon an action in this environment all the individual needs is a set of preferences which determine the relative desirability of different states of

affairs. If the individual faced with a choice between action X and action Y prefers the state of affairs which X produces to the state of affairs that Y produces, then this provides a clear motivation for doing X rather than Y.

But the existence of uncertainty drives a wedge between the actions that an individual may take and the ultimate states of affairs which those actions may produce. Because of this the individual's motivation can no longer be understood purely in terms of their preferences over particular states of affairs because the individual must choose between courses of action without knowing precisely what the outcome will be, that is, which state of affairs will ultimately follow from their action. Theories of choice under uncertainty usually attempt to dissolve this wedge between action and outcomes by assuming that individuals have preferences over probability distributions of outcomes. The problem for the theorist who makes this assumption is to find an adequate characterization of preferences over prospects. I want to suggest that it may be a mistake to assume that individuals choose in situations of uncertainty as if guided by some underlying preference function.

Consider choice 1 in the Allais paradox problem above. Try to imagine that you are faced with this choice for real. Now ask yourself two questions. First, which is the best outcome that could result from either of these actions? Secondly, which of A and B is the better option? It seems to me that the first question is much easier to answer than the second. I find that I have no difficulty at all in ranking the payoffs in this problem and deciding that £2500 is most definitely the best. This preference appears to be already clearly formed in my head. I am not exactly sure where it comes from, but there it is! However, when it comes to deciding which is the better of the two options (A or B) I find that for some reason, neither of them register in my mind as being obviously the best. It's not that I don't care which I have – if I really were confronted by such a problem I would not want the choice settled by the toss of a coin.

I would like to decide for myself but the problem is that when I look into my head I find there is no preference which, so to speak, shouts out to me. Instead, I find that there are aspects of each option which attract me. Option A is attractive because it guarantees me £2400. On the other hand option B gives me quite a good chance of winning another £100 and very little chance of losing. But I hesitate about making a choice because I am faced by a dilemma: I can see that whichever action I decide upon could turn out to have been the wrong decision once the uncertainty is resolved. I want to suggest that this is a characteristic of all but the most trivial uncertain choice situations and that the dilemma produced by uncertain choice situations creates a certain 'tension' in the mind of the chooser. This tension, as I call it, is, I feel, akin to what Festinger (1957) calls cognitive dissonance.

The basic premise of the Festinger's theory is that an individual may

experience cognitive dissonance – that is, a state of psychological unease – whenever he holds conflicting cognitions. The theory predicts that because dissonance is unpleasant, individuals will try to adopt strategies for eliminating, or at least reducing, dissonance. This might be brought about by a change in behaviour, or a change in belief or attitude. Aronson (1979) draws out the connection between cognitive dissonance and the notion of ‘self-esteem’. If we assume that human beings have a basic desire to conceive of themselves, as among other things, reasonable, sensible or perhaps even rational people, then this provides a somewhat richer motivation for dissonance-reducing behaviour: we can understand dissonance-reducing strategies as behaviour directed towards the maintenance of self-esteem.

An example commonly used to illustrate a situation where dissonance might occur is the case of a smoker who believes that smoking can cause lung cancer. The theory implies that dissonance may be aroused by the conflicting cognitions that, ‘I am a smoker’ and ‘smoking may kill me’ and that the individual might attempt to reduce dissonance by giving up smoking or revising downwards their assessment of the likely health risks. Alternatively, the individual might adopt attitudes ‘consonant’ with the act of smoking, by, for example, glamorizing smoking as a socially important facet of their lives.

It seems to me that uncertain choice situations might well have all the ingredients required for the arousal of dissonance.⁴ let us return to choice 1 in the Allais paradox but this time, rather than viewing it as a purely hypothetical choice problem, let’s place it in a little more context. Imagine your dilemma in this situation: you have a £2400 overdraft, and several weeks to go to the next pay cheque. For some of us this may not require too vivid an imagination! You then have to choose between A and B. Suppose you first contemplate choosing option B, this looks really quite attractive in your situation because the likelihood is that you will be able to payoff your overdraft and, if state S1 occurs, have a bit left over to see you through to the end of the month. But then the down side (the possible aversive consequence) hits you – wouldn’t it be awful if S2 came up – god, wouldn’t you hate yourself for not having chosen the alternative A which is open to you. Oh, but come on, you say to yourself, surely that’s being too

⁴ Cooper and Fazio (1984), have argued that the existence of conflicting cognitions is a necessary but not sufficient condition for the arousal of dissonance. They argue that three further conditions must be satisfied before the existence of conflicting cognitions will arouse dissonance. First, the behaviour of the individual must have aversive consequences, that is, have possible outcomes which the individual dislikes. Secondly, the aversive consequences must be foreseeable, that is the agent must be aware of the possibility of aversive consequences. Finally, the individual must have some degree of freedom, that is, more than one action open to them. Since these conditions will be defining characteristics of many risky choice situations, it could be argued that risky choices constitute prime candidates for the arousal of dissonance.

pessimistic since the chances of S2 occurring are so small . . . What I am suggesting here is that you may find yourself in a state of mental turmoil, with feelings analogous to those of cognitive dissonance, by virtue of the conflicting reasons you can find for taking one action, but then the other.

This is not to suggest that the above problem is beyond the capacity of the human mind to solve, far from it. If you are told that you have to choose one or the other now or lose the opportunity of either, I am sure that you would make a choice. What is at issue here is the process by which an individual would arrive at such a choice. My claim is simply that such a choice should not be thought of as guided by some pre-existing preference in the head of the chooser. But if we accept this claim, then there is clearly a question about how our poor schizophrenic individuals ever manage to make up their minds. I think that the theory of cognitive dissonance may also provide some clues to this.

In the standard economic account of the rational agent, the individual is moved by a mixture of beliefs and desires and individuals are assumed to undertake that action which they believe will lead to the state of affairs that they most desire. In conventional economic theory, desires (or preferences) are taken as given and questions about individual's beliefs which arise in, say the discussion of expectations, are typically confined to the determination of 'rational beliefs', given the information available to the agent. (One exception to this is the work of Akerlof and Dickens, 1982, which applies cognitive-dissonance theory to the market for labour in a hazardous industry). A key insight provided by the theory of cognitive dissonance is that action is not the only variable available to the individual and that beliefs may be adjusted in order to bring about harmony between actions and desires: the smoker who believes that smoking may kill them can resolve the conflict among cognitions not only by changing their action (giving up smoking), but by changing their beliefs about the risks of smoking.

It seems clear that whether it is beliefs or actions that adjust is likely to depend upon the situation. A smoker may adjust their beliefs because addiction to tobacco makes a change of action deeply stressful. On the other hand, it seems more plausible to assume that the individual who is sick each time they eat oysters is more likely to give up oysters than adopt the belief 'being sick is good for me'. Situations of uncertainty provide an interesting case. I have argued that a characteristic of uncertain choices is that the individual will find no course of action which will be completely consistent with all the cognitions which they are likely to form. Whichever action the individual contemplates there is always some reason they can think of for doing something else.⁵ This implies that since it is impossible to

⁵ One expectation to this is the situation where one action is stochastically dominant. It seems to me that statewise stochastic dominance would provide a very compelling reason for choosing the dominating action. Even so, there is evidence that individuals do not always choose dominating options (Tversky and Kahneman, 1986) and Loomes and Sugden (1987) show how anticipated regret may lead an individual to choose a dominated option.

completely resolve the tension induced by conflicting cognitions through the choice of action we might expect an individual to adjust their beliefs to produce a set of cognitions consonant with one of the actions available to them. I will call the process of adjusting beliefs with the aim of selecting or justifying a particular action a rationalization strategy. In practice this adjustment of belief could take a number of forms.

One possibility is that individuals might form some conjecture about the nature of the underlying stochastic process on the basis of past experience. For example, an individual playing roulette having observed a run of wins on red may form the belief that 'black must be next'. This is the well-known 'gamblers fallacy'. In a similar way, an individual who has had a run of bad luck might use this fact as a rationale for 'playing safe'. While such conjectures may be entirely unfounded there is plenty of anecdotal evidence that people appeal to essentially irrelevant information to help them decide how to play in games of chance. There is also evidence that individuals may adjust the subjective probabilities which they attach to uncertain events at some point during the process of choice. Knox and Inkster (1968) interviewed individuals at the race track and found that there was a clear tendency for individuals who had just placed bets on horses to think that their chances of winning were higher relative to individuals who were about to place bets.

The selection of action by any of these routes requires the decision maker to form beliefs which are either unfounded or blatantly false. It therefore seems unlikely that this kind of belief change will provide a satisfactory resolution in choice situations where an individual applies considerable thought to an important decision. If an individual is making an important decision and if their self-image is one of a sensible or rational chooser, then such acts of self-deception will themselves be a source of cognitive dissonance. For this class of problem (and chooser), another process may well be involved: let us call it 'judgment'.

A simple process of judgement in a choice between a pair of uncertain actions might work like this. The individual constructs a set of reasons why each action might be chosen. They then rank these reasons according to how compelling they are relative to one another and from this ranking select one of the actions. The final selection could be derived from the 'ranking-of-reasons' in any number of ways, for example, the individual could choose the action with the most highly ranked reason. Through this process the individual manages to isolate one reason as a prime motive for action.

V Theories of choice under uncertainty reconsidered

The process of judgement I have just described is in some ways similar in spirit to aspects of Shackle's theory. The individual begins with a problem

for which there is no unique solution. The choice of action requires thought and imagination on the part of the individual and they proceed by stripping down the problem to focus on certain aspects of the situation which come to epitomize the choice from the point of view of the individual concerned. Of course there are significant differences between Shackle's theory and this process of rationalization. For Shackle, choice requires imagination primarily because individuals are confronted by fundamental uncertainty. The point of much of the above discussion has been to argue that imagination is required even for well defined risky choices. Moreover, I can see no particular reason for supposing that an individual will come to 'characterize' an uncertain choice situation precisely in the way that Shackle or Ford assume: that is by reducing it to a two dimensional loss/gain scenario. Most uncertain choice situations have many dimensions which could provide potential foci for the attention of the chooser. Let me illustrate this by considering a few factors which could enter an individual's rationalization strategy.

Contrary to Shackle's view, it seems that some sort of expectational calculation may provide the individual with meaningful information. By carrying out a simple expectational calculation the individual can formulate some kind of measure of the average attractiveness of the possible outcomes of uncertain actions (an expected utility is just one such measure). Moreover, the individual may decide that the outcome of such a calculation does provide a compelling reason for taking a particular course of action. Having said this, I am not claiming that, having made such a calculation, an individual would, or indeed should, be expected to act solely upon the result of this calculation in every conceivable situation.

Consider an individual who is trying to decide whether to remain at *status quo* wealth or alternatively to commit a large proportion of that wealth to a new business venture. Let us suppose she believes that there is a 90% chance that the business will be successful and return a high profit, but recognizes there is a 10% chance that the business will fail and she will lose her whole investment. She calculates that her expected utility is maximized by the venture so she takes the plunge. But, unfortunately things do not turn out so well and the business goes bust. Now imagine how the investor feels after the event. She is worse off in real terms than if she had not invested and would clearly be better off had she not attempted to maximize her expected utility. Now, will the fact that her expected utility was high, reassure her after the event, that she made the 'right' decision, and, if not, is it reasonable to assume that a high expectation provides a satisfactory rationale for the choice in the first place from the point of view of the individual?

Those convinced by EUT might reply by arguing that it would be irrational to engage in the self-recrimination involved in my story: *Ex ante* the investor knew full well that things might turn out the way that they did,

but nevertheless she was prepared to take on the risk. So, while it is bad luck that things did not work out the way she would have liked, the benefit of hindsight should not lead her to castigate herself for the decision she made since, with the information she had available to her she took what looked to be a good option.

Now, if an individual confronting a choice between actions believes that they have good reason for taking one course of action rather than another then, so long as the individual has no cause after the event to believe that they had, perhaps through foolishness or hastiness, misunderstood the situation, then self-recrimination would appear to be perverse. But to assume at the outset that the individual 'had good reason' for the action or was 'prepared to take on the risk' misses the point. The question at hand is precisely what constitutes a good reason for taking one course of action rather than another. The recognition that maximization of an expectation does not guarantee good outcomes raises questions over whether such a rule provides good reason – or at least the only good reason – for choice, since when we consider following such a strategy we can anticipate undesirable outcomes, we can see that it might not be as good for us.⁶

Moreover, it is possible to think of other motivating factors besides the maximization of expected utility. The alternatives to EUT discussed above each embody assumptions which can be interpreted as intuitions about 'other factors' which motivate the chooser. To illustrate this, consider prospect theory. The essential (though by no means the only) difference between prospect theory and EUT is that prospect theory assumes individuals attach subjective valuations or decision weights to probabilities. Kahneman and Tversky suggest a number of restrictions which decision weights might satisfy. For example, they argue that the function which maps from objective probabilities to decision weights may be generally convex but with discontinuities at each end, such that individuals may attach disproportionately large significance to certain outcomes and, at the other end of the scale, completely discount events with very small probabilities. Another possibility is suggested by disappointment theory which predicts that, *ceteris paribus*, an individual may be, deterred from an action that has outcomes which would rate as particularly 'disappointing' to

⁶ Proponents of the axiomatic approach to EUT might well be jumping up and down in the aisle by now shouting 'doesn't he understand the central result of the von Neumann and Morgenstern approach to EUT which proves that a rational individual (that is an individual with preferences consistent with the axioms of EUT) will behave as if maximizing expected utility?' The result is quite correct, but it has no bearing on the argument here. The fact that an individual with a set of fully formed preferences that satisfy the axioms of EUT will, as a matter of pure logic, maximize the expectation of some function (the existence of which is deduced from the axioms) tells us little or nothing about how we might expect individuals who do not have well defined preferences to behave. Neither does it provide a particularly helpful guide to action since such individuals have no von Neumann-Morgenstern utility function to consult.

them, relative to the other possible outcomes of that action. It seems to me that a number of factors like these might well influence agents choices. I say this not only on the basis of personal intuition, but also because, as I noted above, experiments have produced results consistent with the novel predictions of some of these theories.

VI Conclusion

This article was motivated by the apparent inability of mainstream economic theories to provide an adequate descriptive characterization of the behaviour of individuals choosing in situations of uncertainty. The main argument has been that rather than assuming that there is some underlying maximand which determines individual responses to uncertainty, we should view action as emerging from rationalization strategies which individuals employ in an attempt to resolve the tension in the mind which uncertainty produces. However, the role played by dissonance in such strategies differs importantly from the conventional understanding of the function of dissonance in human behaviour. Dissonance reducing strategies involving shifts in belief are often interpreted as nonrational, if not irrational, attempts to justify ones own behaviour, after the event. On my account, however, at least some rationalization strategies, such as those analogous to what I have called judgement, should be viewed as coherent processes for establishing ones own preference prior to the act of choice.

But assuming that a number of different factors may enter rationalization strategies then the problem is how to construct a theory capable of handling a multiplicity of influences on choice behaviour. This is a problem which I have attempted to set rather than solve in this article. However, in my view, the ideas expressed in this article connect quite naturally with other attempts to reconsider the basic foundations of mainstream economic theory. For example, certain developments in the 'behavioural' approach to economic theory, and in particular, Peter Earl's (1983) synthesis of multidimensional lexicographic choice with Shackle's potential surprise, could provide a framework for the further development of the ideas set out above.

VII References

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