Shadow pricing

Introduction

When society sets environmental targets on provision of non-marketed ecosystem services it is an implicit valuation of the services. As an example, when a country complies with e.g. the Water Framework Directive it accepts any costs incurred to reach specific water quality levels. Using this approach assumes that it is a socially optimal and well-informed decision to produce a mix of services where water quality regulation is provided at a specific level. If society increases the relative valuation of water quality regulation, the optimal mix of provision of fresh water quality and other services including agricultural products is assumed to be updated through the agreement of new targets. The shadow price is the marginal cost of obtaining an additional unit of the ecosystem service by implementing the environmental target. As an additional unit of the targeted ecosystem service restricts production of other marketed ecosystem services, the change in the mix reflects the relative values. The shadow price society 'pays' for provision of the ecosystem services is the loss from not obtaining the value from producing marketed goods. The method takes into account that economic actors can adjust the way in which the mix of services is produced. Taking this into account avoids exaggeration of the costs and in turn the value of the ecosystem services.

Keywords

Opportunity costs; Implicit valuation; Targets for environmental quality.

Why would I chose this approach?

The methodology is particularly useful in an ecosystem service context to illustrate the scope of ecosystem-based approaches to meet environmental quality targets in contrast to technology-based approaches. The value of ecosystem services to provide e.g. clean water and reduced climate change can be quantified using a shadow pricing approach and compared to the costs it would take to provide these services using technology-based approaches or to the costs of policy inaction. Estimating shadow prices requires identifying the most cost-effective ways of achieving the environmental target. If compared with alternatives, shadow prices can raise awareness of the economic rationale for using ecosystem-based approaches to reach environmental targets.

The spatial scale at which shadow pricing works best is the scale at which environmental targets are set. Most studies therefore choose a regional or national scale. The shadow pricing method measures the costs of providing services that can be delivered from changes in ecosystems; specifically the costs of changes in land, freshwater and marine management. The main criticism of using this methodology is that it is not based on preference assessment. The assumption that the environmental targets reflects preferences in society at large, can be a strong assumption and needs to be acknowledged when the method is used. An advantage of using this methodology is that its application generates knowledge about trade-offs and synergies between provisions of different ecosystem services. The approach is well-known by economists, but only a few examples exist in ecosystem services research.

What are the main advantages of the approach?

- It is a recognised principle in economics, it draws on modelling relationships between provision of different outcomes using existing data;
- Avoids hypothetical biases related to stated preference methods;
- Well suited to conducting sensitivity analysis as a way of analysing the implications of uncertainty;
- Can be used to provide public policy rationales for providing ecosystem services and can be linked directly to land use policies.

What are the constraints/limitations of the approach?

- Requires the compilation of large data sets;
- Needs extensive modelling competence;
- The method relies on the estimates of the cost and effectiveness of different management measures.

What types of value can the approach help me understand?

Shadow pricing is highly appropriate to elicit monetary values and anthropocentric instrumental values of nature's benefits, including both direct use and indirect use values. It is not suitable for evaluating the intrinsic value of nature, neither is it applicable to elicit option, bequest and existence values.

How does the approach address uncertainty?

The valuation approach is well-suited for sensitivity analysis. By systematically varying key model parameters the shadow pricing approach can reveal how the valuation depends on critical natural science and socio-economic assumptions.

How do I apply the approach?

The flowchart below (figure 1) provides a short description of the steps in the application of shadow pricing. The steps can roughly be divided in two parts. The first analytical part (steps 1-3) organises the data, conducts the statistical analysis and estimates a production frontier model. The second application part (steps 4-5) will vary depending on the decision context. In the flowchart below the steps relate to using the method for evaluating the consequences of alternative policies.

Figure 1. Steps involved in the application of Shadow pricing

Requirements

Requirements		Comments
Data collection requirement	**X Data is available** ☐ Need to collect some new data (e.g. participatory valuation) ☐ Need to collect lots of new data (e.g. valuation based on surveys)	
Type of data required	**X Quantitative** ☐ Qualitative	
Expertise and production of knowledge needed	☐ Working with researchers within your own field **X Working with researchers from other fields** ☐ Working with non-academic stakeholders	
Software requirements	☐ Freely available **X License required** **X Advanced software knowledge required**	For example GAUSS requires a licence and specialist knowledge to derive cost-effective alternatives and implicitly the price.
Time requirements	**X Short-term (less than 1 year)** ☐ Medium-term (1-2 years) ☐ Long-term (more than 2 years)	
Economic resources	**X Low-demanding (less than 6 PMs)** ☐ Medium-demanding (6-12 PMs) ☐ High-demanding (more than 12 PMs)	
Other requirements		

Where do I go for more information?

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