

Incorporating time lags and outcome uncertainty in estimation of welfare benefits – a cost-benefit analysis of water quality improvements in Limfjorden, Denmark

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Abstract

Cost-benefit analyses are commonly applied to assess the net welfare effects of policies to improve surface water quality. These analyses often rely on generic assumptions regarding discount rates to account for time lags between measure implementation and resulting improvements, and sensitivity analyses to account for uncertainty regarding the actual outcome of the policy implementation. However, preferences for uncertainty in relation to actual timing and outcomes in the specific case setting are rarely directly measured and incorporated. In this paper, we conduct a cost-benefit analysis of implementation of policy measures to achieve the EU Water Framework Directive target of good ecological status in Limfjorden, Denmark. The specific mix of policy measures are identified through a cost-effectiveness analysis, which also provides the basis for the aggregate welfare costs. Benefit estimates are obtained from on a stated choice experiment, which allow explicitly accounting for preferences for the time lags and outcome uncertainty that are inherently present when implementing a mix of policy measures to improve surface water quality in the specific case area. As a reference point, we first conduct what could be considered a rather typical CBA, assuming that water quality improves within the expected timeframe and with the anticipated magnitude according to the policy measures considered necessary to reach good ecological status. This baseline analysis indicates that implementation of the mix of policy measures to achieve good ecological status in Limfjorden may be costly, but will overall lead to large and robust increases in net societal welfare. Departing from this reference point, we then loosen the assumption that the policy measures will work completely as expected by directly adjusting benefit estimates according to people's preferences for increasing time lags and outcome uncertainty as estimated in the stated choice experiment. We find that this reduces the net present value by up to 30 %, potentially blurring the otherwise clear conclusions drawn from the the more typical CBA. This suggests that in order to avoid inflating net present value, it may be important to account for welfare impacts of time lags and outcome uncertainty in a more explicit way than what is commonly done in CBA.