Debating Nature's Value: the role of monetary valuation

How should we view monetary valuation of environmental goods and services? The theory behind valuation is grounded in expected utility theory (von Neumann and Morgenstern, 1944) and its more recent developments, which form an analytical framework used to explain people's decisions under uncertainty, based on the assumption that decisions stem from, and therefore reveal information about, individuals' preferences. In neoclassical economics, individual 'total economic value' (TEV) represents all the ways that goods and services influence individual utility. This is revealed through the decisions or preferences of an individual, acting under a budget constraint, and expressed as their 'willingness to pay' (WTP). At a societal level, TEV represents the aggregate of these individual values, either as a simple sum or using weighting criteria, in particular to reflect income/wealth distributions and the diminishing marginal utility of income.

For a particular ecosystem or natural 'asset', therefore, TEV can be thought of as the sum of all the ways the ecosystem functions, ecosystem services and goods influence the utility of individual humans, as reflected by their WTP values, again either as a simple sum or following a weighting scheme (Figure 1). Integrating TEV over time, using discounting to convert future values to present day equivalents, gives the net present value of these flows. Assuming calculable risk about future flows, these values are often expressed as expected values, and cost-benefit analysis (CBA) compares the expected values of different courses of action. However other treatments and decision rules may also be used, for example to implement some degree of risk-aversion in the calculations (Wegner & Pascual, 2011).

Even if nothing else, this provides a useful framework for thinking about ways that humans might value aspects of nature. Note in particular that, although the framework is grounded in individual preferences, it nevertheless provides space both for non-selfish preferences (non-use values: existence, altruistic, bequest) and also for uncertainty about future preferences and uses (option and insurance values). In a similar way, the ecosystem services framework (see e.g. Daily 1997), often combined with the TEV framework, provides a useful checklist of ways in which natural systems provide benefits to humans. There is no claim that these values and benefits are an *exhaustive* representation of natural values; rather, the frameworks provide a minimum set of things to consider.

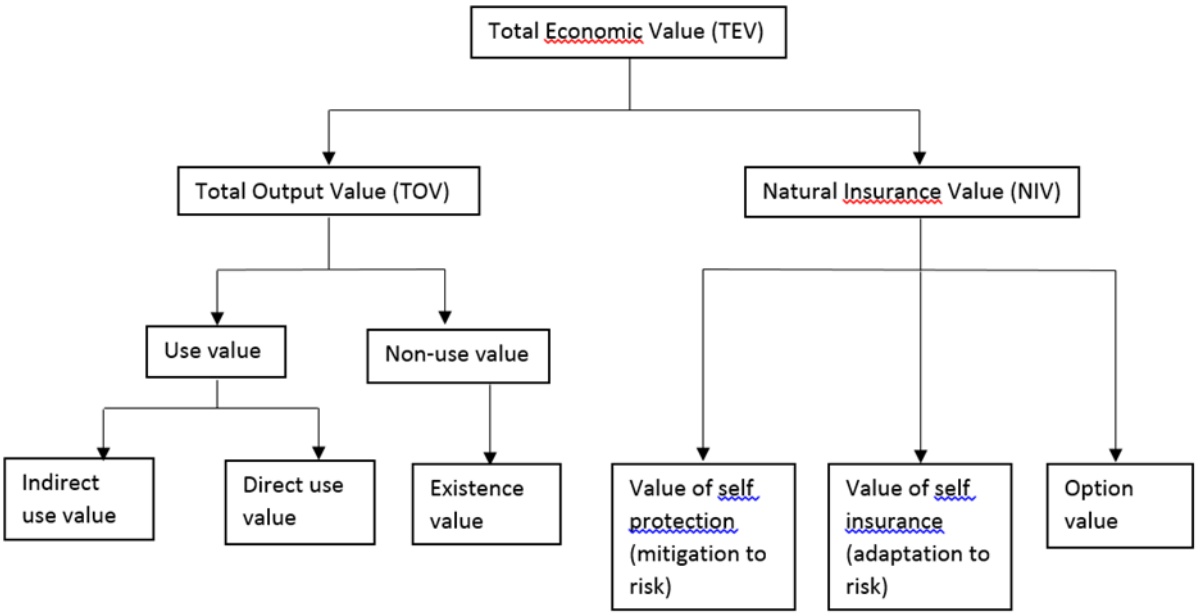

Figure 1: The TEV framework (extended to include insurance values: see e.g. Pascaul et al 2015)

Thus, environmental valuation is one manifestation of a model of how aspects of the natural world influence human wellbeing. Like any model, the important issue is not whether it is 'right' or 'true', but rather whether it is 'useful'. Thinking about it in terms of attempting to represent an underlying truth is not helpful, and makes for rather an easy straw man. It's much more interesting to consider whether or not valuation is useful as a decision support tool in different contexts. Here we should recognise that there are many different purposes and uses for valuation and CBA evidence. These include, for example, the following broad categories:

- Project appraisal, policy appraisal and impact assessment
- Monitoring and review of decisions
- Demonstrating 'Value for Money', seeking funding
- Prioritisation of investments
- Planning and location decisions
- Pricing decisions: fees, payments, compensation for damages
- Understanding, communication, and advocacy

Each of these may call for different specific methods, and different requirements for accuracy and research expenditure, commensurate with the decision context and the spatial and temporal scale of application, ranging from localised, static appraisals to globalised, dynamic strategic assessments. Different applications in different social and political contexts may also evoke different ethical and practical objections.

There are many well-recognised problems, both theoretical and practical, with applications of the valuation model. Some of these are summarised in Table 1. While researchers are generally well aware of the limitations, and the results appropriately caveated (valuation and CBA guidance in

particular always calls for sensitivity analysis, full reporting of assumptions, weaknesses, omissions…) this might not carry over to decision-makers using results.[1]

It's worth noting that many of the same criticisms apply (with varying force) to market institutions and indeed to other forms of collective choice. Markets using monetary currency as a unit of exchange and store of value are very powerful institutions for exchanging information about abilities and needs, and (nearly?) nobody would argue we'd be better off without them. But, (not quite so nearly?) nobody believes that markets should be free of regulation or intervention – certainly not economists, who give considerable attention to market failures and possible remedies.

[1] Decision makers misusing evidence to suit their ends is hardly unique: the question is whether monetary valuation evidence makes that easier or harder…

Table 1: Some problems arising in the valuation model

Assumption	Problem?	Generalisation	Conclusion
Individuals are the best judges of their own welfare.	Demonstrably untrue in some cases (e.g. drug addiction) and doubtful in general (e.g. myopic decisions).	Democratic societies basically reflect this view and allow wide freedom of choice within a framework of rules to curb excesses.	More a limit than a problem: recognise TEV focuses on individual preferences. Other moral decision rules may be considered.
Individuals have the required information and cognitive ability to have stable, well-formed preferences that they express through decisions.	Probably untrue, in particular for hypothetical decisions and unfamiliar goods and services, and preferences may be context dependent and vary over time.	Poor information also affects other methods. Market institutions consistent with assumptions, with limits (advertising, trade descriptions…).	Will reduce accuracy for some goods/services. Partial mitigation via information, time for reflection, deliberative methods.
Interpersonal comparability of utility.	Not clear that any unit of benefit to one individual represents the same 'human welfare' as the same unit to another.	A problem for any system (including voting systems) and not limited to monetary units.	Practical option is to act 'as if' comparisons reliable, using weighting to reflect priorities / distributional goals.
Values expressed are constrained by incomes / ability to pay.	Derived estimates of social value assume existing income distributions are desirable, or at least fair or that inequalities should be corrected through income policies.	Policies to redistribute incomes via taxes and benefits mean that actual market distributions can be deemed at least in part a reflection of democratic decisions.	WTP-based values for non-market goods and services are not necessarily valid measures of their social value; income weighting can help.
Smooth, continuous value functions.	Non-linearities, threshold effects and areas of highly inelastic demand / rapidly changing values.	Severity depends on scale of application: small-scale, marginal assessments less likely to suffer than large-scale, major changes.	Limits on use of valuation when dealing with critical natural capital or potentially catastrophic changes.
Inevitable data gaps, in ecological/scientific understanding, and/or in the valuation evidence base.	No valuation analysis or economic appraisal such as Cost Benefit Analysis (CBA) can be considered complete and accurate.	Applies to all methods, and CBA can include a wide range of values, sensitivity analysis, clear statements of gaps.	CBA must be viewed as an aid to deliberation, not a way of providing "the answer".
Optimism bias: tendency to	CBA likely to be biased (both ways, including	Not specific to economic valuation	Be aware of and make formal

underestimate future costs and overestimate benefits.	underestimating the costs and overestimating the benefits).	methods – more about physical outcomes and timings.	adjustment for optimism (or 'pessimism') bias.

In any event, the use of market values to account for goods and services actually traded in markets (including ecosystem services such as food or timber production) is *relatively* uncontroversial – disagreements are mostly about rules and interventions (subsidies, taxes, redistribution etc.) not the use of markets per se. But the estimation and uses of economic values for services such as clean air provision or biodiversity protection – or education, or health – can evoke very strong responses from different perspectives. In effect, the use of non-market valuation methods extends market thinking and tools to areas where property rights are not fully defined. This extension varies in degree, depending on the application, and can be very contentious, both on fundamental ethical principles, and for practical reasons. For example, there is justifiable concern that valuation could support policies that are regressive, because it may appear more 'efficient' to cluster environmental 'bads' where people are poorer, because willingness to pay is constrained by ability to pay.

The question of whether or not valuation 'helps' in any particular use or decision context seems to be the most important one. Valuation is certainly not essential: there are alternative ways of carrying out appraisal (MCA, collective decision methods), for example, and even environmental taxation could be implemented without necessarily using valuation to set the tax rates. But does it make these processes easier, more defensible, more transparent, more (cost-)effective…? In particular, are arguments for recognising the importance of the natural world more convincing (for some decision makers, in some contexts) if they're expressed in monetary value terms?

Alongside that, we need to consider whether there are any unintended results, in particular over time. This is where concerns about 'crowding out' of non-market motives and values are important (see e.g. Rode et al 2015). Similarly, is there a risk that expressing values in monetary terms provides a drive for those values to be 'captured' via market creation (i.e. defining property rights and bringing the environmental goods and services inside the 'productive boundary' of national accounts) and/or introduction of new environmental tax bases? And what would be the distributional impacts of that? Does use of valuation evidence create further demand for such evidence, locking decision processes in to a particular approach (see e.g. Mathieu et al, 2016 for an example in the UK water industry)?

These questions probably don't have single answers: rather, the extent to which valuation is useful will be dependent on environmental, economic, and social/political contexts. For example, there will always be bounds on the appropriate uses of values. Values change with quantities, so any particular point estimate is only going to be accurate at the margin, and any value for a non-marginal change in quantities is usually going to be an integral of a non-constant function. Thus the consequences of imprecise valuation depend on the elasticity of demand for an environmental service: risks are low where elasticity is low; where elasticity is high, rapidly changing values make the consequences of small quantity changes significant, so valuation and control by price are riskier; for 'critical natural capital', elasticity is effectively infinite, marginal valuation is inappropriate, and the Precautionary Principle must apply (Farley, 2008).

So for me the key issue to debate is not whether monetary valuation is 'accurate', 'complete' or 'true', but rather "under what conditions is monetary valuation useful?" Let me conclude with an example. The Costanza et al (1997) global valuation exercise is a popular punch-bag, even amongst economists - the general reaction there was "these numbers are largely nonsense" but often also "wish we'd thought of doing this". And that's actually a pretty sensible reaction, because while nobody considers their ecosystem service valuation 'right'[2], the authors did largely achieve their aim of demonstrating that even a partial accounting of nature's gifts would show huge sums. But my main point is about their update (Costanza et al. 2014). The 1997 estimate for the global value of ecosystem services was c.$46 trillion/year in 2007 $US. The 2014 study updated the unit values and took account of land use/land cover change from 1997-2011. The new estimate is c.$125 trillion/year, but this does not imply that things have improved – it derives from an increase in unit values, not physical services. Rising values are not always a good sign: unit values will increase when a good or service becomes scarcer, and the net impact depends on elasticities. A revaluation of the 1997 services using 2011 values would be c.$145 trillion/year. So the repeated exercise showed the loss of eco-services from 1997 to 2011 due to land use change could be estimated at about $20 trillion/year. A meaningless number, or a powerful way of combining and communicating the combined impacts of a wide range of degradations that might otherwise be difficult to grasp and compare with other priorities?

Addendum: Values in accounts

There is a lot of activity ongoing in the area of environmental accounting, so it's worth noting here that the purpose of accounting, and the value principles being used, are not the same as for welfare assessments. National accounting is what underpins GDP estimates, and omits most non-market activity, because "balance has to be struck between the desire for the accounts to be as comprehensive as possible and the need to prevent flows used for the analysis of market behaviour and disequilibria from being swamped by non-monetary values." (SNA, 2008). The national accounts do, however, include imputed values for several non-marketed services (including fixed capital consumption, healthcare, education, and the services of financial intermediaries) though not for others (notably services produced and consumed by households). Environmental and ecosystem accounting seek to extend the boundary of the accounts to include ecosystems and their services.

National accounting uses exchange values ('prices') not welfare values (TEV), and although GDP is often used as a measure of welfare "there are several conventions in the SNA that argue against the welfare interpretation of the accounts" (SNA 2008). This explains why the environmental values used in accounts are different from those used in CBA. It also illustrates the risks of a tool being misused – and indeed, of society becoming locked-in to that misuse, with serious consequences (in the case of GDP, pathological focus on growing an indicator that isn't even a measure of economic welfare).

It's this error that green accounting seeks, in part, to mitigate. But in this context, the interpretation of price changes in accounts is a particular concern. A higher figure in accounts might be thought 'better': more people benefit and/or there's an improved quantity or quality of service. But there are other possibilities: increased scarcity (overfishing, crop failure…); decreased competition; loss of substitutes or increase in their prices; 'marketisation' (a self-fulfilling prophecy?). Sustainability requires maintaining welfare at lower throughput (flows), with non-declining wealth (stocks) – which

[2] And they're certainly not the price or value of the natural world, nor do they claim to be.

is one reason why if ecosystem accounts are to be used, it's vital that the physical accounts be considered alongside the monetary.

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