Reflections on Climate Change, Economic Development, and Global Equity*

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Introduction

Let me begin by acknowledging the Global Development and Environment Institute at Tufts, and Jomo Kwame Sundaram, co-recipient of the 2007 Leontief Prize. I am honored to be in the company of these distinguished colleagues, as well as those who have been recipients of the Prize in previous years. It is a fulfillment of the scholarly calling to be able to exchange ideas with other members of a community dedicated to the pursuit of knowledge, and to the use of that knowledge for the benefit of humanity.

Economics, Climate Change, and Global Equity

When nearly every news story about the climate policy debate in the United States alludes to the question of whether action to reduce greenhouse gas emissions would "harm the economy," it is easy to wonder about the role economists are playing in the debate. The same question arises when protection of the climate (or of the global environment more generally) is said to be in opposition to the aspiration for economic development by the poorer countries of the world. In thinking about the linked issues of climate change and global equity, it is reasonable to ask: Is economics part of the problem or part of the solution?

The fact is that it is possible to formulate several kinds of interesting economic models that are pertinent to climate policy. Economics also has insights on the relationship between climate and economic development. What may not be as clear, however, is that there are real limits to what economics has to offer on these subjects. The economic models that are used to form recommendations on climate policy (and that have

implications for global equity and development) have built into them *moral positions* of various sorts. It is these implicit ethical assumptions that account for the difficulties we encounter in the analysis, and that explain why it is so hard to reach consensus.

There is no doubt that many garden-variety policy issues can be fruitfully handled within the economic framework. The foundation of modern welfare economics is the "Kaldor-Hicks compensation principle," which holds that a policy is socially desirable if the winners (those whose material well-being is improved by the policy) are able to compensate the losers (whose material well-being is reduced) so that the losers are made whole, leaving something left over of the winners' gains. This approach to policy has a great deal to recommend it in a pluralist society in which improvement in the material standard of living is a "least common denominator" objective that (almost) everyone can agree upon. Of course in reality, as former Leontief Prize recipient Amartya Sen has pointed out (1979), the monetary compensations required by the Kaldor-Hicks principle often are not paid. This drawback can be mitigated if numerous policies are being enacted over time, each resulting in relatively small gains and losses distributed across diverse groups. Then the gains and losses experienced by individuals will tend to cancel out, with a tendency for net gains over time if policies that pass the aggregate Kaldor-Hicks test are adopted. Needless to say, there is no guarantee of this: policies may consistently favor particular groups in society, and there is nothing to prevent governments from enacting laws and regulations that do *not* pass the Kaldor-Hicks test.

Climate presents a different kind of challenge. The chief beneficiaries of climate mitigation investments will be members of subsequent generations, most of whom are not yet born. Those who must make the investments are the people who are alive today.[1] Even if future generations would prefer that we invest in climate protection rather than other kinds of distant-payoff projects, there is no way of our knowing this because the future generations cannot convey their yet-to-exist preferences to us. And compensating payments of the Kaldor-Hicks type are not possible between future generations and us because time travel is impossible – benefits accruing to future generations cannot be transferred back to the present.

Economic Climate Models and Their Implicit Moral Assumptions

Consider some examples of the kinds of economic models used in climate policy analysis. The most common are *discounted utility* (DU) models. Behind the jargon, what these models do is to frame the climate problem as a standard cost-benefit analysis. The policy authorities attempt to maximize the discounted utility derived from a future stream of consumption, subject to the technological limits of the economy's productive capacity. Climate effects impinge on the consumption stream, and reductions in greenhouse gas emissions are treated as an additional cost of production. The planning horizon stretches into the indefinite future because of the time scale of climate effects.

[1] Duncan Foley (2007) has pointed out that climate mitigation investments that come at the expense of other investments with very long-term payoffs need not reduce present-day consumption. The climate investments could be substituted for other long-lived investments that would pay no dividends to the current generation, provided such investments could be identified.

Note the implicit moral assumptions built into this model: (1) The weight assigned to the welfare of successive generations declines over time according to the "subjective rate of time discount." Mathematically, the weights have to decline faster than the utility of consumption rises to prevent the sum that is being maximized from becoming infinite.[2] (2) The utility of consumption can be summed across individuals of different generations (and within a given generation). This entails a particularly strong form of interpersonal comparison of utilities (and of utilitarianism), hardly a consensus philosophical stance. (3) All the goods relevant to "consumption" are included in the utility function, even those that are notoriously difficult to measure (such as the value of ecosystem services). Converting these semi-intangibles to something that can enter a mathematical function requires highly contestable methods of assigning quantities and qualities to such goods.

Aside from the implicit moral positions embodied in these assumptions, discounted utility models are subject to serious criticisms from entirely within the framework of economics. This is not the place to elaborate on those criticisms, but the main ones are that the discounted utility formulation is not consistent with observed individual behavior (Frederick et al. 2002); current DU models do a very poor job of accounting for risk and uncertainty, particularly the uncertain possibilities of catastrophic climate-induced

[2] Ramsey, who first formulated a model like this (1928), recognized that time discounting at a rate different from zero was morally unacceptable. He could not have been more unambiguous: "One point should perhaps be emphasised more particularly; it is assumed that we do not discount later enjoyments in comparison with earlier ones, a practice which is ethically indefensible and arises merely from the weakness of the imagination" (p. 543). It is ironic that the class of models in which discounting is mathematically necessary have come to be referred to as "Ramsey models."

change (Stern 2007; Weitzman 2007);[3] and the current models fail to incorporate changing relative prices of "the environment" and ordinary goods and services (Sterner and Persson 2007).[4]

A second approach to climate policy modeling sets the problem in the *overlapping generations* (OLG) framework. These models take note of the fact that members of successive generations "overlap" for at least part of their lifetimes, so that transfers between successive generations can be made. Without going into the details, OLG models rest on the assumption that a "social contract" between the generations will be adhered to through time, so that the "young" generations do not simply renege on their promises to repay the debts that the "old" rely on to sustain them when they are no longer productive. (We may have an opportunity to test the realism of this assumption when the Social Security System goes bankrupt in a few decades.) Additionally, the weights assigned to the welfare of different generations can be specified explicitly (e.g., Howarth and Norgaard 1992).

Another set of models describing the long-term evolution of the economy are *growth models* of the type pioneered by Solow and Swan (see Solow 1989). The simplest of

[3] The kinds of catastrophes discussed by the Intergovernmental Panel on Climate Change include shutdown of oceanic circulation patterns, collapse of Antarctic or Greenland ice sheets, or warming-induced release of methane from the permafrost or offshore methane hydrates (IPCC 2001).

[4] If the "services" provided by the natural world are in fixed supply, the price of those services will rise relative to that of produced goods and services over time, particularly if the elasticity of substitution between the two kinds of goods is low.

these conceptual models exhibit steady-state or sustainable growth paths[5] as a function of the rate of savings (broadly defined to include investments made to preserve the environment). The steady-state path with the highest per capita consumption at each point in time (relative to other feasible steady-state paths) is the "Golden Rule" path. Higher consumption might be possible for a particular generation or generations, but only at the expense of the well-being of future generations – the higher present consumption is not sustainable. The Golden Rule or something like it is an ethical precept found in many cultures; in this setting each generation limits its consumption (in the interest of future generations) in the same way that it would wish previous generations had done for it. Thus the Golden Rule.[6]

Finally, it is possible to imagine a thought experiment in which all the *generations meet at the "beginning of time"* to trade with each other. The generations each have endowments based on their potential command of goods and services (including the environment), and the trades take the form of moving productive capacity forward or backward in time. The thought experiment arises from the Arrow-Debreu general equilibrium model with time-dependent goods; the embedded ethical assumption is that all generations can be "present" to interact with the others, and that all have equal standing to do so (DeCanio and Niemann 2006).

[5] The notion of "sustainability" has been developed in a variety of ways in the literature. A recent treatment emphasizing the moral and economic aspects of the concept is Howarth (2007).

[6] See discussion in DeCanio (2003) for the role of this principle in an historical policy situation.

Needless to say, these different formalisms give somewhat different policy advice, depending on the strength of the tie between the generations (i.e., the rate of subjective time discount in discounted utility models, the welfare weights of the different generations in OLG models, etc.). Even so, it is an indication of just how serious the climate problem is that *all the models advise some kind of action to reduce greenhouse gas emissions, starting now*. The debate is over how much action should be taken, and how quickly to ramp up the emissions reductions; none of the models favors a do-nothing approach. The only people who oppose any action on greenhouse gas emissions are those who deny the validity of climate science or who believe that mild global warming will be beneficial on net, at least for some period of time.[7]

As a consequence, the real debate associated with the economics of climate policy is as much a function of *the underlying moral assumptions* of the models as their technical details. It is also the case that, once the need for some kind of action on climate is recognized, the problem of how to apportion the costs and responsibilities for that action depends on concepts of fairness and governance, not only on the economics of the situation. The fundamental requirement for action on climate is that the present generation decides, for ethical reasons that go beyond concern only for their present consumption of goods and services, that it is their *duty* to future generations to avoid "dangerous anthropogenic interference with the climate system."[8]

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[7] It is difficult to construct a coherent argument for indifference to *indefinitely large* increases in future global greenhouse gas emissions. The basic science of global warming is as solid as anything we know.

[8] The quoted phrase is from the United Nations Framework Convention on Climate Change, Article 2 (1992). This Article of the UNFCCC also asserts as an objective that climate policy should "enable economic development to proceed in a sustainable manner."

Global Equity and Economic Development

Now suppose hypothetically that the intergenerational equity problem has been constructively addressed and that today's generation has reached a consensus that global greenhouse gas emissions should be restricted, perhaps by a percentage that rises over time and is subject to periodic re-negotiation in light of new scientific evidence. Translated into the language of economics, the "preferences" of the present generations would have been redefined to incorporate our duty to the future as a tangible obligation, fulfillment of which contributes to our own well-being. One way of doing this might be to specify that the utility functions of members of the present generation take a form such that greenhouse gas emissions controls are included as "goods." Another way could be to include an atmospheric greenhouse concentration target as a constraint in the utility maximization process. The near-universal agreement among economists that these emissions constitute an externality means that global welfare could be increased (in the sense that it is possible to reduce emissions in such a way as to pass the Kaldor-Hicks test in the present) by attaching some cost to these emissions. There remains the global equity problem: how should this cost be spread across the current population of the world?

We know that the externality could be corrected if emissions allowances – "property rights" in the atmosphere and biosphere's ability to absorb CO_2 and other greenhouse gases – were in place so that greenhouse gas emitters would have to buy permits from the owners of the emissions rights to be allowed to pollute. A global greenhouse gas

emissions tax would accomplish the same thing, with distribution of the tax revenues playing the role of the allocation of emissions allowances. We can imagine an institutional framework in which these rights are owned by a central global authority, and in which each person pays the central authority an amount equal to the net benefit he or she receives from the globally mandated emissions reduction.[9] As in the case of the Kaldor-Hicks principle itself, there are extreme practical difficulties with such an approach, not least of which is that there is no real way of knowing what the net benefit of the emissions reduction to each person is. In principle, however, the aggregate value of the payments must be positive, given that greenhouse gas emissions constitute a true global externality. No one would be worse off for his or her payment to the central authority, and the clearinghouse would have money that could be distributed in any way the authority saw fit. These distributions would obviously improve the material well-being of the recipients.

The possibility of a Kaldor-Hicks improvement conditional on the consensus that some level of greenhouse gas emissions reductions is justified has been established. However, economic efficiency could be achieved by any number of different ways of distributing the emissions allotments. Economics can tell us that a variety of such schemes would create across-the-board benefits for the present generation (again, contingent on its internalizing the well-being of the future generations), and can even offer guidance in the design of institutions for creating and allocating the emissions permits (a single central

[9] This could even allow for some individuals to make a negative payment to the central authority if the climate change would have benefited them.

authority is not the only way), but it cannot tell us which distributional plan to choose.[10] That choice requires a combination of statecraft (to reach an enforceable agreement among the 200-odd sovereign governments) and, again, *moral considerations*. Does fairness require some kind of symmetry in the past or present use of the capacity of the atmosphere to accommodate greenhouse gases? Do the virtues of charity and prudence require that efforts be undertaken to improve the material condition of the poorest members of society? Do the rich have a "noblesse oblige" duty to contribute proportionally more to the solution of this global problem than the poor? There is no reason to expect that the debate over these questions would be easy or non-contentious even though the net benefits of climate control would make the allocation of emissions rights pass the Kaldor-Hicks test, because different allocation schemes would obviously result in different net benefits realized by individuals and nations.

Although the two moral issues – the obligation to future generations and defining a fair allocation of the emissions allowances within today's generation – are conceptually separable, in practice the two issues will have to be confronted simultaneously in the international (and domestic political) negotiating process. As if either set of moral dilemmas were not challenging enough, *two* such quandaries need to be resolved. The resolution will have to reach beyond economics.

[10] Some allocations of emissions rights might achieve the desired reduction in greenhouse gases, but would not be universally welcomed. An allocation could fail to improve everyone's welfare if none of the rights were allocated to those whose net benefit from averting global warming was small.

The Limits of Economics

If economics is unable to arrive at a solution of either the intergenerational or international equity questions, why does it continue to play such a prominent role in the climate policy debate? We do not typically appeal to economics in deciding other moral questions, particularly when life-and-death issues are at stake. I think there are several reasons: as noted earlier, economics certainly has valuable advice to offer for many policy questions (and hardly anyone would deny that advancing the material prosperity of the populace is a worthy goal of government), and economics can provide insight into the provision of incentives, the design of institutions, and the avoidance of unintended consequences. Yet there is a downside to framing policy questions purely in terms of the material self-interest of the citizenry. Casting every social decision in this way can create habits of mind in which politicians (and their constituents) are unwilling even to consider options that might require *real sacrifices*.

As I have argued above, least-common-denominator utilitarianism (as in the Kaldor-Hicks compensation principle) is an understandable response to the problem of formulating policy in complex modern societies that are characterized by anonymous dealings, mobility of persons and capital, and ubiquitous commerce. Pre-industrial or traditional societies were based much more on local interactions – such as within extended families, fiefdoms, religious assemblies, or urban guilds. Most people lived in one place for their lifetimes, and personal contacts mediated economic relationships. In modern developed/industrialized societies, on the other hand, many of the most important transactions are with strangers; we are subject to market forces that can originate on the

other side of the globe; and the market's invisible hand organizes economic activity in counterintuitive ways (as when it produces public benefits from private greediness).

Strong utilitarianism offers a way to simplify drastically all this complexity, and to reduce the social welfare problem to one of simply adding up utilities. This can in some cases be simplified even more – adding up changes in incomes according to the Kaldor-Hicks principle. It makes no difference whether it is applied to a village of 100 or a nation-state of 100 million people. Utilitarianism seems to make the problems of policy formation in a mass society *tractable*.

This simplification dovetails with the allure of being able to cast policy problems (especially economic ones) in the scientific mold. By formulating the social objective as maximization of a mathematical function (at the individual level, the utility function; at the aggregate level, the social welfare function) utilitarianism allows economics to put on the trappings of natural science – mathematical modeling, quantification, and computation. This has a number of effects that are beneficial to economics as an academic discipline. It creates a barrier to entry in the form of a great deal of required mathematical training that restricts the supply of aspiring economists and therefore raises the incomes of those who make it in. But more seriously, by reducing questions that are essentially moral to questions that appear to be purely technical, the underlying moral assumptions *that are still there* are obscured. Non-transparency allows promotion of the analyst's views as if they were a logical or mathematical necessity.

At the most basic level, the inability of economics to address the matters of duty and equity that must be part of the solution to climate change arises from the attempt by economics (and the other social sciences) to emulate natural science by adopting a strictly materialist and deterministic philosophical stance. Materialism has been wildly successful in advancing our understanding of the physical world, but to carry it over to the analysis of human behavior and social dynamics does violence to the essential reality of those realms. The materialist approach may serve to uncover some patterns and regularities in human affairs, but carried to its reductionist limit (as is done in the natural sciences) it implies a world without the possibility of genuine choice. "Policy analysis" becomes an empty concept, because the behavior of politicians is as much subject to the iron determinism of material interests, social structures, and institutional rigidities as the movement of the planets is constrained by the laws of general relativity. The microscopic randomness of quantum theory does not offer a way out, because there is no convincing evidence that human brains are affected by quantum-level randomness, and in any case, randomness is no substitute for intentional choice and moral responsibility.

Is There Hope?

Even if we discard the deterministic image of human society, it does not follow that there are no constraints on what can be accomplished by human action. We do live in a material world, a world subject to the physical laws that govern inanimate matter. One of the contributions economics can make is to expand the boundaries of solutions that are available to us. To begin with, solving the climate problem can *alleviate* global poverty

rather than exacerbating it.[11] The global distribution of wealth and income is quite unequal, both across countries and within countries. As a result, measures to stabilize the atmosphere in which the emissions rights are allocated more equally than the current wealth distribution actually would increase the incomes of the majority of people even without accounting for the benefits of climate stabilization (see Boyce and Riddle 2007 and the references they cite,[12] for example).

Creation and allocation of emissions allowances would internalize the global climate externality by creating a new form of tradable wealth – the emissions permits. This wealth could help jump-start economic development by putting purchasing power in the hands of the poorest members of the global economy (see Baer *et al*. 2007 for a recent specific proposal), and it would do so in a way that would strengthen market incentives rather than dulling them as ordinarily occurs with the confiscation and redistribution of wealth. Huge barriers would have to be overcome to make such a system workable, barriers involving governance issues at both the international and the national levels. It would be unwise simply to turn this wealth over to tyrannical governments that do not function for the benefit of their people; the emissions allowances would need to be distributed to individuals, and precautions taken against their simply being appropriated by governments for non-development purposes. Even in democratic societies, the problem of aligning the actions of governments with the interests of the governed is one

[11] It is well-documented that numerous "no regrets" options would reduce pollution while improving productivity and economic performance. Adopting these technological possibilities improves welfare along all dimensions and is non-controversial from a policy standpoint.

[12] These studies refer mostly to the United States economy, but there is little doubt that the result generalizes.

whose magnitude and depth we are only beginning to realize, especially because the complexity of modern life makes it difficult or impossible for the people to know what policies actually would benefit them (Friedman 2005).

Economics also points to the potential for technological progress that can make the transition to a low-carbon economy less difficult than it might seem at first. Business firms are multidimensional entities, and countless empirical studies show that they are not optimized down the last rivet as some naïve economic models would have it. This means that the productive organizations of society can focus some of their high-quality effort on improving energy efficiency and otherwise reducing greenhouse gas emissions without undermining their overall productivity. Additionally, consumers' preferences and choices are dependent on the salience of environmental concern. If consumers come to realize that their habitual or unthinking behaviors have adverse consequences for future generations, the behaviors can be changed at low or zero cost. The historical experience of the Montreal Protocol on Substances that Deplete the Ozone Layer shows that it is possible to avert a major global environmental threat through enlightened diplomacy, cooperation between industries (and between industry and government), and technological innovation. What is necessary is that the governments of the leading countries demonstrate in a clear and unambiguous fashion that the problem *is* going to be solved.

Fundamentally, however, the *reasons* to avert dangerous climate change and to seek global equity are moral. Accommodations and political compromises may be necessary,

but the central issues of duty and fairness are not far removed from the ethical foundations of all the world's major cultural and religious traditions. The underlying moral questions of "What constitutes the Good?", "What are our duties?", and "How should we act?" cannot adequately be fit into the economic framework. This does not mean that meeting the material needs of people is irrelevant or that it does not have a moral dimension. It is obvious that the full development of human potential can be thwarted by poverty. Yet it surely is possible to recognize the suffering caused by material deprivation while at the same time acknowledging that poverty is not the only cause of human distress. The human condition – mortality, the inevitability of personal losses, and the intrinsic limits to our capabilities – cannot be escaped by increases in material production. Similarly, it is not likely that we will be able to find a path to safe stabilization of the climate by appealing only to the material self-interests of those who are alive today.

All of these considerations point to the necessity for going beyond economics if we are to come to grips with the long run problems facing humanity. Without denying the contributions of economics, there is no escaping the metaphysical questions that have engaged humans over our entire history as self-conscious, rational beings. What course this search for wisdom might take for each of us is a subject too immense to be addressed here. We can only acknowledge the enduring importance of the quest.

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