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Clive L Spash

INTRODUCTION

The current population of the earth is responsible for a large and growing class of actions resulting in persistent environmental damages. There is concern for the effects of the free disposal of wastes because many of the substances created are highly toxic, their absolute quantity is far in excess of the natural assimilative capacity of the environment, they can bioaccumulate, and once created they may persist for many decades, centuries, or longer. Examples of such actions include: the creation and release into the environment of persistent toxic chemicals (such as PCBs); the production of radioactive materials during the operation and decommissioning of nuclear power stations; the release of chlorofluorocarbons, causing the destruction of the stratospheric ozone layer; and the combustion of fossil fuels, which may cause global climate change via the greenhouse effect. The resulting environmental damages are significant, irreversible, long term, and asymmetrically distributed over time, ie, the net benefits accrue now, and the net costs accrue in the future.

As the general pervasiveness of persistent damages increases, an answer is needed to the question: should this generation care about those of its actions which result in a degraded environment in the further future? And, if we do care, what should be done in response? Both environmental economics and environmental philosophy have attempted to answer these questions, however, cross-fertilisation of ideas has been limited. By drawing on, and comparing, both these fields of knowledge, current obligations in the face of future environmental damages are analysed.

In this paper the argument is made that in choosing the discount rate, economists take an ethical view about the claims of future generations. The ethical position has received little attention or justification. Four justifications for discounting future claims are considered and rejected. The alternative approach adopted by environmental economists is to come to ethical terms with the future by studying the policy implications of various ethical principles. However, the principles employed are found to possess too many attributes of utilitarianism to do justice to the belief that future people may be harmed by our present policies and have a right to be free from such harm. The acceptance of such a right entitles future people to either compensation in the form of transfers or a veto over certain policies.¹

DISCOUNTING THE FUTURE

Discounting is performed to calculate the present value of a stream of costs and benefits associated with a project or policy. The present value represents the amount of money that must be borrowed at a given interest rate to supply the same stream of net returns as would be obtained through the project or policy, given perfect capital markets. If benefits exceed costs in every time period the present value is positive for any discount rate. Generally, however, the choice of the social discount rate is crucial in determining whether the present value is positive or negative.

The process of discounting the future is defended by economists as the way people behave and value things. Both consumers, via a positive rate of time preference,² and producers, via the social opportunity cost of capital, are observed to treat the future

as less important than the present. Consumers lend money and expect to be rewarded for their abstinence from consumption, eg, savings account interest.

Producers earn more interest on earlier cash receipts by loaning them to others in the economy and tying into their productivity; making earlier profits more valuable.

Neoclassical economists have shown how, in a simplified world, a unique discount rate is determined by the market. Individual rates of time preference determine decisions over present consumption and savings (the marginal rates of substitution between present and deferred consumption). Aggregate savings provide a supply of loanable funds. Deferring current consumption increases future income via the marginal productivity of capital. Under perfect competition, savings and investment schedules intersect to define a unique equilibrium, where the marginal rate of return on capital equals the marginal rate of time preference.³ That is, a single discount rate prevails.

The suitability of the market-determined discount rate for long term, public policy decisions is brought into question by the fact that only the time preferences of the present generation enter into the process. Individuals with finite life expectancies are likely to act differently in their private consumption decisions from a society that has a collective commitment to life in perpetuity.⁴ Thus, the supply of loanable funds for investment is influenced by private time preferences that diverge from a collectively determined rate of social time preference. A higher discount rate than is socially optimal will occur and the level of investment will be too low to make adequate provision for future generations.⁵

In fact, the process of discounting the future, at almost any positive rate, creates insignificant present values for even catastrophic losses in the further future. Thus, the standard application of cost-benefit analysis to long term environmental damages gives the impression that the distant future is almost valueless. In addition, the distribution of net costs in the future, and net benefits now, makes the actions responsible for long term environmental damages falsely attractive.

Some authors believe discounting future streams of costs and benefits (on the grounds of time preference or capital productivity) has been widely accepted by economists.⁶ The only problem then lies in practising the technique. In arguing about the choice of a social rate of discount the economics literature can be split into the following categories:

- (i) an infinite social discount rate should be used;
- (ii) the intergenerational (between generations) discount rate should be greater than zero but less than infinity;
- (iii) (a) the intratemporal (within a generation) and intergenerational discount rates should be the same; or,
- (iii) (b) the appropriate social discount rate is zero; and
- (iv) a negative intertemporal discount rate should be used.

Lemons has placed the philosophical viewpoints on whether a duty to posterity exists into three categories:⁷

- (i) no moral obligations beyond the immediate future exist;
- (ii) moral obligations to the future exist, but the future is assigned less weight than

the present; and

(iii) rights and interests of future persons are the same as those of contemporary persons.

This is an incomplete ranking and should also include:

(iv) moral obligations to the future exist, and the future is assigned more weight than the present.⁸

There is an obvious correlation between the economic and philosophical perspectives. The economist's (iii) splits Lemons' third viewpoint into two, and forces a clarification of what "same" is used to imply. As members of the current generation we may weigh our own welfare differently over our own life-times; treating the future as less valuable. If future generations are to be treated in the "same" way, then the intertemporal and intergenerational discount rates should be equal. Yet, weighting the present more heavily than the future is often a myopic policy for ourselves. For example, intratemporally, people fail to provide adequately for their retirement, leading to government support for the elderly. More importantly, as mentioned earlier, any positive discount rate will cause catastrophes in the further future to be reduced to insignificant factors in the present decision making process.

The acceptance of discounting as the proper approach to intertemporal distribution requires an unavoidable moral judgement.⁹ A zero social discount rate, where intergenerational decisions are involved, would prevent future environmental damages implicitly being ignored. Only at the extreme of an infinite discount rate would no future effects of current actions be taken into account. More commonly an arbitrary

but positive rate is used in cost-benefit analysis. Thus, the future is held to matter, but how far this is so depends on the rate chosen.

JUSTIFICATIONS FOR DISCOUNTING

Four general justifications for discounting the future effects of present actions can be identified.¹⁰ First, the very temporal location of our descendants disqualifies them from equal treatment with current members of the body politic. Yet does this mean future people should be treated as if they were already dead? The current generation does affect the probability that future individual's need for drinkable water and desire for clean air will be satisfied. Assuming the existence of a given population, when should the effective dividing line be drawn between now and the less important future?¹¹ Factors such as age, temperament, or interest change the chosen dividing point of time into present and future. Failing to acknowledge the importance of environmental degradation in the future, just because psychologically it is thought of as separated from the present, is totally arbitrary.¹²

Second, the argument has been made that we should restrict our attention to the aspects of our actions for which preferences are known and exclude unknown future preferences. This argument is similar in line of reasoning to the need for personal identity in making hypothetical intergenerational contracts.¹³ That is, no coherent sense can be given to making persons better or worse off if the specific persons are different *ex ante* and *ex post*. This argument relies on the assumption that all rights come from individuals and therefore the identity of individuals is central to their

rights. Thus, individuals cannot claim to have been harmed by the actions of their predecessors which leave them in poverty (for example) because their existence is contingent upon the events causing their poverty. As long as future individuals do not regret their existence, any action is then justified no matter what the consequences because the future identity of individuals is determined by the action.

These lines of reasoning fail to account for the fact that there can be wrongs to future persons despite indeterminacy concerning their identities and our ignorance of their special needs. Whoever exists can be reasonably expected to have the same biological and social needs as those now existing. Along these lines Annette Baier has concluded that "... the wrongs we can do a future person are usually restricted to injuries to interest fixed before the identity of future persons are fixed (and to such frustrations and pain as is consequent upon the injury to such interests), and cannot include injury to interests not yet fixed or frustration of wants and concerns not yet fixed or hurts to sensibilities not yet fixed".¹⁴ A safe assumption is that the basic human needs for food, shelter, health, and security will remain a prerequisite for the satisfaction of other desires.¹⁵

In addition, David Richards has argued that the relevant moral issue is to determine how, whoever exists, persons will fare under different policies.¹⁶ Thus, regardless of who exists they will be better off without, for example, cancer. The choice between societies made up of cancer ridden individuals and cancer free individuals does not require that the individuals be identified. The identity of the persons under alternative policies is irrelevant.

The third attempted justification is that the human race will at some stage become extinct, so more consumption today prevents potential resource wastage tomorrow. If this extinction is exogenous (eg, due to the cooling of the sun) and the date can be predicted the intergenerational distribution of world resources could be arranged to ensure nothing was left.¹⁷ Uncertainty concerning the extinction date would be solved by maintaining a reserve, as an insurance policy. This is much the same problem as an individual faces in allocating consumption over their lifetime. The point is that exogenous extinction can, at least theoretically, be considered without discriminating against the future to the extent of effectively excluding it from current decisions.

Endogenous extinction implies the human race is in control of the factors which determine extinction. For example, assuming the earth has a finite stock of energy, and evolution is irrevocable, a high consumption rate today means fewer lives in the future. Yet, such control over our own destiny does not imply weighing the importance of the future less than that of the present. The literature concerning such internal determination of extinction varies in solution from Georgescu-Roegen,¹⁸ arguing for intergenerational equity, to the spaceship earth literature,¹⁹ emphasising increases in future consumption to balance environmental degradation.

The fourth and final justification for discounting relies upon the uncertainty of future events. For example, where the uncertainty concerns the demand for a depletable resource it is assumed to be positively related to the distance in time from the depletion decision. The conventional answer is to reflect such uncertainty in an increase in the discount rate; resulting in a faster rate of depletion. Fisher has shown

how the type of uncertainty under consideration can result in either increased or decreased depletion rates.²⁰ That is, uncertainty can result in resources being preserved for the future rather than depleted faster. Thus, where assimilative capacity is being depleted, with uncertainty as to the stock, risk aversion would argue in favour of reducing the rate of depletion, eg, reducing the rate at which carbon dioxide is released and atmospheric capacity is mined.

Similarly, in public project appraisal the argument is put forward that the appropriate adjustment for risk is made by raising the discount rate used to calculate the present value of the investment. However, except under special circumstances, there is no well-defined way to adjust the discount rate such that it will make the appropriate adjustment for risk in the present value of uncertain future benefits and costs in each period. This is explained at length, in the context of energy related projects, by Lind.²¹

The argument might also be applied to projects which create long term damages. In this context, there is a probability that no damages will occur and this probability might be increasing over time. This is equivalent to arguing that undertaking actions which can harm others is justified because there is a chance they will remain unharmed. My loosening the wheels on your car is acceptable because you might not crash as a result.²²

Given the essentially ethical nature of this issue an appeal to ethical rules for guidance seems potentially enlightening.

ETHICAL RULES IN ENVIRONMENTAL ECONOMICS

In order to focus attention on the intertemporal (between generations) resource allocation and distribution of welfare, economists commonly assume consumption is split equally among the members of any given generation.²³ The assumption avoids intratemporal (within a generation) distribution and aggregation issues, and as a result treats generations as if they were individuals. Karl-Goran Maler has discussed the conditions under which the well-being of members of a generation can be aggregated and treated as a single unit.²⁴ A similar assumption is to assume each generation consists of homogeneous individuals who can be represented as a single agent, see Norgaard and Howarth.²⁵ Thus, even though economists work with a brand of utilitarianism which is individualistic (ie, all interests and benefits are interests or benefits of individuals) such assumptions effectively treat generations as single agents having utilities. This approach is followed below.

In order to clarify the relationship between generations, environmental economists have reviewed the implications of adopting several ethical rules.²⁶ In most instances the ethical rules have been defined in terms of individual welfare in a given state, and simplified so as to be expressed in mathematical formulae. Four ethical rules, as they exist in the literature, will be examined with the aim of finding the implications for the treatment of long term environmental damages. These four rules are the classical utilitarian, the egalitarian, the libertarian (Paretian), and the elitist.

The elitist rule requires that the welfare of the best off be improved and sees actions

decreasing their welfare as wrong. The egalitarian rule is the exact opposite requiring the same for the worst off. (This Max-Min approach is often referred to as an intergenerational Rawlsian rule. Egalitarianism is then a direct result of making this operational.) Both rules focus entirely upon the relative level of well being, without any concern about the exact sizes of welfare gains or losses.

The egalitarian rule requires that the welfare of different generations be equated with each other. This implies a subsistence argument, given an indefinitely large or infinite time horizon, finite life-supporting resources, and an atemporal viewpoint. That is, in order to spread a finite amount of resources across infinite generations, and maintain equity, all generations would be committed to living at a subsistence level. The fact that moving to such a subsistence level is precluded, because the future would then have lower welfare, means distributional transfers should maintain the level of welfare inherited. Any reduction of that welfare level must be countered by a corresponding increase.

Elitism only considers future generations in so far as the welfare of future generations features in the welfare functions of individuals (selfish altruism) or the future comprises the elite. Distributional transfers will only be made if this increases the welfare of the best off generation. Injuries caused to future generations will be uncompensated as long as the welfare of the elite is unaffected. More than this, changes which improve the welfare of the elite at the expense of others will be undertaken.

Neo-classical utilitarianism (maximising total utility) focuses upon gains and losses of personal welfare, without any concern about welfare levels; requiring any generation to sacrifice one unit of utility when another generation can, as a result, be provided with more than one unit of utility. Intergenerational redistributions are made according to the respective marginal utilities of consumption, where utility is dependent upon own consumption alone.²⁷ A utilitarian ethical system would require intergenerational welfare redistributions if future generations have a marginal utility greater than the current generation. (Determining the marginal utility of future generations poses a practical barrier to making this requirement operational. In addition to non-existence there are the problems raised by measuring cardinal utility and interpersonal comparisons.) Compensation for the effects of long term pollution will occur when the marginal utility of the current generations' loss, from the compensation payment, is less than the future generations' marginal utility gain.

Under a Paretian ethical rule the status quo is maintained; no redistribution of welfare is allowed unless at least one person is made better off and none worse off. The outcome of the rule will depend upon the definition of the starting point. Assuming the next generation can be at least as well off as the welfare level inherited, the Paretian rule requires transfers to maintain at least that level. Causing the welfare of the next generation to fall below that received from the previous generation would make the next generation worse off. Injury must then be fully compensated.

LIMITATIONS OF THE ETHICAL RULES

The attempts to vary the ethical basis of economics are somewhat limited from a philosophical viewpoint. Effectively the process of incorporation transforms all the rules into variations on a utilitarian theme. The Paretian ethic is a case of restricted utilitarianism, where total utility is maximised unless this makes somebody worse off.²⁸ Central facets of utilitarianism also exist in each of the other rules.

Utilitarianism has two main features, the principle of consequentialism and the utility principle.²⁹ Consequentialism regards the rightness or wrongness of an act as being determined by the results that flow from it. The utility principle holds some specific type of state (eg, pleasure, happiness, welfare) as the only thing that is intrinsically good. The egalitarian and elitist rules as above also have the consequentialist principle and the utility principle. The only change from neo-classical utilitarianism is the concern over the welfare levels of specific groups, as opposed to the welfare of all groups as if they were one.

This concern for welfare levels is not to be derided but is misleadingly represented as the incorporation of alternative ethical concepts. In fact, the two types of rule can be combined in one criterion. The use of welfare levels is but a variation on a neo-classical utilitarian theme.³⁰

The problem which economists are confronting seems to go beyond the utilitarian framework. That is, in an effort to incorporate new philosophical ideas a challenge is being mounted against utilitarianism, but is then retracted by being subsumed into the utilitarian framework. As is argued below, the confrontation is between a

deontological perspective and a teleological one.

Teleological ethical theories place the ultimate criterion of morality in some non-moral value (eg welfare) that results from acts. Such theories see only instrumental value in the acts but intrinsic value in the consequences of those acts. In contrast, deontological ethical theories attribute intrinsic value to features of the act themselves. For example, lying is wrong even when it produces better consequences than any of the alternatives.³¹

INVIOABLE RIGHTS VERSUS COMPENSATION

Under the ethical rules considered above the relative merits of social states depend uniquely on the personal welfare characteristics of the respective states; excluding considerations of rights. If two states generate the same personal welfare values for each person, under welfarism, they must be treated in exactly the same way.

Intergenerational efficiency as defined under these ethical rules allows for the violation of human rights.³² The idea of a right to remain unharmed by others can easily conflict with these rules.

As Sen has pointed out,³³ even if the future generation may be richer and may enjoy a higher welfare level, and even if its marginal utility from the consumption gain is accepted to be less than the marginal welfare loss of the present generation, this may still not be accepted to be decisive for rejecting intergenerational transfers when the alternative implies uncompensated long term effects of pollution. As far as the

Pareto Criterion is concerned the present generation might be well off and future generations starving and cancer-ridden due to the greenhouse effect and stratospheric ozone depletion, yet the future could only be made better off by making the present worse off.

The transfer of a set of "goods" may be unacceptable as an attempt to correct for loss or injury due to the violation of the rights of future generations. As Barry has stated, doing harm is in general not cancelled out by doing good.³⁴ Thus, a sea level rise due to the melting of the Antarctic ice sheet is in general not cancelled out by compensation. Conversely compensation does not licence society to pollute, provided the damages created are less than the amount of compensation. In which case compensation cannot be used as an excuse to continue actions causing long term environmental damages. The question is, given that they will exist, do future generations not just have rights but do they have inviolable rights?

The justification for rights of future generations is similar to that for rights of foreigners. For example, consider the export of toxic wastes, say from country A to country B. Country A wants to be rid of toxic wastes and therefore pays country B to accept them. The right of B's citizens to have an environment free of toxic wastes is bought and sold. Yet, should A act in this fashion? If A does not wish to have toxic wastes neither should they be imposed upon other countries. The rights of A's citizens to a toxic waste free environment cannot be bought by violating the same rights of B's citizens. The same argument extends to future citizens of B or future citizens of A.

Many economists would object to the above line of argument and to a ban on the international trade in toxic wastes because the contracting parties are entering into an agreement of their own free will. Yet, even if asymmetries of information between contracting parties and disparities in their relative wealth are absent, a ban can be justified by appealing to a different philosophy. Contrary to economic philosophy there are many cases of intrinsic human values, which societies protect from violation by contractual agreement. For example, the right not to be a slave, to freedom of speech, to freedom from torture, to sue another party. Freely contracting children are protected from working in coal mines despite the potential economic gains. The value of maintaining such inviolable rights is not reduced because there are those who would, and do, accept the loss of their rights given enough money.

The acceptance of an inviolable right of future generations to be free of intergenerational environmental damages would have serious policy implications. Compensation could no longer be used to justify environmental degradation in violation of such rights, although there would still be a role for compensation. Irreversible damages, which cannot be prevented by stopping pollutant emissions or other actions responsible for future damages, would require compensation. Uncertainty over the consequences of our actions and a persistent drive away from environmentally benign production and consumption processes would ensure a continued need for compensation.

However, all actions causing long term environmental damages would have to be stopped. The current generation would be obliged to identify all activities causing

long term damages and ban them regardless of the cost. Immediately this raises the problem of conflicting rights across generations. The continuation of activities creating long term damages denies the future the right to remain undamaged and asserts the dominance of the current generations rights. The current generation imposes damages regardless of the gain now and the extent of the future damages. For example, chlorofluorocarbon deodorant propellants have very close substitutes and could be banned at little cost. While this would prevent the depletion of the ozone layer such a ban has consistently been resisted. However, we can ask whether people have the right to an undegraded environment or component of welfare the environment provides? If the latter ozone depletion can be justified as long as cheap UV protection is provided.

COMPENSATION AND JUSTICE AS OPPORTUNITY

The discussion of intertemporal allocations has evolved over time from the idea of splitting a fixed, finite cake to one of productivity and opportunity maintenance. This moves the emphasis from a particular resource stock towards the welfare generated from a given economic and political system given available resources and technology. As Solow has stated: "The current generation does not especially owe to its successors a share of this or that particular resource. If it owes anything, it owes generalised productive capacity or, even more generally, access to a certain standard of living or level of consumption".³⁵

The problem posed by non-renewable resources is that future generations will have

fewer options, other things remaining the same. That is, for a given technology and capital stock output will be lower and environmental degradation higher. Barry suggests reduced access to easily extractable and conveniently located resources be "compensated" via improved technology and increased capital investment.³⁶

Compensation in this sense is the provision of basic transfers for, what economists view as, the maintenance of utility, and can alternatively be seen as productive opportunities.

The level of "compensation" being referred to in this literature is restricted to the maintenance of a basic opportunity set, and therefore is appropriately regarded as a basic transfer. However, there is no particular reason to limit compensation for damages to a specified rule being used to determine distributional transfers. The reference point for compensation is the level of damages caused to the individual. The reference point for distributional transfers is the welfare level, difference in welfare, or opportunity set of others, eg, the current generation compared to future generations.

Productive opportunity fails to clarify the two strands of moral argument being made here. First, that future generations have the right to a certain welfare or opportunity to obtain that welfare. Second, that actions which harm future generations require that compensation be made or activities be stopped. Reducing the stocks of non-renewable resources affects future generations in a different manner from the creation of long term environmental damages. The concern in the case of resource depletion is for the maintenance of basic transfers. The concern in the case of

environmental damages is for reparations for the violation of the right not to be harmed.

Compensation (defined as making amends for loss or injury) implicitly involves an asymmetry of loss and gain. Long term environmental damages entail an asymmetric distribution of loss and gain over time. Intergenerational compensation is the counterbalancing of negative transfers by positive transfers. This requires the use of transfer mechanisms, but all transfer need not be compensatory. For example, under an egalitarian ethical system the welfare level received from the previous generation should be maintained for the next generation. The current generation starts with a set of natural resources, environmental assets, capital, knowledge, and capabilities which can only be regarded as a means of compensation in so far as they can be used to increase, not merely maintain, welfare.

An example in the intratemporal context should help clarify the distinction being made here, and show the usefulness of the definitions. Assume there is an individual who receives government payments because he or she is unemployed and has no means of support. The government provides for him or her a minimal standard of living. Without the government payments the individual's welfare may be assumed to be much lower.

Assume that this individual lives next to a weapons factory run by the government. Unfortunately, there is a toxic waste dump on the site which has been leaking radioactive materials into the local environment. Following discovery of the leak,

there is a proven cause-effect relationship between the radioactive releases and the local high incidence of cancer cases. This individual has developed cancer since living in the area.

Can the government now say to this individual that he or she is so much better off already, due to the payments the government makes to provide a minimal standard of living, that they need not be compensated for the cancer? It should not take long to realise that the two payments cannot be morally linked. One is made on the grounds of equity, and the other on grounds of injury.

Yet, a common argument is that the current generation need not be concerned over the loss or injury caused to future generations because they will benefit from advances in technology, investments in capital, and direct bequests. These are the transfers society has deemed should be made to provide some minimal standard of living. Thus, on the discovery of the long term environmental impact of emissions of the greenhouse gases this generation cannot turn to the future and state that they have no obligation for intergenerational compensation because basic transfers were supplied.

POTENTIAL AND ACTUAL COMPENSATION

Modern welfare economics is based upon the principle of "potential compensation". That is, if the gainers from an action could compensate the losers the action is an improvement regardless of whether compensation is actually paid. If compensation is

actually paid the principle is nothing more than the Pareto Criterion.

Freeman has claimed that the Pareto Criterion is not widely accepted by economists as a guide to policy and plays no role in "mainstream" environmental economics.³⁷

He goes on to state that the basis of cost-benefit analysis is the hypothetical compensation criterion, which "... is justified on ethical grounds by observing that if the gains outweigh the losses, it would be possible for the gainers to compensate fully the losers with money payments and still themselves be better off with the policy". Thus, the justification for the results of cost-benefit analysis (according to this view) is that they are potential Pareto improvements, but Pareto improvements themselves are rejected!

The only use of the potential compensation criterion is, therefore, to deny the need for compensation. The ethical implications of such a recommended definition of efficiency are hardly acceptable.³⁸ Hypothetical compensation is consistent with making the poor yet poorer.

A persistent view, among adherents of the positivist program, has been that economists should avoid evaluation and prescription. Talbot Page points out that applied welfare economists have largely limited themselves to one normative idea, efficiency, which is often regarded as so universally appealing and analytically tractable that they scarcely think of it as normative at all.³⁹ Thus, the potential compensation criterion is useful in separating efficiency and equity, but has meant that discussions of actual compensation have been avoided on the grounds that equity

issues are outside of the economists realm. Page has argued persuasively against this view and for the consideration of equity and other normative concepts besides efficiency in applied welfare economics, especially where intergenerational issues are involved. Compensation is one of those other normative concepts and a different moral concern than just equity.

Yet, ethical systems could be devised which would justify no compensation. For example, under some of the ethical rules discussed earlier long term environmental damages and the associated need for compensation could be ignored. In order for no compensation to be made for actions causing long term environmental damages the current generation could be either: (i) elitist with welfare dependent upon current consumption alone, and the belief that future generations will be worse off; or (ii) utilitarian with the belief that the marginal utility of future generations will be lower for all levels of consumption.⁴⁰ Under these circumstances there will be no basic transfers either. Ethical systems requiring distributional transfers imply compensatory transfers will be made, when they are necessary.

Economics has failed to confront the ethical implications of discounting. As a result, intergenerational damages are accepted without much concern. Where long term damages are acknowledged and taken into account they are weighted to be less important than present benefits. If after weighting damages are still significant enough to warrant compensation, this concern can be dispelled by either the potential compensation criteria or the existence of basic transfers. Two fundamental steps forward would be to recognise the need for actual compensation and to start

considering the existence of the intrinsic rights of future generations.

I am indebted to Andrew Brennan, Ralph C d'Arge, Richard Howey, and anonymous reviewers for insightful comments, without implying responsibility for the resulting product.

- 1 The paper is not primarily concerned with the existence, size or composition of future generations. Implicit throughout the paper is the assumption that some stable population has been achieved, and will exist into the further future. The existence of an increasing population, which exacerbates the problems under discussion, can imply a moral argument in favour of population control. However, long term environmental damages can exist whether or not population is controlled, and are a function of the nature of our society not merely its scale. A world population of one billion can still choose to generate electricity with nuclear power, creating radioactive waste, or use chlorofluorocarbons as aerosol propellants, destroying the ozone layer.
- 2 Positive time preference means that individuals prefer benefits now rather than later.
- 3 John V Krutilla and Anthony C Fischer, "Further Analysis of Irreversibility: Discounting, Intergenerational Transfers, and Uncertainty", in The Economics of Natural Environments: Studies in the Valuation of Commodity and Amenity Resources, by John V Krutilla and Anthony C Fischer, Baltimore: Resources For The Future, Johns Hopkins Press, 1975, chapter 4, p.61.

- 4 Ibidem.
- 5 F P Ramsey, "A Mathematical Theory of Saving", Economic Journal, 38, no.152 (1928). A C Pigou, The Economics of Welfare. London: Macmillan, 1932.
- 6 David Simpson and James Walker, "Extending Cost-Benefit Analysis for Energy Investment Choices", Energy Policy, 15, 3 (June 1987): 221.
- 7 John Lemons, "Atmospheric Carbon Dioxide: Environmental Ethics and Environmental Facts", Environmental Ethics, 5, 1 (Spring 1983): 31.
- 8 This fourth category is not an unrealistic scenario. Consider for example the extreme sacrifices made by Russians after the revolution in order that their descendants might be better off.
- 9 Talbot Page, Conservation and Economic Efficiency, Baltimore: Resources For The Future, Johns Hopkins Press, 1977.
- 10 The first three can be found in Gregory Kavka, "The Futurity Problem", in Obligations to Future Generations, eds Richard I Sikora and Brian Barry, (Philadelphia: Temple University Press, 1978); Mary B Williams, "Discounting Versus Maximum Sustainable Yield", in Obligations to Future Generations, Sikora and Barry; Robin Attfield, The Ethics of Environmental Concern, (New

- York: Columbia University Press, 1983); and R Kerry Turner, "Wetland Conservation: Economics and Ethics", in Economics, Growth and Sustainable Environment, eds David Collard, David Pearce, and David Ulph (New York: St Martin's Press, 1988).
- 11 Discounting assumes no dividing line because benefits and costs are reduced toward an asymptotic limit. However, effectively the future becomes insignificant as future values tend to zero.
- 12 Nigel Dower, "Ethics and Environmental Futures", International Journal of Environmental Studies, 21 (1983): 29-44.
- 13 Derek Parfit, "Energy Policy and the Further Future: The Identity Problem" in Energy and the Future, eds Douglas Maclean and Peter G Brown, (Totowa, N J: Rowan and Allanheld, 1983). Also see, Bryan G Norton, "Environmental Ethics and the Rights of Future Generations", Environmental Ethics, 4 (1982): 319-337.
- 14 Annette Baier, "For the Sake of Future Generations", in Earthbound: New Introductory Essays in Environmental Ethics, edited by Tom Regan, Philadelphia: Temple University Press, 1984, 233.
- 15 The Sumerians, living more than five millennia ago, enjoyed poetry, music, elaborately decorated pottery, art, and cuneiform writing, as well as having the

same basic needs we have today.

- 16 David A J Richards, "Contractarian Theory, Intergenerational Justice, and Energy Policy", in Energy and the Future, eds Douglas Maclean and Peter G Brown, (Totowa, N J: Rowan and Allanheld, 1983), 141.
- 17 Such an argument has been made by Geoffrey Heal, "The Intertemporal Problem", in Natural Resource Economics: Policy Problems and Contemporary Analysis, ed D W Bromley, (Boston: Kluwer Nijhoff, 1986). The comment, by Ronald Cummings and Spencer Pearse, following that article is also directly relevant to the discussion here.
- 18 Nicholas Georgescu-Roegen, The Entropy Law and the Economic Process, (Cambridge, Mass: Harvard University Press, 1971).
- 19 See Ralph C d'Arge, "Essay on Economic Growth and Environmental Quality", The Swedish Journal of Economics, 73, 1 (March 1971); and Ralph C d'Arge and K C Kogiku, "Economic Growth and the Environment", Review of Economic Studies, 40 (1973): 61-78.
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- 27 An egalitarian argument can be made to follow from the utilitarian approach. This requires an appreciation of the law of diminishing marginal utility (additional income yields less than previous additions, though the total continues to rise), and assuming that all individuals are fundamentally alike in their preferences and capabilities for enjoying goods. In the strict form, the utilitarian argument for egalitarianism depends crucially upon the identity of

the utility of income across generations. At the opposite extreme, an elitist argument can be made, if the marginal utility of income of the rich generation is higher than that of the poor generation. On these points and their discussion in an intratemporal context, see A J Culyer, The Economics of Social Policy, (New York: Dunellen Company, 1973), 64-90.

- 28 The Pareto criterion is commonly applied in the intergenerational context as in the intragenerational context. That is, an initial endowment is allocated to each generation and then redistributions are allowed if they are Pareto improvements.
- 29 Louis P Pojman, Ethical Theory: Classical and Contemporary Readings, (Belmont, California: Wadsworth Inc, 1989).
- 30 See Amarya K Sen, "Approaches to the Choice of Discount Rates for Social Benefit-Cost Analysis", in Discounting for Time and Risk in Energy Policy, ed R C Lind (Baltimore: Resources For The Future, Johns Hopkins Press, 1982); and Talbot Page, "Intergenerational Justice as Opportunity", in Energy and the Future, eds Douglas Maclean and Peter G Brown, (Totowa, N J: Rowan and Allanheld, 1983).
- 31 Pojman, Ethical Theory, 663-665.

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- 33 Ibid, section 7, p.345.
- 34 Barry, "Intergenerational Justice in Energy Policy", 21.
- 35 Robert M Solow, "On the Intergenerational Allocation of Natural Resources", Scandinavian Journal of Economics, 88, 1 (1986): 142.
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- 38 Edward J Mishan, "Survey of Welfare Economics - 1939-1959", in Welfare Economics: Ten Introductory Essays, 2nd edition, New York: Random House, 1969, 46.

- 39 Talbot Page, "Intergenerational Equity and the Social Rate of Discount", in Environmental Resources and Applied Welfare Economics: Essays in Honour of John V Krutilla, edited by V Kerry Smith, Baltimore: Resources For The Future, Johns Hopkins Press, 1988, 71-89.
- 40 A third case in which the future is better off and egalitarianism rules is in fact implicit compensation because the level of loss is being balanced against the extent to which the future remains better off.

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