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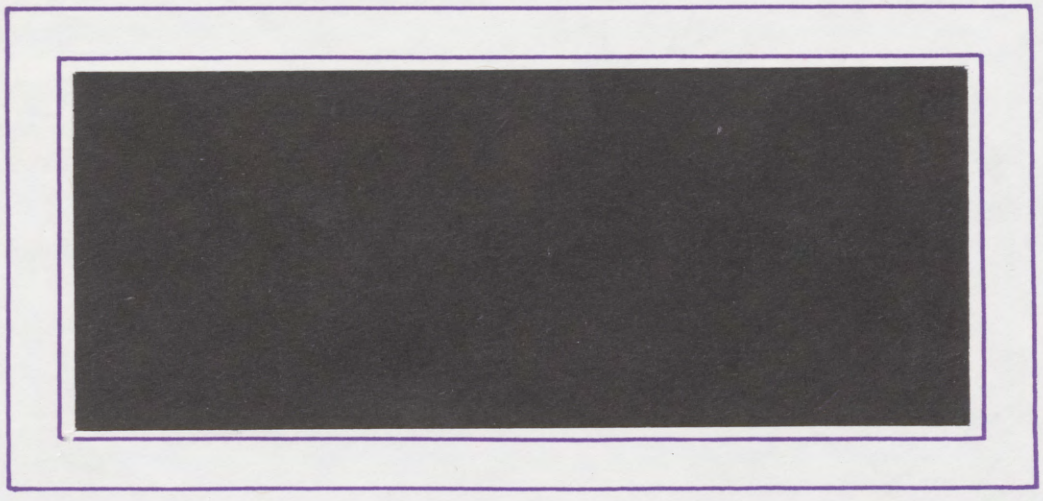

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IS SUSTAINABILITY OPTIMAL?: EXAMINING THE DIFFERENCES BETWEEN ECONOMISTS AND ENVIRONMENTALISTS

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William K. Jaeger

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Research Paper No. 168
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Abstract

This paper examines the differences between economists and environmentalists on issues such as resource scarcity, intergenerational equity, and the composition of social capital. While economic notions of optimal growth and the techniques of benefit-cost analysis are seen to have advantages for evaluating complex tradeoffs due to their concreteness, they have potentially serious limitations as well. The analysis identifies two sources of potential bias in the use of welfare economics for social choice: First, there is a "conservative reinforcement" implicit in benefit-cost analysis methods which will bias estimates of optimality. Second, and perhaps more importantly, the aggregation of individual willingness to pay as a measure of social welfare is shown to be invalid in the case of "positional goods," where the demand for the goods reflects the desire of individuals to raise their own relative standing. This error will cause the economic calculus to be biased against non-positional goods, including non-rival goods such as the environment. Because the dynamic consequences of even small biases in judging optimality may give rise to large social costs, the use of economic measures of welfare for social choice and environmental policy needs corrective modification. The paper concludes that such modification would likely narrow the apparent differences between economists and environmentalists.

Introduction

Concern that the pursuit of 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." The term "sustainable development" originated with the 1987 report by the World Commission on Environment and Development (the Brundtland Report), which defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Since that report, sustainability has become a watchword for innumerable causes -- local and global, environmental and non environmental. The meaning of the term is fraught, however, with ambiguity and uncertainty. Indeed, it has been questioned whether the benefits from the introduction of the term "sustainable development" in raising awareness of important social issues outweigh the confusion and contradictions created by its vagueness. In any case, 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 to be dubious.

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. In addition, the kinds of tradeoffs that are inevitable as an economy grows have been addressed in the economics literature under the heading of "optimal growth" (Maler 1974, Solow 1974), although they have not received widespread attention. Nevertheless, the introduction of the notion of sustainability may have clouded rather than clarified the often discordant perspectives of economists and environmentalists. These differences may, to some degree, reflect contrasting individual priorities that reduce to a problem of reconciling individual preferences with social choice for the production of public goods: what weighting system should society use in public choice? However, differing tastes are unlikely 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 could prove useful, if not in narrowing the gap between them, then perhaps in reducing misunderstandings and lost opportunities for policy.

This paper will examine and try to explain the major differences between economists and environmentalists on resource and environmental issues. 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. In contrast, an attempt to ensure sustainability implies for many environmentalists strict limits on current and future use of natural resources to maintain stock levels inherited from the past (i.e. no net reduction in the environmental resource base). However, the difference between optimal growth and sustainability need not be significant if social well-being implies, at least for some resources, a very high premium on retaining the existing stocks of natural capital.

Some key differences between environmentalists' and economists' perspectives are characterized below to provide the foundation for an attempt to at least partly explain or reconcile their divergent judgments. Most of the paper, however, examines several tenets of standard welfare economics and the potential ramifications of relaxing some of their underlying assumptions. My observations on the limitations of the environmentalists' approach are intentionally cursory, not as a slight of this side of the argument, but because that group is less monolithic in its aims and motivation and because my primary focus is on the underpinnings of economic analysis.

The economic and environmental world view

Several key issues can be used to frame the principal differences between economists' and environmentalists' perspectives.[1] These issues include intergenerational equity, the

[1] Here I mean to include not just activist or extreme environmentalists, but the broader

composition of social capital, and imminence of global resource scarcity (Thoman and Crosson). Each of these is discussed briefly below.

Intergenerational equity. Intergenerational equity is a critical issue for economists and environmentalists -- and is central to notions of sustainability. Economists tend to accept the practice of "discounting" the value of future consumption opportunities by use of a social discount rate with the rationale that, given the productivity of capital (return on investments), the future can be made better off by investments than by deferred consumption. Productive investments will make future generations better off and thereby compensate them for reductions in the availability of some other specific assets. The issue of the correct social discount rate and the extent to which it may differ from market interest rates is complex. There is an extensive literature, however, which develops persuasive theoretical grounds for using a social discount rate that is lower than the market interest rate (See Lind et al).

Some environmentalists (and in fact a few economists) regard the use of a positive discount rate for social choice as inappropriate and misguided. 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).

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

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public views concerning the environment. Polls have indicated that a large majority of the public in the U.S consider themselves to be environmentalists.

institutional capital in the form 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. The concern is especially strong for the possibility of very large or irreversible damages.

Global resource scarcity. Impending catastrophe due to the total depletion of key environmental resources has been the source of contentious debate for centuries. From Malthus, to Jevons, to Ehrlich, 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 (Simon), the possibility that real resource limits are now more constraining than in the days of Malthus would seem impossible to disprove. Several economists, in fact, have pointed out that there are indeed unambiguous limits to growth, limits that are unavoidable results of the first and second laws of thermodynamics (Georgescu-Roegen, Daly). However, the importance of this conclusion is

[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.

unclear, given our ignorance of the relevant time-scale, and by the fact that these conclusions would hold equally in a world without humans.

The debate about resource scarcity has to some extent been misguided, however. 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). 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. Indeed, in a rigorous theoretical analysis Charles Perrings, concludes 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.

In addition to these concerns, there are other 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 solitude (J. S. Mill).

Guidance for social choice. 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. But beyond that, 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 preferences (which may include concern for the future generations) to provide a basis for interperiod tradeoffs.

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 policy options to abate global warming by a well-known economist warns that premature action that would cost about 1 percent of GDP per year would be too high a price to pay for an aggressive policy to slow global warming significantly to avoid damages that, while uncertain, could prove to be catastrophic (Nordhaus). 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.

Fundamentals of the economic approach

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.).

At the macro level economists recognize that GDP is an unsatisfactory measure of a nation's economic productivity. Nevertheless, *were* GDP an adequate measure of the net benefit associated with all activities which generate well-being, then the criterion of maximum value of social product would be consistent with maximizing growth in GDP.[3]

Among the questions that are important to answer for assessing the strength of the economists' approach are a) can one successfully measure 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?

There are many aspects to the first question: the adequacy of methods for valuing public goods, our ability to value and anticipate changes in the future marginal valuation of categories of goods and services with changing scarcities and rising income, etc. However, the focus here is to examine several assumptions of the economist's construction of the economy for welfare analysis, and to assess their validity and usefulness, especially with respect to the notion of sustainability and optimal growth where environmental considerations are important. This may be viewed as an attempt to understand the very strong objections of environmentalists to market outcomes and economists' prescriptions. One explanation for this divergence 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.

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[3] Despite recognition of its limitations (e.g. clean up from an oil spill contributes to GDP, as does medical costs of pollution-induced cancer), GDP is often used by economists as a decision criterion. Recently, there is a growing body of literature arguing for a reformulation of Net National Product (NNP) to reflect the depreciation of natural capital (Dasgupta and Maler).

Either hypothesis could provide some explanation for the often strong and negative views of environmentalists regarding economic approaches to the environment. What follows below is an attempt to examine the second hypothesis: to determine if there are ways in which economic methods of addressing optimal growth/sustainability questions 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. I explore below four aspects of economic analysis that may have implications for social policy and optimal growth relevant to the environment: 1) the "conservative reinforcement" problem in benefit cost analysis, 2) how relative standing and the demand for "positional goods" complicates the measure of social welfare, 3) the interaction of sovereign individual choices, markets and social welfare, and 4) the potential dynamic consequences of sub-optimal policy interventions.

Conservative reinforcement

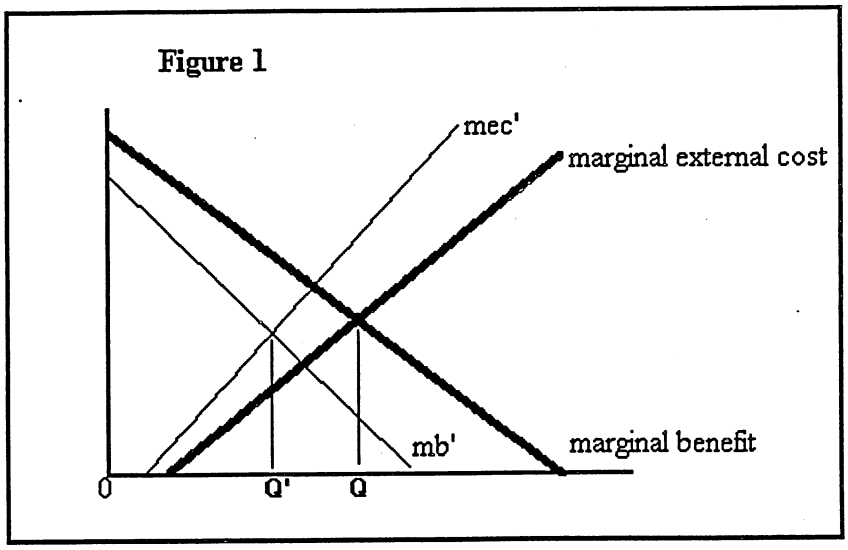
In a competitive economy, each of an infinite number of property rights arrangements will give rise to a different Pareto-efficient allocation of resources, distribution of commodities, incomes and prices. More generally, for any set of institutions (including property rights), there exists a unique Pareto-optimal allocation of resources. 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 complicates the evaluation of alternative institutional arrangements in the following way. 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. It follows that when an allocation of resources corresponding to one property rights arrangement A is evaluated using prices that result from a *different* property rights system B, there will be a downward bias in the valuation of social product for B's

allocation. As a result, benefit-cost analysis that attempts to value the outcome of a potential change in property rights will, in valuing the social product based on prices resulting from existing property rights, introduce a downward bias in the value of the alternative specification. This kind of bias has been called "conservative reinforcement," because it tends to reinforce a preference for the existing situation (Randall).

For benefit-cost analyses involving environmental resources, the problems being addressed are often "emerging" ones that involve previously non-scarce resources where scarcity has resulted (or assimilative capacity has been exceeded in the case of waste sinks) from the increased scale of economic activity relative to the resource base (e.g. atmospheric ozone and aquifer depletion). In these uni-directional cases, the status quo arrangement will generally be *de facto* rights to those whose use of a resource produces an externality affecting others, rather than an institutional arrangement that confers individual or collective rights to those being damaged. These *de facto* property rights gives rise to an allocation of resources and prices which, relative to the existing value of social product, will bias downward the value of social product that would result from any alternative property rights regime. As a result, the evaluation of alternative institutional arrangements aimed at internalizing external costs will include a bias against the change.

This general proposition is implicit in a principal critique of the Coase Theorem about income effects when property rights are altered. 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 polluters were liable, and required to compensate those being affected by the pollution in some way, then 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 income effects, a change in property rights can be expected to alter product and factor prices and resource allocations as well. For example, if 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.

Furthermore, virtually all environmental externalities involve uncertainty about the magnitude and timing of potential external effects arising from resource utilization. In many

cases the potential magnitude of costs are very high and the eventual damages may be irreversible (as in the cases of species extinction and global warming). In these situations, a risk premium or option value is recognized by economists as a necessary addition to the expected value of the resource that may be damaged. Here too, however, the magnitude of the premium or option value will be affected by property rights (or liability) for the damages that may occur. Where the potential damages are great and property rights favor the polluter, the magnitude of the option value will also be biased downward.

Relative standing and the social benefits of economic growth

Most economists tend to accept unquestioningly the assertion that preferences -- as revealed in markets or by notions of "willingness to pay" -- should have equal weight given the impossibility of making interpersonal comparisons of utility. 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.

While it is certainly impossible to go very far in making objective interpersonal comparisons of utility for purposes of social choice, the lack of differentiation between different categories or kinds of wants and sources of satisfaction makes economists' methods extremely blunt instruments that make more refined judgments about social choice extremely difficult. 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" (Scitovsky, Sen).

Sen has tried to understand why the levels of consumption necessary to satisfy some sources of satisfaction might rise as average income rises. One reason for this is to explain the "Easterlin Paradox", a pattern of survey findings within and between countries that shows that

people do not judge themselves to be better off ("happier") as incomes in a society rise overall based on cross-country data. Even in the same country at two different points in time, the survey results suggest that a rise in the average income does not result in a larger segment of the population considering themselves to be happy (Easterlin). It is only the relative income (or relative standing) within the same country at a given time that produces a higher ratio of affirmative responses; those above the average income are more likely to say they are happy. This result has been replicated in numerous studies, all of which are consistent with the hypothesis that relative standing is important, potentially more important than the absolute level of consumption, in determining individual well-being.

The ways in which individuals try to raise their relative position in society will vary. However, to the extent that consumption of certain goods and services have a "demonstration effect" on one's position (sometimes referred to as "keeping up with the Jones"), then the demand for positional goods (Hirsch) will reflect this. If relative standing is an important motivation for consumption behavior, then it would have implications for other economic phenomena as well. Indeed, Duesenberry's "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, who they associate with, etc. Competition in athletics and education tend 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, and that it goes beyond household choices of consumer goods.

For example, there is evidence 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.

Described variously as a demonstration effect, demand for positional goods, or a consumption externality, this phenomenon has been evident in the economics literature for some time (Duesenberry, Hirsch, Frank). But its importance with respect to the environment has not been recognized. As Frank 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).

Most environmental goods and services are public, or nonrival goods, things that an individual can benefit from without any diminution of the benefits accorded to others. 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 whales and panda bears, 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. Goods that are nonrival, obviously, cannot be positional goods since no one is excluded from their use so no one can attach, by demonstration, positional status through 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 in cases where individual ownership is possible, i.e. Ted Turner's Montana ranch, but not the Nature Conservancy land trust).

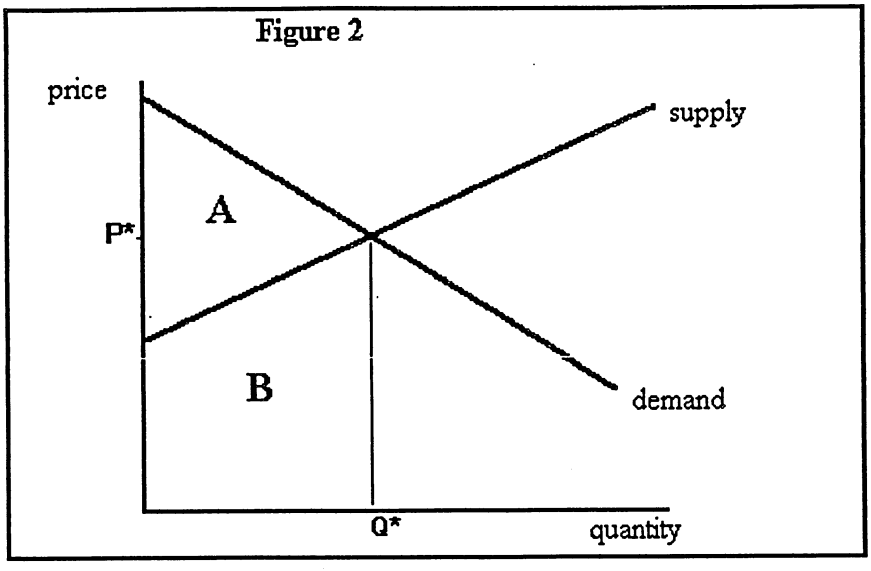
For purposes of maximizing the value of social product (benefit-cost analysis or GDP

[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, Marris).

growth), the pursuit of higher standing must be treated differently from the other categories of sources of satisfaction (comfort, novelty, stimulation, etc.). 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, Sen (1983), Frank, and others have pointed out, having high relative standing is instrumental to the realization of numerous legitimate human aspirations. It is completely consistent with the pursuit of self-interest.

The problem, however, for purposes here 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.

The magnitude of these effects may be large. The simple analytics of the welfare value from the production and consumption of a good 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 true value is -B (where 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 because the resources that went into producing the good are positive, the net social benefit will be negative.



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 clothes and consumer durables). Nevertheless, this does not weaken the argument being made above. To the extent that the positional attributes of the goods involve extra costs, then one can simply think of them as a composite good where the positional and non-positional utilities are complements. Therefore, the analysis above of a purely positional good can be thought to apply to that constituent of a good which is positional.

The implications of this for benefit-cost analyses would be of little consequence if the kinds of costs and benefits being compared represent bundles of output with similar shares of positional goods. Where the environment is concerned, however, 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:

> 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.

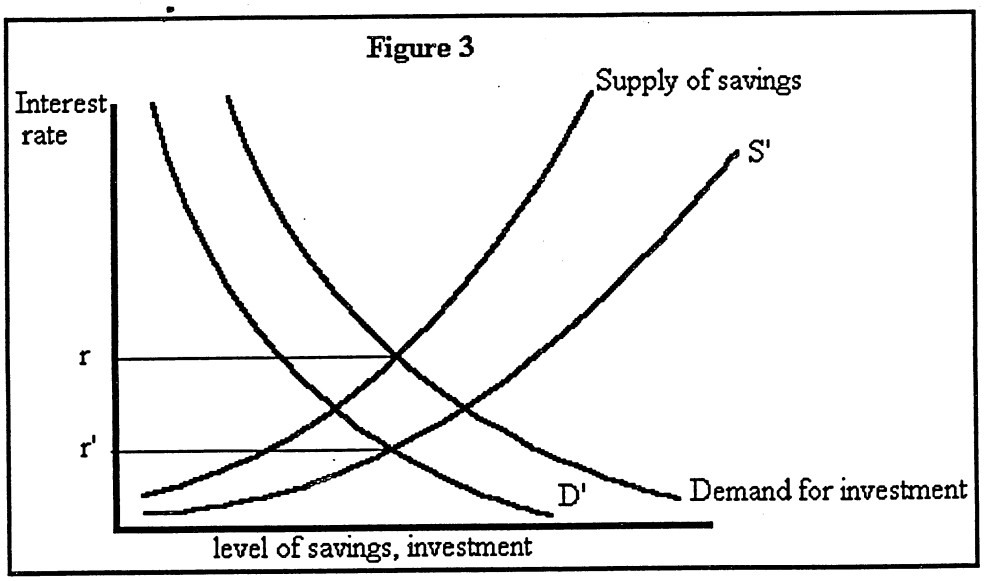
To the extent that assessing an optimal growth path includes tradeoffs between environmental and other non-positional goods, and that the benefits of continued economic growth reflects an aggregation of individual desires to raise relative standing, then a dollar-for-dollar computation of net benefits will be flawed, and the benefits of economic growth overstated.

The implications of this problem for welfare economics extend beyond the individual goods being consumed to more general market failure due to its effect on intertemporal allocations. The supply of savings and the demand for investable funds are influenced by positional goods 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 out relative to that 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 absence of positional goods then, the demand function for investable funds (the marginal efficiency of investment function) would shift inward as illustrated in figure 3.

The net effect of this is unambiguous: In an economy with positional goods there will be a higher market interest rate, r, than would be the case in the absence of positional goods (r' in figure 3). Since the individual benefits from consuming positional goods cannot be aggregated as a measure of social welfare, it is also the case that their influence on the market interest rate should be removed in order to apply an "appropriate" discount rate to social cost-benefit calculations. This effect may be substantial. Furthermore, by influencing the discount rate, the bias created by positional goods will affect all intertemporal tradeoffs involving private and public goods and will give rise to sub-optimal investments in non-positional goods and excess current consumption.



Consumer sovereignty, social welfare, and pecuniary externalities

The aggregation problem associated with positional goods poses a clear bias in conventional welfare measures. But there are additional limitations to applying these very blunt instruments to policy questions. Amartya Sen has tried to define the "standard of living" in a more complex and insightful way (as an alternative to per capita income) by using notions of how individual "capabilities" and "functionings" are more germane to the notion of standard of living than simply income. He points out, for example, that the income required for assuring some "capabilities" (e.g. nourishment, shelter, inoculation from a specific disease) are unlikely to rise substantially as the average income level in a society rises. For other categories, however, such as the "capability" of "appearing in public without shame," the income (and resources) required will likely rise with higher per capita income as community standards of appearance are likely to rise. Sen sees some difficulty, however, in differentiating between the capability of appearing in public without shame and what Sen calls

opulence.

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.. It is not clear how this could be done, or how one could link "willingness to pay" or specific expenditures with particular sources of satisfaction (at what level does eating change from satisfying subsistence needs to one of avoiding boredom?). It would appear, however, from academic writing and observed policy making, that these kinds of distinctions or weightings are often being made implicitly. For example, both Sen's writing on hunger and famines and the widespread support for and use of food stamp programs would seem to substantiate a recognition that access to a minimum level of food is not something that should be left simply to individual "willingness to pay" -- it will often be below levels that are socially acceptable because of constraints on individual "ability to pay." Hence, in this instance, the edict of considering consumer choice to be sovereign has been overruled to assure a minimum level of one vitally important commodity, 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.

The prevalence of public and private food programs, and of national food security policies, may be evidence of a societal "revealed preference" for assuring the "capability" of consuming some vitally important commodities and overruling the edict of consumer sovereignty. There are other examples of this, including health care and education where society appears to believe that satisfaction of certain wants should not be left entirely to the marketplace to sort out -- again rejecting the principles of welfare economics which hold that

maximizing economic surplus will maximize social welfare.

Are the "capabilities" associated with the environment ones that society would deem deserving of some priority? Or is this just a question of tastes? In the way that food stamp programs suggest a "revealed social preference," does the Endangered Species Act reveal social preferences with respect to nature that differ from those that would arise from the maximization of economic surplus? If nature (its existence and access to its amenity value) were to be ranked among the "capabilities" that are included in Sen's measure of the standard of living, what is the minimum standard? How do we assess tradeoffs? Can economic approaches to social choice be modified to reflect this notion without a loss of objectivity and consensus? Or does economic analysis fail to recognize a social preferences toward the environment that are not captured in the aggregation of individual wants, in the same way that it fails to recognize social preferences for assuring basic nutrition, health care, and education? Might it be, too, that the divergence is more subtle and long-term than the more immediate and obvious examples of food and health care?

Support for welfare programs may, to some extent, reflect some underlying recognition that individual consumption of positional goods can have deleterious effects on social welfare through welfare reducing "pecuniary externalities." 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). They exempt from this, however, pecuniary externalities, where the actions of one or more parties alter the market equilibrium for goods or services, thereby altering 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.

Assuming pecuniary externalities to be innocuous requires acceptance of consumer sovereignty in the sense of making no distinction between the social value of wants that cause a shift in market equilibrium, and those of the individuals who are affected by the results. But to

the extent that society would prefer to differentiates between kinds of individual preferences, or in recognizing that the demand for positional goods involve consumption externalities that dissipate their aggregate social value, then pecuniary externalities can not be assumed to be harmless in a social welfare sense. This problem is illustrated by Sen's analysis of the causes of famines. He demonstrates that in many historical cases, famine has resulted from shifting market conditions rather than an absolute scarcity of food. His approach to understanding the social welfare implications focuses on a notion of "exchange entitlements," or real and reliable purchasing power, which imply a high social value to assuring allocations of certain vitally important goods up to some threshold level. In this case, changes in market conditions can be socially deleterious, and pecuniary externalities must be considered real externalities.[5]

By according a high weight to nourishment, or discounting the social value of positional goods, standard economic valuations of welfare are shown to be inadequate and the door is opened to consideration of other human wants that, up to some level of consumption, deserve some kind of special consideration. Environmentalists, as well as some economists, may see this as a better approach to assessing standard of living.

Relative standing and its implication of interdependent utilities complicates economic analysis, something that modern economic science seems determined to avoid. 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, assumptions that would make such analysis prohibitively complex tend

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[5] During the 1979-80 OPEC oil shock the promotion of the use of grain to make gasohol was debated. In that debate, there was considerable unease about the prospect of a development that would lead to owners of gas-guzzling Oldsmobiles inflicting "pecuniary externalities" on those who would buy grain to satisfy basic nutritional needs.

An alternative way of interpreting these issues is in the limitations of "willingness to pay" as a proxy for interpersonal comparisons of utility where there may be large differences in the marginal utility of consumption of crucially important goods like food and shelter below certain levels. The way to include the issue of positional goods using this approach would be to recognize the consumption externalities associated with positional goods.

to be avoided 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 (e.g. Deaton and Muellbauer pp. 223, 238).

The implications of this analysis for optimal growth and sustainability are straightforward. If scarce environmental assets are being used in the production of positional goods, then the conventionally-measured value of social product will exaggerate, and possibly grossly exaggerate, the social benefits of economic growth. The impact on intertemporal allocations -- and the intertemporal price used to discount public as well as private investment decisions -- will be to shorten the relevant time horizon and to undervalue and mismeasure the well-being of future generations.

Dynamic considerations

If in our static analysis the issues raised above produce only modest biases in the economic method, one might argue that, lacking an obvious alternative method that is superior, the current economic approach is reasonable. However, small biases in static models could potentially lead to large social costs over time. Economic models generally assume the technology of production, the preferences of consumers, and the institutions that facilitate economic activity to be given (an exception is that technological change is sometimes assumed to continue, but at a constant rate, neutral to factors of production, and not influenced by the policy or program under evaluation). This conventional approach has been questioned in the "induced innovation" literature (coming primarily out of agricultural economics) which argues on theoretical and empirical grounds that the rate and direction of technological change is influenced by relative prices. Persuasive evidence of this is provided by comparing the technology paths in US and Japanese agriculture earlier this century favoring labor-augmenting and land-augmenting technologies, respectively (Binswanger).

The implications of induced innovation are germane to the environment. To the extent that technology is endogenous and responsive to price signals, the economic costs 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, but if, for example, a policy such as a gasoline or carbon tax were to induce innovation toward cheaper clean fuel substitutes for carbon energy, this could lower or even eliminate the costs of the original policy. The general point is simply the dynamic counterpart to the static analysis of the optimal externality.

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). This process could easily result in an inferior technology dominating the market. Examples such as the dominance of the gas engine over steam, conventional clock face over other designs, typewriter keyboards, or the dominance of VHS over Beta videocassettes illustrate this possibility. In these cases, early random events may give one technology an advantage over the second, from which the competing technology was unable to recover, despite (possibly) it being inherently more efficient after some initial development period. 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 dynamics of market failures of this kind have received only scant attention in the economics literature. There appears to be little attention 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 (exceptions include Kahn, Arthur). 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.

A analogous argument can be made for the dynamics 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 to be fixed, an assumption that is steadfastly defended by many economists (Stigler and Becker).

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. John Stuart Mill 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). And Frank Knight saw human wants as something to be discovered, in a process of searching and learning that takes a lifetime. Despite a lapse of several decades during which economics became 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)

In a world of changing and changeable preferences, the practice of economic valuation of benefits and costs over long periods of time while holding preferences fixed will prove excessively inflexible toward policy interventions, and is likely to exaggerate costs by ignoring the dynamic adjustment of preferences to changing prices and availabilities. Demand for goods and services will normally be more elastic in the medium-run than in the short-run

because fixed costs become variable. This reasoning can be extended to include technology and preferences. Over longer periods of time, the costs of changes in current behavior may be much less costly than short-run estimations would imply. In effect, the "technology of consumption" changes in response to different relative prices in an analogous way to production technology: the fixed costs of habits, familiarity, 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.

If both production and consumption "technologies" are continually shaped by prices and scarcities, then the progress for both will be path dependent and may result in irreversible selection of mutually-exclusive paths. Furthermore, 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 institutional change will be biased against the change. These institutions include laws and property rights, formal and informal organizations, and codes of individual and collective behavior (culture). These institutions will influence, and be 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 (1988) calls "co-evolutionary."

The notion that many dynamic phenomena are less prone to analysis in welfare economics is not new (Bator, p. 56). Measuring the net benefit of a project, a public investment, or economic growth in a dynamic context becomes virtually impossible, as the notion of economic surplus becomes amorphous. Indeed, long ago Frank Knight understood this limitation and concluded that, as a basis for addressing social problems, welfare economics must ultimately dissolve into a study of aesthetics and morals.

For the purposes here, however, these dynamic processes, and the potential that policy decisions influence them, are raised to underscore the point that a small bias in evaluating the socially optimal policy, based on static assumptions, can result in large costs in the dynamic context: If there are biases present in the economic methods of social choice, arising from conservative reinforcement and the erroneous aggregation of individual demands for positional goods, then even if the magnitudes of the biases are modest, the eventual social costs can be very large.

Summary and conclusions

Making tradeoffs in the face of uncertainty, resource scarcity, and irreversibilities presents daunting problems for public decisions. Economists utilize 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 way of reconciling conflicting individual values and dealing with inherently difficult decisions. Yet by relying on individual preferences the approach will be biased, perhaps severely, on many issues involving the environment.

First, conservative reinforcement will give welfare economics a bias in favor of existing institutions and resource allocations when valuations are derived from prices, allocations, and measures of economic surplus based on status quo property rights. Especially in the case of emerging environmental externalities that are unidirectional, where status quo property rights tend to be *de facto* rights of the polluter rather than the pollutee, this will bias the judgments of optimal pollution, as well as benefit-cost analysis of measures to reduce the level of pollution, in favor of higher levels of pollution.

Second, if the demand for positional goods is a significant and increasing share of measured economic surplus, then economic growth will receive too high a weight when traded off against non-positional goods such as the environment (and other non-rival or public goods). Evidence that relative position is important in explaining human behavior from the work of

Duesenberry, Easterlin, and Frank suggest that this bias is large in magnitude. These biases may persist and be reinforced over time given the dynamic and endogenous nature of technology, wants, and institutions. Such biases may guide social choices down a sub-optimal path from which society will become irreversibly committed.

To return to the issues which framed the differences between economists and environmentalists (intergenerational equity, social capital, and global resource scarcity), several observations can be made. First, there may be potentially strong biases in the methods of welfare economics where measured increases in well-being may actually disguise a decline in social welfare.

Second, production and consumption of positional goods create an intertemporal misallocation through their effects on savings and investment, that will give rise to a market interest rate higher than the social optimum. This introduces an *additional* bias to the use of market interest rates as the social discount rate, reinforcing those biases already established in the literature. This will 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.

Third, the presence of positional goods will lead to overexploitation of exhaustible resources due to the effect on the market interest rate, and also to the extent that these resources are used in the production of positional goods.

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. Given the path-dependent nature of technology and changing preferences, society's choices may be constrained in ways that irreversibly prohibit recovery of a socially preferred path.

In addition to these potential biases, the role 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 is likely to be rising 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 becomes operationally problematic. But so to is making adjustments for the difficult-to-measure biases introduced by positional goods and conservative reinforcement.

Applying the economic methods without making these adjustments may be misleading and socially costly. However, 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.

The findings do suggest, however, that some modification of standard welfare economics is needed to better judge policies that, directly or indirectly, affects the environment. Some means of approximating the magnitude of the biases indicated above is needed. Furthermore, given the enormous uncertainty in many environmental areas, some composite set of policy criteria, for example including a safety-first decision rule, 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. One is left in search of some modified set of decision rules which, upon elaboration, may bear resemblance to the kind of strong sustainability constraint being advocated in various forms.

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