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Commentary

Economic Inequality and the Value of Nature

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ABSTRACT

Understanding what influences the value of nature is crucial for informing environmental policy. From a sustainability perspective, economic valuation should not only seek to determine a society's willingness to pay for environmental goods to devise an efficient allocation of scarce resources, but should also account for distributional effects to ensure justice. Yet, how economic inequality affects the value of non-market environmental goods remains understudied. Combining recently developed theoretical results with empirical evidence, this Commentary shows that more equal societies have a higher valuation for environmental public goods and that non-market benefits of environmental policy accrue over-proportionally to poorer households. On this ground, we discuss implications for environmental valuation, management and policy-making and identify a number of fruitful areas for future research. We conclude that environmental valuation should explicitly account for economic inequality, and that encompassing assessments of the distributional effects of environmental policies must consider the distribution of non-market environmental benefits.

1. Introduction

Appropriately representing the value of non-market environmental goods or ecosystem services in societal decision-making poses a fundamental challenge for ecological and environmental economics.[1] Accordingly, approaches to value nature's contributions to people are diverse and abound (Pascual et al., 2017). Most valuation studies – among them many published in this journal – follow the standard economic approach of capturing the economic value individuals attach to environmental goods by eliciting their willingness to pay (WTP) for the provision of environmental goods by use of stated or revealed preference methods,[2] and then summing up individual WTPs over all members of society.[3] As values for environmental goods are increasingly applied to inform regulatory or judicial decision-making (Atkinson and Mourato, 2008; Bateman et al., 2013; Bishop et al., 2017), the step of aggregating individual values needs more thorough reflection.

Ecological Economics as a school of thought is not only oriented towards economic efficiency but also aims at sustainability and thus distributive justice (Costanza, 1989; Baumgärtner and Quaas, 2010). Therefore, the nexus of environmental valuation and economic inequality deserves particular attention. Beyond methodological concerns, it is timely to consider these two issues intertwined, as on the one hand the loss of environmental goods is widespread and accelerating (Butchart et al., 2010; Pimm et al., 2014; MEA, 2005), and on the other hand concerns about economic inequalities are becoming more prevalent in science, policy and society (Stiglitz et al., 2010; Piketty, 2014; OECD, 2016; IMF, 2017). However, with few notable exceptions,

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[1] For the sake of brevity, we make no distinction between environmental goods and ecosystem services and only refer to 'environmental goods'. Sections 2 and 3 focus in particular on the case of environmental *public* goods in fixed quantity, i.e. goods whose consumption is non-rival and non-excludable and the amount of which is exogenous to the valuation. For example, one may think of clean air, biodiversity conservation, or climate regulation.

[2] The *value* of a good is the increase in individual or societal well-being due to an increase in the good's level or quality. There are different benefit or welfare measures, such as equivalent or compensating surplus (Freema, 2003). For marginal changes and standard preferences, equivalent and compensating surplus are identical and equal WTP. Marginal changes imply that we here consider a project that is very 'small' in relation to the economy; 'standard preferences' are usually self-regarding (DellaVigna, 2009) and thus omit, for example, altruism and relative consumption concerns.

[3] For any Pareto efficient allocation the amount of a public good is characterized by the Lindahl-Samuelson condition that the sum of individual WTPs within a society should equal the marginal costs of public good provision (Samuelson, 1954). Equivalently, one could take the mean WTP as found in a representative study, and multiply it with the number of individuals in a society. We will thus often refer to 'mean WTP' when we speak about the 'aggregate WTP'.

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valuation studies largely ignore issues of economic distribution, even though it is known that the inequality of income or wealth may affect individual and societal environmental values (Barbier et al., 2009).

To shed light on this important nexus, this Commentary discusses how economic inequality affects the value society attaches to nature. Given the sparse literature on this issue, we focus on standard economic valuation approaches and the case of income inequality, as it is the most studied measure of economic inequality, and because income is typically elicited in environmental valuation studies (in contrast to wealth). The literature provides promising ways to account for economic inequality within standard economic approaches. Indeed, there is a clear relationship between mean WTP and income inequality: For most empirically relevant cases, a reduction in income inequality increases the value society attaches to public environmental goods (see Section 2). This implies that the incidence of environmental policies, defined as their distributional consequence across income groups, is such that non-market environmental benefits accrue over-proportionally to poorer households. We discuss implications of economic inequality regarding the practice of benefit transfer (Section 3.1), adjustment of WTP for inequality in environmental cost-benefit analysis and its relation to equity or distributional weights (Section 3.2), and the distributional consequences of environmental policies (Section 3.3). Section 4 points towards research needs within approaches to valuing environmental goods. Overall, we conclude that it is neither necessary nor appropriate to ignore distributional aspects in standard economic valuation approaches.

2. How Does the Distribution of Income Affect the Valuation of Environmental Goods?

In a recent contribution, Frank and Schlenker (2016: 652) conjecture that "if preservation values increase with income but at a decreasing rate, as commonly assumed, then a more equal society will exhibit higher values for conservation. The income distribution might thus be as important as overall economic growth". Addressing this conjecture, Baumgärtner et al. (2017a) build on previous work by Ebert (2003), who has been the first to analyze the incidence of non-market environmental good provision. Specifically, they use a standard constant-elasticity-of-substitution utility function and relate the degree of substitutability or complementarity between an environmental public good and a human-made consumption good to the WTP. A constant income elasticity of WTP that is smaller (larger) than one implies that preservation values increase with income but at a decreasing (increasing) rate. Baumgärtner et al. (2017a) show that if the constant income elasticity of WTP is below one – as assumed in the conjecture by Frank and Schlenker (2016) – societies with a more equal distribution of income have a higher mean WTP.[4] Indeed, empirically the income elasticity of WTP appears to be below unity in almost all cases (Drupp, 2018; Kriström and Riera, 1996) and it is usually estimated as a constant, as it is the case for biodiversity conservation at the global level (Jacobsen and Hanley, 2009).

Fig. 1 illustrates this result. Consider a society of two households with different incomes: household B has a higher income, Y_B, than household A with income Y_A. WTP increases with income, Y, but at a decreasing rate, such as depicted by the solid black curve. Thus, the income elasticity of WTP is below unity. Now consider a reduction in income inequality that leaves society's mean income unchanged (a 'Pigou-Dalton-transfer'): the income of the relatively richer household B is decreased by the amount ΔY to Y'_B, and the income of the relatively poorer household A is increased by the same amount ΔY to Y'_A but still the richer household B is better off $Y'_B > Y'_A$. An income elasticity of WTP for environmental public goods below unity implies that, with this change in the income distribution, the increase of WTP_A of the poorer household A is larger than the decrease in WTP_B of the richer household B. Thus, mean WTP in the more equal society, $\overline{WTP'}$, is higher than in the more unequal society $\overline{WTP}$, i.e. $\Delta WTP = \overline{WTP'} - \overline{WTP} > 0$. It also follows for an income elasticity of WTP equal to unity – and only in this case – that the distribution of income does not influence mean WTP.

In their theoretical analysis, Baumgärtner et al. (2017a) consider not only two households, but a whole distribution of incomes within a large society. Specifically, they assume that income is distributed log-normally within society. They show that while income inequality is important, mean WTP for environmental public goods changes more elastically with mean income than with income inequality except for extreme cases. Hence, the conjecture of Frank and Schlenker (2016) can be qualified as follows: Income elasticities below one imply that reductions in income inequality increase mean WTP, but changes in mean (that is per-capita) income have a relatively stronger effect. Baumgärtner et al. (2017a) further derive correction or transfer factors that allow controlling for the effect of income inequality on mean WTP for environmental public goods, such as for differences in income inequality in different societies, or between the current unequal income distribution and normatively desired ones. We discuss three implications of these findings in the following section.

3. Implications

3.1. Account for Income Inequality in Value or Benefit Transfer

As conducting primary environmental valuation studies is time-consuming and costly, the transfer of environmental values from a study site to a policy site ('benefit transfer') has become one of the most commonly used approaches for obtaining values for environmental goods (Pearce et al., 2006; Richardson et al., 2015). Strictly speaking, it is only valid to perform benefit transfer if the study and the policy site are identical in all aspects that determine mean WTP for the environmental goods. However, in practice, benefit transfer is applied much more widely. It is therefore crucial to control for differences in important determinants of WTP in this process, including differences in the distribution of income. While a number of guidelines, such as in Germany (UBA, 2012), the OECD (Pearce et al., 2006), and the UK (Defra, 2007), already suggest how to account for differences in per-capita income, accounting for income inequality has been neglected so far. Baumgärtner et al. (2017a) derive closed-form benefit transfer factors to account for income inequality and show that WTP adjustments can be substantial.[5] Meya et al. (2017) empirically investigate the adjustment for income inequality in benefit transfer for a multi-country valuation study. They find that adjusting for income inequality indeed increases the accuracy of benefit transfer. These two studies suggest on theoretical and empirical grounds that benefit transfer studies should employ a transfer factor for differences in income inequality above and beyond controlling for differences in per-capita income. Likewise, this adjustment for differences in income inequality is relevant for scaling up mean WTP values from single sites or unrepresentative samples, to assess mean WTP for environmental goods of larger areas and actual society.

[4] Some environmental goods are likely to be complementary to human-made consumption goods. In this case, the mechanism would go in the opposite direction: redistribution towards a more equal society in income terms would imply a lower mean WTP for non-market environmental goods.

[5] The transfer factor to adjust mean WTPs for differences in income inequality between a policy and a study site, with $\overline{WTP}^{policy} = T_{CV}(\bullet) \times \overline{WTP}^{study}$, is $T_{CV}(CV_Y^{policy}, CV_Y^{study}) = \left(\frac{1 + {CV_Y^{policy}}^2}{1 + {CV_Y^{study}}^2}\right)^{\eta(\eta-1)/2}$, where ${CV_Y}^{policy}$ (${CV_Y}^{study}$) is the coefficient of variation of income at the policy (study) site, which is computed as the standard deviation divided by the mean of income, and η is the income elasticity of WTP.