5 ESTIMATING (RISK) PREFERENCE FUNCTIONALS USING EXPERIMENTAL METHODS
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5.1 INTRODUCTION

Suppose you wish to describe how some particular individual takes decisions under risk. This could be for several reasons, most obviously: because you wished to predict how this individual might behave in some future decision problem; or because the individual wished to know whether or not the decision rule that he or she was implicitly using was a sensible rule in some sense. How might you set about this task?

The economics literature on decision-making under risk would be an obvious place to start. Until a few years ago the guidance given by this literature would have been very clear: the 'rational' decision-maker is one who obeys the axioms of Expected Utility theory (henceforth abbreviated to EU). Thus, if our individual is a 'rational' decision-maker - and who would say that they were not? - all that remains to be discovered is that individual's (Neuman-Morgenstern) Utility Function. I shall describe ways of doing that during the course of this paper.

But things are not so easy nowadays. As other papers in this Workshop make clear, the 'rationality' imposed by EU is a very strict concept of rationality and one that cannot be defended by logic alone. Moreover, extensive experimental evidence suggests very strongly that some individuals do not behave as predicted by EU - although their behaviour does have some signs of consistency - which suggests that their implicit observance of rationality is rather different from that of EU. For them, estimation of a (Neuman-Morgenstern) Utility Function would be entirely

1 Throughout this paper the discussion will refer to decisions under risk. However much of what I have to say carries over to decisions under uncertainty.

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inappropriate - and lead to incorrect predictions and an inaccurate description.

If one abandons EU - as the other papers in this Workshop make clear - it is not obvious where one goes: there is at present no one obviously 'better' theory of decision making under risk. Indeed, experimental evidence suggests very strongly that different people are different and use different decision rules: what is 'rational' behaviour for one individual is not so for others; what is the 'correct' decision rule for one individual is not so for others. So, in trying to discover the rule used by any individual, one must keep an open mind. However, at the same time, one must necessarily follow the usual scientific methodology - and make some underlying maintained assumption or hypothesis: it is simply not possible to make any kind of inference without some kind of maintained hypothesis (though, of course, one can *ex post* try and test that maintained hypothesis).

In the context of the problem posed by this paper, the maintained hypothesis must relate to the process which the individual (either explicitly or implicitly) uses to take decisions under risk: for example, does the individual have well-defined deterministic preferences over the objects of choice (risky prospects)? does the individual choose on the basis of those preferences? As we shall discover, the experimental evidence suggests certain possible answers to certain questions of this type - though obviously the underlying 'truth' can never be known. The answers are crucial to the interpretation of the evidence provided by the individual's behaviour - as we shall explain in section 4. First, however, we will in section 2 explore the way that this evidence can be obtained in an experimental setting - and how that experimental setting can be designed so as to elicit 'accurate' inferences. Section 3 will outline and summarise the guidance given by the economics literature (on decision making under risk) as to the types of 'rationality' that might be guiding our individual. We shall concentrate particular attention on the implied preference functional - as this (and its parameters) is what we ultimately seek to discover. Section 5 then looks at how one uses the experimental data to estimate the parameters of the preference functionals suggested by the literature. Section 6 reports on previous results of carrying out this procedure and Section 7 discusses how one might interpret the results and hence come up with the 'best' preference functional for a particular individual. Section 8 concludes.

### 5.2 EXPERIMENTAL METHODS

The problem is as follows: we have an individual who is unable to articulate the underlying axioms of his or her behaviour but who is able to express preferences over risky choices. We want to design an experiment (with an appropriate incentive mechanism) to enable us to discover the individual's decision rule. When we remark that our individual is able to express preferences over risky choices we mean, at the very least, that if presented with two risky choices, $C_1$ and $C_2$, the individual is able

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2 In making this assumption we are following the route normally travelled by economists. In contrast, (some) psychologists might argue that individuals can directly introspect on the axioms underlying their preferences/choices. However, we feel that there is ample evidence - particularly from teaching EU to economists! - that people will intellectually agree with axioms as canons of rational choice, but then display behaviour which manifestly contradicts those axioms.

3 Again this distinguishes economists from (some) psychologists who would argue that incentives are unnecessary. If the individual is a willing subject who really does want to learn about his or herself then perhaps we would agree - but if not, not.