

Only the text in the *green italics* represents the consensus views of the SAB Committee on Valuing the Protection of Ecological Systems and Services and has been approved by the chartered SAB. All other text was provided by individual committee members and is offered to extend and elaborate the very brief descriptions provided in chapter 4 of the SAB Report, *Valuing the Protection of Ecological Systems and Service* and to encourage further deliberation within EPA and the broader scientific community about how to meet the need for an integrated and expanded approach for valuing the protection of ecological systems and services.

Market-based methods

Excerpt from draft SAB Committee report, *Valuing the Protection of Ecological Systems and Services*: *Market-based methods seek to use information about market prices (or market demand) to infer values related to changes in marketed goods and services. For example, when ecological changes lead to a small change in timber or commercial fishing harvests, the market price of timber or fish can be used as a measure of willingness to pay for that marginal change. If the change is large, the current market price alone is not sufficient to determine value. Rather, the demand for timber or fish at various prices must be used to determine willingness to pay for the change. In general, market-based methods can value only those services supplied in well-functioning markets. These methods have been used to assess the welfare effects of a wide variety of public policies.*

Further reading

Barbier, E.B., and I. Strand. 1998. Valuing mangrove fishery linkages. Environmental and Resource Economics: 12: 151-166.

Boardman, A.E., D.H. Greenberg, A.R. Vining, and D.L. Weimer. 2006. Cost-benefit analysis: Concepts and practice. 3rd ed. Upper Saddle River, NJ: Prentice-Hall.

Freeman, A.M., III. 2003. The measurement of environmental and resource values. 2nd ed. Washington, DC: Resources for the Future.

Hufbauer, G., and K.A. Elliott. 1994. Measuring the costs of protection in the US. Washington, DC: Institute for International Economics.

McConnell, K.E., and N.E. Bockstael. 2005. Valuing the environment as a factor of production. In Handbook of environmental economics, ed. K-G. Maler and J.R. Vincent. Amsterdam: North-Holland.

Winston, C. 1993. Economic deregulation: Days of reckoning for microeconomists. Journal of Economic Literature.

Brief description of methods. The market-based approaches to economic valuation are used to estimate the economic values of ecosystem services that are an input into the production

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of a good or service that can be bought and sold in a market at an observable price. For private goods and services purchased in competitive markets, the price of a good reflects the valuation of an extra unit of that good or service by the set of participants in that market. For small changes, market prices can be used as a measure of economic value of each unit of the goods involved. For larger changes, however, marginal willingness to pay (demand) and marginal cost (supply) are unlikely to remain constant, requiring estimation of changes in consumer and producer surplus.¹

This approach can be applied in a variety of contexts. For example, wetlands often serve as nurseries for fish species that are harvested for commercial markets. They are thus an input to commercial fishing, and their services affect the supply and market price of harvested fish. The economic benefits of protecting wetlands can then be estimated by their contribution to the market value of the output of the commercial fishery. For relatively small changes, the additional output of the fishery can be valued simply by multiplying the change in output by the market price of the fish. Similarly, when a river is used as a source of irrigation water for agriculture, both the water quantity and quality directly contribute to the production of food. The economic benefit of an improvement in either water quantity or quality can be estimated by its contribution to the market value of food production. Again, for small changes, the market price of the agricultural product multiplied by the resulting change in output provides a measure of the value of the water quality or quantity change.

Status of the methods. Market-based methods are based on well-established economic principles and econometric practices (Boardman, et al. 2006, McConnell and Bockstael 2005). They have been used for more than 30 years to evaluate a variety of economic policies (Hufbauer and Elliott 1994, Winston 1993). Applications to the valuation of ecosystem services include

¹ Consumer surplus measures the excess of the sum of the marginal values over the expenditures that must be made to obtain the good at a fixed price. Thus, consumer surplus sums up the differences between the maximum a consumer would be willing to pay for a good minus the amount actually paid (price) for each unit consumed. Similarly, producer surplus measures the excess of receipts for the good over the sum of the marginal costs to provide each unit. Producer surplus is then a comparable concept. It aggregates the difference between what producers are willing to sell a product for (supply) and what they actually receive (price) for each unit they provide. Adding together changes in consumer surplus and producer surplus generates the change in total economic benefit.

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Barbier and Strand (1998) and Barbier, Strand, and Sathirathai (2002). EPA has used these methods to value ecosystem service benefits from air pollution control in the markets for agricultural products and for timber products (US EPA 1999).

Limitations

Estimating both consumer and producer surplus requires the development of empirical models for the demand and supply relationships describing market outcomes. Depending on each application this can be difficult due to lack of data at the level of resolution required to describe how economic policies affect each of these relationships.

The majority of environmental policies do not directly impact the prices and quantities of goods and services traded in markets, so this method is only available in a limited subset of cases. In addition, it will only capture the benefits of a change that are manifested in marketed outputs. For example, a wetland may contribute not only to commercial fishery production but also to flood control, water purification, wildlife habitat, etc. These other benefits would not be captured by a market-based approach. Another limitation of this method is that, if there are market imperfections stemming for example from market power, this can confound the measurement of demand and supply and distort the relationship between prices and the marginal value and marginal cost of providing a private good. As a result, this distortion will carry over into any estimation of economic values based on market prices.

Many non-environmental factors can affect demand and supply relationships that are also important. Seasonal variations in use or availability of goods and services related to environmental policies can affect prices, and this needs to be considered. The modeling and estimation of demand and supply functions can be complicated. Ultimately, what can be learned about the influence of environmental or any other policy is limited by the available data. These limitations are best described as an identification problem – do we have sufficient information to identify the effects that are hypothesized to reflect how environmental policy influences market supply and demand?

Key References

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- Winston, C. 1993. Economic deregulation: Days of reckoning for microeconomists. *Journal of Economic Literature*