ABSTRACT. Behaviour norms are considered for decision trees which allow both objective probabilities and uncertain states of the world with unknown probabilities. Terminal nodes have consequences in a given domain. Behaviour is required to be consistent in subtrees. Consequentialist behaviour, by definition, reveals a consequence choice function independent of the structure of the decision tree. It implies that behaviour reveals a revealed preference ordering satisfying both the independence axiom and a novel form of sure-thing principle. Continuous consequentialist behaviour must be expected utility maximizing. Other plausible assumptions then imply additive utilities, subjective probabilities, and Bayes’ rule.

Keywords: Expected utility, subjective probability, decision trees, Bayes’ rule, consequentialist behaviour.

1. INTRODUCTION

An almost unquestioned hypothesis of modern normative decision theory is that acts are valued by their consequences. Indeed, Savage (1954) defines an act as a function mapping uncertain states of the world into a domain of conceivable consequences, thus identifying an act with the state-contingent consequence function which it generates.

Normative decision theory then erects a superstructure of various possible axiom systems upon this basic “consequentialist” hypothesis. The axioms and their implications are discussed at great length, without general agreement as to their acceptability or not as principles of rational behaviour. This discussion is usually conducted in a “normal form” decision problem where, relying upon von Neumann and Morgenstern’s (1944) reduction of extensive games, the agent is viewed as having to choose a decision strategy specifying what decision to make in every conceivable set of circumstances. In a normal form decision problem, consequentialism means that behaviour is judged to be acceptable if its consequences (or, more generally, its risky and uncertain consequences) lie in the choice set corresponding to the feasible set of consequences resulting from all possible decisions. In other words, consequentialism...
implies that behaviour should reveal a consequence choice function. No other rationality postulates or axioms are implied by consequentialism alone.

In decision trees, however, consequentialism has much more powerful implications. A decision tree (Raiffa, 1968) amounts to a one person game in extensive form, in which there is perfect information because uncertainty is deemed to be resolved only when the agent knows how it is resolved, and because of perfect recall. A decision strategy in the normal form implies using consistent decision strategies in all possible "continuation trees" – or "subtrees" which continue from any node of the decision tree. These consistent decision strategies are just continuations of the original decision strategy. Consequentialism applies to these continuation strategies in the continuation decision trees no less than to complete strategies in complete decision trees. That, at least, is the fundamental hypothesis of this and several related papers.\(^2\) It would be false if missed opportunities, regrets, sunk costs, etc. affected behaviour and yet were excluded from the domain of consequences. As a normative principle, however, consequentialism requires everything which should be allowed to affect decisions to count as a relevant consequence – behaviour is evaluated by its consequences, and nothing else. If regrets, sunk costs, even the structure of the decision tree itself, are relevant to normative behaviour, they are therefore already in the consequence domain. Indeed the content of a normative theory of behaviour is then largely a matter of what counts in practice as a relevant consequence, rather than whether consequentialism and other abstract axioms are satisfied. For example, the standard economists' injunction to ignore sunk costs is a practical normative principle. Whereas expected utility maximization is a principle which has no practical content (beyond continuity of behaviour with respect to changes in probabilities) until the consequences which are the arguments of the utility function have been specified.\(^3\) Another practical normative principle in economics, which I happen to find ethically unacceptable, is to consider only aggregate consumption of each good and aggregate income, rather than the distribution between rich and poor consumers.

Here, however, my subject is the implications of consequentialism for the structure of normative behaviour – in particular, the extent to which consequentialism implies that behaviour must maximize expected utility.