ABSTRACT. The paper addresses the question, how policy decisions under uncertainty depend on the underlying welfare concept. We study three different welfare measures: The first is directly based on the ex ante (expected) utility of a representative consumer whereas the second relies on an ex ante and the third on an ex post valuation of policy changes compared to the status quo. We show that decisions based on these measures coincide if and only if risk-neutral expected utility maximization is applied. Differences between the decisions are analyzed for both, risk-averse expected utility maximization and the MaxiMin criterion. For risk-averse decision makers, differences between the first and the second concept arise if the absolute risk-aversion of the decision maker is not constant in income. For risk-aversion and the MaxiMin criterion, the effort levels to provide a public good based on an optimization of ex post utility changes exceed those based on the first or second concept. Implications for environmental policy decisions based on the concepts of abatement costs and benefits from abatement are discussed.

KEY WORDS: Decisions under uncertainty, Welfare measures

1. INTRODUCTION

Policy decisions are often to be made under uncertainty. The consequences of a decision may depend on a state of nature whose realization is not known at the time the decision is made. In order to make decisions in such a context of risk or uncertainty, usually the concept of expected utility maximization is applied. Alternatively, the MaxiMin criterion could be employed, i.e., the decision could be based on a valuation of the worst conceivable scenario. In order to determine expected utility and to evaluate the worst case scenario, however, one has to specify the underlying welfare concept. The implications of this choice for policy decisions are studied in this paper.

As an example, throughout the paper, we refer to decisions on how much emissions of a pollutant should be abated. Here, different welfare concepts can be found in the literature: in some models (ex-
pected) utility, which is often specified as (expected) benefits from emissions less the environmental damage, is maximized. In other models, the (expected) increase of utility compared to a reference scenario is optimized. This is often done by maximizing benefits from reducing emissions, i.e., avoided damage, minus the abatement costs. The abatement costs are defined as the loss of benefits from emissions due to reducing emissions. Note that this second concept depends crucially on a reference level, referred to as the status quo emission level. Both concepts have been applied to environmental decisions under uncertainty. For example, Ulph and Ulph (1997) and Eismont and Welsch (1996) employ the first concept, whereas Welsch (1995) uses the second one.

Analogously, corresponding welfare concepts are used in a wide field of public policy where the effort to provide a (public) good has to be chosen. Looking at some representative consumer, it seems most natural to maximize her ex ante utility. Due to informational restrictions, however, the use of this welfare measure might be not possible. Rather, it may sometimes be easier to assess the change in consumer’s utility due to a certain political action which changes the provided amount of a public good. Then, decision criteria from the literature on the valuation of discrete projects, i.e., decisions of ‘yes-or-no’-type, can be applied. These criteria mostly refer to a measure of the compensating variation. This willingness-to-pay can be determined ex ante, i.e., before the uncertainty is resolved, or ex post, i.e., after the revelation of the true state of nature. The ex-ante willingness-to-pay and the aggregated ex post payments can be interpreted as a second and third welfare measure, respectively.

We show that the three welfare measures coincide with respect to the ‘optimal’ decisions, if and only if the decision maker applies risk-neutral expected utility maximization. For all other decision criteria, optimal emission levels may vary due to the choice of the welfare functional. These differences are studied for risk-averse expected utility maximization and the MaxiMin criterion.

The impact of risk-aversion qualitatively depends on the welfare measure: If the welfare measure bases on ex ante utility or the ex ante compensation measure, then the more risk-averse the decision makers are, the more effort will be made to provide the public good. If, however, decisions are based on an aggregate of