IS SUSTAINABILITY OPTIMAL? EXAMINING THE DIFFERENCES BETWEEN ECONOMISTS AND ENVIRONMENTALISTS

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May 1, 1995

Partial support for this research was provided by the Shared Research Seminar Program, Oakley Center for the Humanities and Social Sciences, Williams College.

Abstract

This paper examines a number of possible explanations for the apparent differences between economists and environmentalists concerning economic growth and sustainable development. Some of the differences are well-known, and relate to issues such as resource scarcity, intergenerational equity, and the composition of social capital. However, our analysis finds that while economic notions of optimal growth and the techniques of benefit-cost analysis have important advantages for evaluating complex tradeoffs because they are quantifiable, they may have potentially serious drawbacks as well. The paper focuses on two potential sources of bias in the use of welfare economics for social choice: First, there is a "conservative reinforcement" in benefit-cost analysis which is likely to produce biases against policy interventions to protect a degraded environment. Second, and perhaps more importantly, the aggregation of individual willingness to pay as a measure of social benefits is shown to be invalid in the case of "positional goods," where the demand for the good reflects the desire of individuals to raise their own relative standing. This error may cause the economic calculus to be biased against non-positional goods, including non-rival goods such as environmental resources. These biases further complicate the already strained assumptions in utilitarian-based welfare economics that, by relying on revealed preference and consumer sovereignty, are unable to distinguish between, or apply different weights, to the satisfaction of different categories of preferences. Furthermore, because the dynamic consequences of even small biases in judging social optimality may give rise to large social costs or advance an unsustainable path, there is a danger in relying solely on a potentially-biased measure of welfare as a basis for guiding social choice. The paper concludes by suggesting that efforts to correct these drawbacks of economic analysis are likely to result in approaches to sustainable development that narrow the apparent differences between economists and environmentalists.

Key words: sustainability, conservative reinforcement, relative standing, positional goods, benefit cost analysis

I. Introduction

Concern that unbridled economic growth will have adverse, severe, and irreversible effects on the environment and natural resource scarcity is not new, but the issues have recently been drawn together under the heading of "sustainability" or "sustainable development." Since 1987 when the Bruntland report (WCED, 1987) defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," sustainability has become a watchword for innumerable causes -- local and global, environmental and non environmental. The term, however, is fraught with ambiguity and uncertainty: it seems to have come to mean too many different things to different people and, given its vagueness, its usefulness for public policy appears to many observers to be dubious.

The advent of the term sustainable development may have clouded rather than clarified the often discordant perspectives of economists and environmentalists. Prior to its current usage, sustainability was most commonly used to refer to the sustainable yield of a specific biological resource such as a fishery. And the kinds of tradeoffs that are inevitable as an economy grows over the long-term have been acknowledged in the economics literature under the heading of "optimal growth" (Maler 1974, Solow 1974), although they have not received widespread attention. Yet recent debate between economists and environmentalists surrounding sustainability, suggests that to some extent these conflicts may reflect individual differences that reduce to the dilemmas of public choice: problems of reconciling individual preferences with social goals and the production or protection of public goods.

Differing tastes are unlikely, however, to explain away all of the differences in these strongly held positions. More subtle and complex issues surely underlie the contrasting views of economists and environmentalists. Hence, an inquiry into the sources of these differences is needed, if not in narrowing the gap between them, then perhaps in reducing misunderstandings and lost opportunities for policy.

This paper explores some of the differences between economists and environmentalists on resource and environmental issues. One explanation for the divergent views of economists and environmentalists might be that it is not the result of misperceptions of one or the other group, but rather due to an invocation of moral imperatives by (some) environmentalists. An alternative explanation for the often emphatic objections -- and perhaps not entirely unrelated to the first -- is a perception that the economic prescriptions for social choice are flawed and may produce outcomes that impose very large costs and irreversible losses on society.

In section II below, key differences between environmentalists' and economists' perspectives are characterized to provide a foundation from which to explore the sources of their divergent judgments. Given the conceptual difficulties in using the term "sustainable development," the analysis will take as a starting point the economic notion of "optimal growth." Optimal growth as a planning concept attempts to maximize some notion of intertemporal social well-being. Section III examines the second hypothesis above; to determine if there are ways (in addition to some of the better known qualifications of normative economics) in which economic methods of addressing optimal growth/sustainability questions may offer misleading advice; where economic analysis may introduce biases or ignore aspects of social values which would promote economic policy toward sub-optimal choices with potentially large social costs. Four aspects of economic analysis are examined, each pertinent to social choice and optimal growth relevant to the environment, in sections III through V. They are a) the "conservative reinforcement" problem in benefit cost analysis, b) how relative standing and the demand for "positional goods" complicates the measure of social welfare, c) the interaction of sovereign individual choices, markets, and social welfare, and d) the potential dynamic consequences of sub-optimal policy interventions. Section VII concludes.

II. The economic and environmental world views

Central among the issues that appear to separate economists and environmentalists are intergenerational equity, the composition of social capital, and imminence of global resource scarcity (Thoman and Crosson, 1991). Each of these is discussed briefly below.[1]

First, intergenerational equity is central to the notion of sustainability. Economists tend to accept the practice of "discounting" the value of future consumption opportunities using a social discount rate since the future can be made better off by making productive investments which compensate future generations for reductions in the availability of some other specific assets. Choosing the "correct" social discount rate and the extent to which it may differ from observed market interest rates is a complex issue, however. And there is an extensive literature which develops persuasive theoretical grounds for using a social rate of discount lower than the market interest rate (See Lind et al. 1982).

By contrast, some environmentalists (and in fact a few economists) regard the use of a positive discount rate for social choice misguided and unethical. They argue that the intergenerational obligations of the present cannot be adequately captured through discount rates and asset valuation as long as they are based on an aggregation of individual preferences of only the current generation. They would argue that a) as a criterion for intergenerational welfare this approach is dictatorial by giving absolute power over resource use to the current generation, and b) that the current generation has a larger obligation to protect entire ecological systems that safeguard the evolutionary and ecological processes which contribute to human betterment in complex ways that go beyond the use values that individuals place on specific resources (Thoman and Crosson, 1991).

Second, is the issue of social capital. Economists recognize that what one generation leaves for the next includes not only natural resources and physical capital (roads, factories, etc.), but human and institutional capital in the forms of knowledge, technology, and culture. One component of this "social capital" may rise while another may fall. Economists profess

impartiality regarding the composition of social capital, emphasizing the maximization of its total value rather than singling out any one component for special consideration. This allows flexibility in the tradeoffs between physical capital, human capital, economically useful knowledge, and natural capital (the natural resource base) as well. Future values and expected scarcities of any one asset should result in increased returns on investment to that component of social capital. Imperfect markets and uncertainty notwithstanding, this approach sees individual preferences and expectations as an appropriate guide toward optimal growth.[2]

Environmentalists, by contrast, often hold that special protection of environmental assets and ecosystems requires an approach that limits the fungibility between environmental resources and other components of social capital -- beyond that which is reflected in individual choice. They argue that special protection should dominate other individual interests. A concern that is especially strong for the possibility of very large or irreversible damages.

Third is the question of global resource scarcity. Impending catastrophe due to the total depletion of key environmental resources has been the source of contentious debate for centuries. From Thomas Malthus, to Stanley Jevons, to the Club of Rome, predictions of imminent ruin are legion, and so far have been wrong. Additional resources have been discovered or more often technological change has enabled substitution of other, less scarce, resources. While some argue that the human potential for that kind of ingenuity is limitless (see, for example, Simon 1981), the possibility that real resource limits are now more constraining than in the days of Malthus would seem impossible to disprove. And while some economists invoke the first and second laws of thermodynamics as proof of unavoidable limits to growth (Georgescu-Roegen, 1971), the relevance of these observations at the level of global entropy are unclear given our ignorance of the relevant time-scale, the fact that these conclusions would hold equally in a world without humans, and because the influx of solar radiation into the earth's system violates the theory's assumption of a closed thermodynamic system.

Nevertheless, the debate about resource scarcity has to some extent been misguided. The focus on empirical evidence of approaching resource scarcity has centered on physical natural resources for which markets work well to provide signals and incentives for exploration, substitution, and technological change (minerals, petroleum, food). By contrast, the future capacity of the earth's environment to assimilate the unavoidable waste products associated with economic activity has received less attention, is more difficult (or impossible) to measure and predict, and lacks the incentives that have led to avoiding other severe resource problems. In a painstaking theoretical inquiry, Charles Perrings (1987) has shown a) that the feedback effects of economic activity on the environmental resource base cannot always be anticipated, b) that the extent of the damages caused may be catastrophic and irreversible. and c) that the probability of such occurrences will rise with the scale of economic activity relative to the resource base.

By placing emphasis on the preservation of environmental assets, and by condemning discounting even as it reflects the opportunity cost of capital, environmentalists appear to propose an inflexible criterion with serious limitations. First, the rigidity of a "no tradeoff" approach to social policy seems too restrictive to be realistic or accepted, and the approach lacks an operational guide for specific choices. Moreover, it is unclear how this position would provide guidance in balancing the threat of environmental damage against, say, the urgency of reducing abject poverty and suffering in a developing country. And finally, this approach would seem to be even more dictatorial than the economists' perspective, imposing upon future generations a strict preference for some components of social capital at the expense of others.

In contrast, the economic approach relies on individual's revealed preferences (which may include concern for future generations) to provide a basis for valuation of environmental goods and services as well as for intertemporal allocations. There are non-tangibles associated with natural resources including the value, or premium, placed on the authenticity of ecosystems, the existence value of pristine natural environments, and the availability and human need for amenities

such as solitude (Mill, 1909) that warrant consideration. And in order to permit comparisons in a common metric, economists rely on monetary valuation of non-market goods and services, and assume reasonable weights can be elicited through techniques such as contingent valuation surveys.[3]

This brief sketch is intended to show that both perspectives appear to have limitations: the environmentalist position provides little guidance for social choice where the human costs of restricting resource use are non-trivial; and the economic approach may be naive in its confidence that the outcomes of individual choices in the current generation will, with some exceptions, be optimal in the very long-run given inherent uncertainties and the potential for large and irreversible losses. Nevertheless, one would expect these two, often opposing, viewpoints to agree in extreme cases where the cost to economic well-being of avoiding potentially catastrophic environmental consequences would be minimal. This does not, however, appear to be the case. For example a recent economic analysis of global climate change by a prominent economist warns that premature action to slow climate change, that would cost about 1 percent of GDP per year, would be too high a price to pay to avoid damages that, while uncertain, could prove to be catastrophic (Nordhaus, 1992). Instead, he concludes that the optimal policy is a very low tax on carbon -- the effect of which would be only to delay the expected path of damages from global warming by about nine years.

Operationally, economists tend to use a decision criterion for social choice of maximizing the value of social product -- including the discounted value of future benefits -- an approach with firm roots in utilitarian philosophy. For assessing an individual project or policy, this approach is applied in its most straightforward way in benefit-cost analysis, weighing benefits and costs of a decision or investment (including a representation of the value of assets or services that occur outside the market such as amenity value of natural environments, etc.).

Among the questions that are important to answer for assessing the strength of the economists' approach are, a) can one successfully measure (value) and incorporate non-market goods and services into the analysis in order to make correct social choices? and b) Is the model of individual behavior and social welfare itself adequate to be used as a social planning tool?

Many aspects of the first question have been explored elsewhere. For example, Vatn and Bromley (1994) question whether contingent valuation methods for valuing public goods are reliable (or necessary) when environmental goods embody complex and interrelated attributes that make valuation difficult due to problems of cognition, congruity, and composition. Moreover, there are limits to our ability to anticipate changes in the future marginal valuation of categories of goods and services with changing scarcities and rising income, etc., as well as reliance on market interest rates for guiding social investments and intergenerational equity (Howarth and Norgaard, 1992; Lind et al., 1982).

In the context of these difficulties, however, the focus here is to examine four aspects of the economist's construction of the economy for welfare analysis, and to assess them, especially with respect to the notion of sustainability and optimal growth where environmental considerations are important.

III. Conservative reinforcement

In a competitive economy each of an infinite number of property rights arrangements will give rise to a different Pareto-efficient allocation of resources, distribution of commodities, incomes and prices. More generally, for any set of institutions (including property rights), there exists a unique Pareto-optimal allocation of resources. Given the conditions for efficiency, prices themselves are a function of property rights. Indeed, prices that are efficient for a given property rights arrangement would be inefficient under a different property rights regime.

This endogeneity of prices and allocations biases the evaluation of alternative institutional arrangements on efficiency grounds in the following way. Assume that if the output produced under property rights arrangement A were valued according to the prices generated by that arrangement, it would be found to be efficient. And that under a second property rights arrangement B, the set of prices and allocations for that allocation was also found to be efficient. It follows that if one were to assess the allocation of resources corresponding to one property rights arrangement B, but using prices that exist under a different property rights system A, the value of the social product would be found to be lower than that for the existing allocation A (this would have to be the case if the allocation were efficient under allocation A, as originally assumed). That does not imply that allocation B is inefficient, merely that when it is valued using A's prices, the value of social product is lower than A's. Yet it is equally true that if the prices resulting from arrangement B were used, then B would be found to result in the highest value of social product. Thus, there is a downward bias in benefit cost analysis of institutional change because prices resulting from existing property rights will introduce a downward bias in net benefits of the alternatives. This bias, or "conservative reinforcement" (Randall, 1987), suggests a kind of "tyranny of the status quo." To put the point differently, allocations of resources resulting from different endowments or institutional arrangements are "Pareto incomparable" and therefore efficiency cannot be used to compare them.

This is highly relevant for the application of benefit-cost analysis to the environment. Environmental problems are often "emerging" ones that involve previously non-scarce resources or uncongested public goods where scarcity or congestion has resulted from the increased scale of economic activity relative to the resource base (such as the assimilative capacity of waste sinks including atmospheric ozone, greenhouse gases, and aquifer depletion, and large scale deforestation's effects on habitat and watersheds). In these typical uni-directional cases of externalities, the status quo institutions generally confer de facto rights to those who use a

resource as a waste sink rather than confering individual or collective rights to those who are damaged from the resulting external costs. Conservative reinforcement tells us that if we use benefit-cost analysis to compare alternative property rights arrangements or other policies, there will be a bias against any proposed change.

This general proposition is implicit in one of the principal critique of the Coase Theorem which points out that income effects that would occur when property rights are altered are ignored. Where polluters are not liable for the costs imposed on others, figure 1 illustrates how the standard theory concludes that the optimal level of pollution would be Q, the point where marginal benefits just equal marginal costs. But if property rights were reversed, and polluters were required to compensate those being affected by the pollution, then we expect the marginal cost and marginal benefits relations to differ as a result of the income being transferred from polluter to pollutee. The (negative) income effect for the polluter would be to lower his willingness to pay schedule (to mb') for the right to pollute; whereas the higher income of the pollutee, as a result of receiving payments from the polluter, would shift the marginal cost curve up (as income rises, the demand for all normal goods, including the demand for a clean environment, is expected to rise). Thus, the income transfers implicit in such a change of property rights would shift both the marginal benefit curve and the marginal cost curve to the left (to mec' and mb'). The result would be an optimal level of pollution Q', a lower level than that which had been judged optimal when the source of the externality had de facto property rights.

In addition to these income effects, a change in property rights can be expected to alter product and factor prices and resource allocations as well. For example, if, at the global level, producers and consumers of carbon-intensive goods were required to purchase the rights to emit carbon from others (those who produce and consume non-carbon emitting goods and services), then the prices of those carbon-intensive goods would be higher, the incomes of those who produce and consume carbon-intensive goods would be lower, and the resulting income, price and

allocation effects would give rise to a different composition and valuation of social product, one that would be more favorable to slowing global warming than would be the case when valuing the tradeoff under existing prices and allocations.

IV. Preference aggregation and relative standing

Given the impossibility of making explicit interpersonal comparisons of utility or satisfaction, economists tend to accept the assumption that preferences -- as revealed in markets or surveys -- be given equal weight. Economists often qualify this by recognizing a social concern with equity, and that all members of a society should have some minimum standard of living. But aside from that, the maximization of GDP (even if correctly measured) and the basis for benefit-cost analysis takes all dollars spent, and dollars "willing to be spent," as equal.

The lack of differentiation among different categories or kinds of wants and sources of satisfaction makes economists' methods extremely blunt instruments, and rendering more refined judgments about social choice impossible. Some economists have tried to address this constraint, albeit in a circuitous manner, by trying to articulate and understand a range of different sources of individual and social welfare such as comfort and stimulation, and human "capabilities" (e.g., Scitovsky, 1976; Sen, 1985). And yet, it is at this level of analysis that one is confronted by two fundamentally different approaches to human well-being; want satisfaction -- and the utility of different states of being -- or rights and freedoms. There are questions that have resulted in a large literature in philosophical writings (see Dasgupta, 1993, for a lucid summary). However, trying to resolve these philosophical questions is unlikely to be successful for the purposes here. Nevertheless, there is at least one dimension of individual and social well-being for which some qualifications to economic methods may be made without resorting to judgments about the relative legitimacy or weight to accord different kinds of human aspirations: the desire to raise one's own relative position, or standing, within society.

That individuals' relative position in society has an important bearing on one's sense of well-being is not new. For example, one source of evidence that relative position is vital to happiness comes from the "Easterlin Paradox," (Easterlin, 1964) the finding that people are more likely to judge themselves as being "happy" only if they have high *relative* income. Data from different countries, or for a single country at different points in time when average income has risen, shows that higher average income does not result in a larger segment of the population considering themselves to be happy. Only the relative income, or relative standing, of individuals within the same country at a given time produces a higher ratio of affirmative responses: those above the average income are more likely to say they are happy.

If relative standing is an important motivation for consumption behavior, then it would have implications for other economic phenomena as well. Indeed, Duesenberry's (1949) "relative income hypothesis" originated from the empirical observation that savings behavior can be better explained by relative rather than absolute income -- a phenomenon supported by savings data across countries and over time in a manner analogous to Easterlin's survey findings.

The human desire to raise one's own relative standing seems obvious enough. The desires for self-esteem and to be respected by others are incontrovertible motivations for how individuals choose their careers, how hard they work, whom they associate with, etc. Competition in athletics and education tends to be driven by relative rather than absolute measures of success. And consumer behavior would seem often to be motivated by the desire to demonstrate one's high relative standing -- through the "Jones' effect" or "conspicuous consumption" of positional goods. Indeed, there seems to be evidence that the pursuit of relative standing is pervasive (Frank, 1985). Moreover, there seems to be evidence that this competitive aspect of humans goes beyond household choices of consumer goods. For example, evidence suggests that relative standing is important in the motives and strategic behavior of firms to increase their market share,[4] or by

colleges and universities to enhance their national standing through capital campaigns to build endowments.

As noted above, many of the philosophical doubts about using the maximization of the value of social product as a guide for social policy are not easily resolvable. However, consumption in the pursuit of higher standing must be treated differently from the other categories of sources of satisfaction because standing within society is zero-sum and therefore the adding up of individual's willingness to pay for purely positional goods is invalid. This is not to suggest that the individual motivation to raise one's relative position is an illegitimate source of human well-being. As Hirsch (1976), Sen (1985), Frank (1985), and others have pointed out, having high relative standing is instrumental to the realization of numerous legitimate human aspirations.

This phenomenon, described as a demonstration effect, positional goods, or a consumption externality, has been evident in the economics literature for some time but its importance with respect to the environment has not been recognized. As Frank (1985) points out, such demonstration effects of consumption will vary depending on the nature of the good being consumed. We may buy more cars or bigger houses, in part, to enhance or maintain our relative standing in the community, but our decision to buy insurance, for example, is less likely to be influenced by standing since it is unobservable (it lacks the demonstration effect).

Indeed, for most environmental goods, relative standing is unlikely to be a motivating factor in individuals' willingness to pay for these public or nonrival and non-exclusive goods. This will be strictly true for (nearly) pure public goods such as the amenity value of the atmosphere, clean air, the diversity of species, the "existence value" of protecting endangered blue whales or Bengal tigers, etc.; and it will be approximately true for goods that are nonrival but potentially congestible such as a scenic countryside, wilderness area, or other recreation site. Obviously, goods that are nonrival cannot be positional goods since no one is excluded from their use so no one can demonstration positional status through ownership or exclusive association. Therefore,

the demand for many environmental goods and services, now and in the future, can be thought to be motivated by sources of satisfaction other than the pursuit of standing, except of course in those cases where "environmental assets" can be privatized such as waterfront property or a mountain ranch, or the use value of some biological resources.

In this case, the problem of measuring the value of social product is one of aggregation: if consumption of a positional good raises one person's relative position, which results in net benefit β to that individual, it does not follow that providing the same good to n individuals will produce a net social benefit of $n*\beta$. Each individual's consumption of the good has a deleterious effect -- a consumption externality -- on other individuals and lowers the "positional" value of the good for them. Indeed, if the benefit of the good is entirely positional, then the net social gain in the case where all individuals receive the good would be zero: If we only buy luxury cars as a way of demonstrating our position in the neighborhood, then there is no social benefit to everyone in the neighborhood having a luxury car.

The magnitude of these effects -- and the potential bias in economic analysis -- is potentially quite large. The simple analytics of the welfare value from the production and consumption of a goods market is shown in figure 2. If the gross benefit is represented by area A+B, and the gross cost is B, then the net benefit or economic surplus equals A. If, however, this is a market for a purely positional good, then each individual's benefits from consumption will be offset by the reduction in net benefit received by others (because the value of the good in demonstrating high relative standing has diminished), and the gross benefit is zero. It follows then that the net social benefit (gross benefit minus gross cost) is -B, or a net loss. Thus, for a purely positional good conventional welfare economics would mistakenly assign a positive social benefit equal to area A to the production and consumption of this good, whereas the social value is negative and large (-B may be large in absolute value relative to A): not only are the individual

gains from consuming a positional good canceled out as others consume the same good, but there is an opportunity cost for the resources required to produce the good.

There may exist few examples of "purely positional goods." Most goods one thinks of in this vein combine direct or non-positional consumption benefits with attributes of the good that make it positional (e.g. luxury cars and homes, latest-model clothing). Nevertheless, this does not weaken the argument being made above. To the extent that the positional attributes of the goods involve extra costs, they can be regarded as composite goods where the positional and non-positional utilities are complements, and the analysis above of a purely positional good can be thought to apply to that constituent of a good which is positional.

The underpinnings of benefit-cost analysis assume that the aggregation of individual willingness to pay serves as an aggregate measure of social value. But if there is an asymmetry between the benefits and costs, in terms of the influence of positional goods, then a benefit-cost analysis may be seriously flawed. Where the environment is concerned the bias may be substantial because environmental goods are primarily non-positional. In judging projects or social decisions with environmental consequences, therefore, we are likely to be weighing losses of individual benefits (including positional goods) against environmental assets which are public or non-rival such as wilderness, air quality, species diversity, and atmospheric ozone which are non-positional goods. To use benefit-cost analysis to trade off positional goods against non-rival goods would be analogous to the following analysis:

> A crowd of 110 people want to view a performance on a low stage which makes it difficult to see. Each person in the crowd (except the ten in the very front) would be willing to pay $10 for a stool on which to stand so that they could view the performance better. Stools cost $5 to build, so the net benefit to each person would be $5 ($10-$5). The total net benefit for all 100 persons would be $500 ($1,000-$500). Alternatively, the authorities are considering building a

higher stage, something that would produce the same benefits for each individual, hence they would each be willing to pay $10, or a total of $1,000. But a higher stage would cost $600 to build, and therefore the net benefit ($1,000 - $600 = 400) is lower than the $500 for building the stools for each person individually. Benefit-cost analysis would draw the conclusion that building 500 stools is the preferred solution to the problem.

Of course, once everybody has a stool, nobody can see any better (although I guess those in the second row can). But given that it was not recognized that this was a comparison of two options, one that involved a willingness to pay in terms of raising one's own relative standing (literally), and one that did not involve "positional goods," the wrong outcome was chosen, one that in the end benefited almost nobody. The true net social benefit of the stool program (if we concede that the ten people in the second row will actually benefit) is $100 - $500 = -$400.

Clearly in this case an astute analyst would recognize the "consumption externality" (the blocked views) created when some members of the audience receives a stool, and the obvious error in the calculations would be avoided. However, in a complex world where the causes and consequences of individual actions are separated in time and space, the fallacy of aggregation will not be obvious. If conspicuous consumption of a wide range of goods, as well as the desire to have the newest, latest model consumer durables, is driven by relative standing then this will have repercussions in terms of the rates of natural resource extraction, environmental damage, and waste disposal associated with their production. For example, if the motivation for owning large luxury cars, or building large houses made of exotic woods, or wearing ivory jewelry is primarily as a demonstration of status, then economists' assessments of what would be given up (foregone

economic surplus) in order to reduce the air pollution, or to protect rain forests, or to protect endangered elephants will be exaggerated.

The impact on production and consumption of positional goods in the economy will likely create pervasive biases that are inconspicuous, but no less distorting, by creating a wedge between private and social optima in other markets. For example, their influence on capital markets could distort all savings and investments as follows: Demand for positional goods encourages dissavings at low relative levels of income as Duesenberry observed. Stated alternatively, in the absence of positional goods, the supply of savings would shift to the right relative to the schedule which included positional goods as illustrated by a shift of the savings function to S' in figure 3. Similarly, the demand for investable funds will include the demand for investing in the capacity to produce positional goods. This will imply a higher demand for funds than that which would occur in the absence of positional goods. In the absent positional goods, the demand for investable funds (the marginal efficiency of investment function) would shift to the left to reflect the demand for 'non-positional" investments as illustrated in figure 3.

The net effect of this is unambiguous. In the presence of positional goods, the market interest rate will be higher than it would be in the absence of positional goods (r versus r' in figure 3). Therefore as a basis for choosing a social discount rate, the influence of positional goods on the interest rate should be removed, and the social rate would be lower than the observed market rate: since the individual benefits from consuming positional goods cannot be aggregated as a measure of social welfare, it also follows that their influence on the market interest rate should be removed in order to apply an appropriate social discount rate to cost-benefit calculations. The dynamic implications for capital are analogous to the static ones. By influencing the discount rate, the bias created by positional goods will give rise to below optimal investments in non-positional goods, above optimal investments in positional goods, and the high private interest rate will alter

intertemporal investments toward excessive current consumption. Thus the level and composition of social capital left for future generations will be misguided.

V. Consumer sovereignty and social welfare

The aggregation problem associated with positional goods poses a clear bias in conventional welfare measures. But, as mentioned above, there are other limitations to applying the very blunt instrument of revealed preference to social choice questions. Ideally, one would like to overcome the limitations created by accepting consumer choices as sovereign. But to transcend the acceptance of all individual preferences as being given and having equal weight would require some generally accepted prioritization or weighting of the social value resulting from different sources of human satisfaction: comfort (subsistence, absence of pain), stimulation (novelty, challenge, absence of boredom), sense of self-worth, etc.. Even more difficult is reconciling the utilitarian basis in economics with other relevant concepts in moral philosophy such as rights, freedoms, and responsibilities (see Hausman and McPherson, 1993).

One approach to these problems has been to consider the "standard of living" as a more subtle and complex notion involving how individual "capabilities" and "functionings" are more germane to well-being than simply income (Sen, 1985). Clearly this leads to some kinds of distinctions or weightings being made for satisfaction of different kinds of wants or needs. For example, both Sen's writing on hunger and famines and the widespread support for, and use of, food stamp programs would seem to reflect a recognition that access to a minimum level of food is not something that society is willing to leave to the vagaries of the market place. In this instance, the edict of considering consumer choice to be sovereign has been qualified by a social commitment to assure a minimum level of nourishment. Thus, the notion that "willingness to pay" is an adequate comparator between the well-being of the malnourished and the well-fed is rejected. Other examples revealed by observed social choice include policies for health care and

education where social policy suggests implicitly that certain wants not be left to the marketplace to sort out -- rejecting the principles of maximizing economic surplus. These phenomenon may be seen as according rights where certain rights or obligations of society take precedence over efficiency. Or more precisely, that a socially preferred efficient allocation is one that acknowledges these rights and obligations. Clearly, rights and obligations toward the environment are viewed by many environmentalists in this same way.

Economists' efficiency analysis for intertemporal allocations does not discriminate between alternative efficient outcomes, and therefore is not sufficient to ensure a socially desirable intergenerational outcome. The line between efficiency and equity in the static sense also holds across generations (Howarth and Norgaard, 1990). By redistributing rights across generations, or attaching weight to the welfare of future generations (in the same way that social welfare policy effectively attaches weight to the welfare of lower income groups), the composition of social capital, and the prospects of sustainable levels of consumption, are affected. For example, Howarth and Norgaard (1992) have shown that when resource allocation includes "caring" for future generations, the interest rate, the valuation of environmental non-market goods and services, and the prospects of sustainability, are all affected.

Yet economists regard as "externalities" any cost imposed on an individual that arises from actions or transactions to which he or she is not a party (secondhand smoke, downstream pollution). Exempt, however, are pecuniary externalities where the actions of one or more parties affect market equilibria and thereby alter the prices facing all participants in the market. This is regarded as just a question of a market finding its equilibrium under new conditions which, in a competitive market, will assure efficiency and maximize net benefits.

Yet pecuniary externalities are not innocuous unless we accept consumer sovereignty and draw no distinction between how society values different wants differently. To the extent that the social value of among preferences differs, or that the demand for positional goods create

consumption externalities dissipate their aggregate social value, then pecuniary externalities cannot be ignored in welfare analysis. Yet the desire to formulate economics into solvable mathematical optimization problems has resulted in placing a high premium on simplicity, in order to make other sources of mathematical complexity tractable. As a result, these kinds of qualifications, ones that would make such analysis prohibitively complex, tend to be avoided in economics despite the consequent loss of realism. Thus, while some economics texts acknowledge the possibility of these kinds of interdependent welfare functions, they typically conclude only that it is unworkable mathematically and the theories are not pursued further (see for example, Deaton and Muellbauer, 1980, pp. 223, 238).

VI. Dynamics and social paths

If the magnitude of these biases were thought to be small, then one might argue that lacking an obvious alternative method that is superior, use of the current economic approach is justified. That conclusion would not follow, however, if small biases in static models could potentially lead to large social costs over time. The conventional economic approach that assumes technology, preferences, and institutions to be fixed or exogenously determined, may ignore the effect of important processes. For example, the induced innovation literature argues on theoretical and empirical grounds that the rate and direction of technological change is influenced by relative prices. Evidence of these processes has been documented with regard to agricultural technology in the US and Japanese earlier this century favoring labor-augmenting and land-augmenting technologies, respectively (Binswanger and Ruttan, 1978).

To the extent that technology is endogenous and responsive to price signals, the economic cost estimates of internalizing external diseconomies such as pollution will be overstated. If instruments such as Pigouvian taxes induce lower cost substitution or abatement technologies, then assuming exogenous technology will overstate the costs of corrective action. Neither the

rate nor precise direction of technological change can be predicted. However, if fossil fuel taxes induce innovation toward cheaper clean fuel substitutes for carbon energy, this dynamic effect could presumably lower or even eliminate the original costs of the policy.

In other areas, recent developments in the economics literature on increasing returns and technological change have pointed out that dynamic systems of the self-reinforcing type with positive feedback can lead to a multiplicity of asymptotic states. Initial conditions can combine with early random events, fluctuations, or signals to push the dynamics into a domain of one of these asymptotic states and thus become "locked into" that particular state (Arthur, 1988). If one technology is inherently "better" than the other, but has the bad luck of not gaining early adherents, then the outcome may be the "lock-in" of the inferior technology.

The path dependent dynamics for environmental market failures have received only scant attention in the economics literature. Little attention is given to the possibility that small static inefficiencies resulting from externalities or underpricing of resources could help to push technological change down an inferior path from which "switching" to the optimal path becomes impossible (an exception is Kahn, 1966). If these competing technologies differ in terms of their resource intensity or waste generation, then the lock-in of an inferior technology may have welfare consequences that become both large and irreversibly entrenched as the costs of switching to an alternative technology become prohibitive.

Equally important is the dynamic nature of preferences. By convention, demand is assumed to rise due to such things as population increases, but wants and preferences (the "technology" of consumption) have generally been assumed by economists to be fixed explicitly (Stigler and Becker, 1977) or implicitly in their models and analysis. Although holding preferences fixed is useful as a simplifying assumption for many economic applications, appreciation of the ways in which preferences are shaped by experience and institutions is not new. For example, John Stuart Mill (1909) stressed the malleability of the human character in

response to education and social institutions, something that led him away from the utilitarian (and economic) practice of assessing policies in terms of their usefulness in satisfying existing wants (McPherson, 1983). Indeed, as Frank Knight (1935) saw it, human wants are something to be discovered, in a process of searching and learning that takes a lifetime.

Despite a lapse of several decades during which economics has become highly mathematical and focused on solvable optimization problems, there appears to be some renewed interest in the endogeneity of wants and preferences. Even Becker has recently written that,

> ... the past casts a long shadow on the present through its influence on the formation of present preferences and choices.... [having] profound implications for the analysis of many kinds of economic and social phenomena. (Becker 1992)

Given endogenous preferences, the practice of economic valuation of benefits and costs over long periods of time while holding preferences fixed is clearly excessively inflexible and will exaggerate the costs of policy changes by ignoring the dynamic adjustment of preferences to changing prices and availabilities. Economists assume that demand is more elastic in the long-run run than in the short-run because fixed costs become variable. It is only a logical extension of this insight to see habits and preferences as variable in the long run, and to understand that over longer periods of time preferences respond to different relative prices in an analogous way to production technology as the "fixed" factors of habits, information, and learning-by-doing become variable in the long-term much as technology becomes endogenous in production as a result of investments in research and learning by doing.

With both production and consumption "technologies" being continually shaped by prices and scarcities, the progress for both will be path dependent and may result in irreversible selection of mutually-exclusive paths. In addition, the dynamics of technology and preferences interact with the institutions that facilitate and organize economic and social interactions. Indeed, with

endogenous institutional change, the efficiency criterion that is such a central concept in economics loses all meaning and, given the conservative bias discussed above, the welfare cost of any program to alter institutions will be biased against such change. These institutions, including laws and property rights, formal and informal organizations, and codes of individual and collective behavior reflected in culture, influence, and are influenced by, changes in the economic structures, environment, technology and wants; a complex intertwining of knowledge, values, social organizations, technology, and resource systems that act and react to each other in a dynamic that Norgaard (1994) calls "co-evolutionary." Taken further, the admission that values are endogenous has lead to the conclusion that the challenge in environmental decision making is not to measure revealed preferences for non-market goods and services provided by the environment, but rather that the "challenge is one of specifying the conditions for discourse over what is worth valuing by individuals -- and why that is so"(Vatn and Bromley 1994, p. 139). The notion that many dynamic phenomena are less prone to analysis in welfare economics is not new (Bator, 1957, p. 56). Indeed, Frank Knight (1935) long ago understood these limitation and concluded that, as a basis for addressing social problems, welfare economics must ultimately dissolve into a study of aesthetics and morals.

VII. Summary and conclusions

Making tradeoffs in the face of uncertainty, resource scarcity, and irreversibility presents daunting problems for public decisions. Economists rely on utilitarian-based a criterion of maximizing economic surplus as a guide for these decisions which, taken at face value, has the compelling advantage of offering a concrete basis for reconciling conflicting individual values and dealing with inherently difficult decisions. Yet by relying on individual preferences the approach may be biased, perhaps severely, on many issues involving the environment and provision of other public goods.

Two potential sources of bias have been scrutinized above, conservative reinforcement and the demand for positional good. Each may bias economic methods of evaluating social choices against environmental protection. These could give rise to situations where measured increases in well-being may actually disguise a decline in social welfare. And production and consumption of positional goods may create an intertemporal misallocation through their effects on savings and investment that will drive an invisible wedge between the market interest rate and the correct social discount rate. This could result in the composition of social capital being biased toward positional goods at the expense of the environmental resource base, and leaving future generations worse off, with technologies, preferences, and institutions that are sub-optimal. While the magnitude of these potential biases is unresolved, even small discrepancies in valuing social welfare in static analysis may inflict large costs on society if they are reinforced over time by dynamic processes.

In addition to these potential biases, the roles of uncertainty and irreversibility are paramount considerations for the environment. Since the feedback effects of economic activity on the environmental resource base cannot always be anticipated, and the magnitude and probability of these occurrences are likely to rise over time, there is a case for a social choice strategy that reduces risks. However, given that the probability distributions associated with many potential feedback effects of economic activity are unknown, applying a dynamic optimization model by simply assuming a high degree of risk aversion is not possible operationally. But neither is (at least for now) making adjustments for the difficult-to-measure biases introduced by positional goods and conservative reinforcement.

Despite strong evidence of serious problems, our analysis does not, at least at this point in the inquiry, offer a clear alternative that is superior. Despite its limitations, the economic approach has many strengths, and it remains the case that environmentalists lack a generally

accepted alternative method that can be applied for systematically evaluating tradeoffs in a world of diverse and often conflicting needs and wants.

The findings do suggest, however, that the application of standard welfare economics needs modification to better judge policies that, directly or indirectly, affect environmental and other public goods. Some means of approximating the magnitude of the biases indicated above will be needed. Furthermore, given the enormous uncertainty in many environmental areas, some composite set of policy criteria, for example including a safety-first decision rule or a "safe-minimum-standard" would seem appropriate.

The implications of this analysis may go full circle, however. Guiding policy based on the economic notion of optimal growth is operationally unworkable because its application depends on quantifying inherently unquantifiable risks, and on making adjustments for the as-yet incalculable biases described above. Efforts to correct these drawbacks of economic analysis are likely to result in approaches to sustainable development that narrow the apparent differences between economists and environmentalists. And the search for some modified set of decision rules or composite approach may ultimately result in something that bears resemblance to the kind of strong sustainability constraint being advocated in various forms.

Acknowledgments

The comments and suggestions of Henry Bruton and Michael McPherson are gratefully acknowledged.

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Endnotes

[1] Here I mean to include not just extreme or activist environmentalists, but the broader public views concerning the environment. For example, polls have indicated that a large majority of the public in the U.S consider themselves to be environmentalists.

[2] Of course, where markets fail to allocate resources efficiently (externalities such as air pollution or open access resources such as ocean fisheries), government correction of these market failures may be justified.

[3] Some recent contributions to the debate of contingent valuation surveys include Kahneman and Knetch (1992), Vatn and Bromley (1994), and Hanemann (1994).

[4] Evidence in the economics literature suggests that, in contrast to the assumption of profit maximization normally made, firms often seek to maximize revenue and increase their market share (and enhance their relative standing) even at the expense of profits (Baumol, 1959; Marris, 1964).