A translog approach for estimating the costs of improving waste water treatment in catchments draining into the Baltic Sea

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Abstract

Enhanced waste water treatment (WWT) will play a major role in meeting the Baltic Sea Action Plan (BSAP) targets for improving water quality in the Baltic Sea by 2021. Improved WWT therefore features as an important emissions reduction measure in catchment-scale models such as BALTCOST which aim to identify cost-minimised, spatially-specific implementations of emissions reduction measures around the Baltic (Hasler et al 2011). Reliable location-specific estimates of average and marginal abatement costs are central to the validity of these cost-minimisation models.

To date, it has proved difficult to obtain country- and catchment-specific estimates of both the potential for improving WWT and the costs which would be incurred in implementing these improvements (Schou et al 2006, Gren 2008, Elofsson 2010). Here we use a translog approach (Christensen & Greene 1976, Caves et al 1981) to estimate total, average and marginal cost functions for tertiary-level WWT from a panel of firm-level WWT cost data from Denmark. The estimated translog cost function is found to be compatible with a Box-Cox form estimate of the scale response of WWT costs in Poland (Berbeka et al). In addition, the translog approach also provides estimates of the elasticities of WWT cost with respect to the prices of three key inputs: labour, energy and capital re-investment/renewals. These elasticities are applied, together with GIS-derived estimations of the percentages of local populations currently connected to WWT networks, to estimate the potential for improving WWT at particular locations around the Baltic Sea, and the costs which would be incurred in making those improvements.

Translog results indicate that WWT costs are sensitive to the scale of operation and to variations in the price of inputs to the WWT process. This suggests that there is likely to be considerable variation in the cost improving WWT between the various catchments which drain into the Baltic Sea. The cost-effectiveness of WWT as a measure for improving Baltic water quality is therefore likely to vary very substantially between locations when further differences in the physical retention of nitrogen and phosphorus within the different catchments are also accounted for in spatially-specific cost-minimisation models.

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