SUSTAINABLE DEVELOPMENT

Making Sense of "Sustainability"

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Sustainability and *sustainable development* are now such "motherhood and apple pie" concepts in popular debate that they are at once over- and underdefined. *Our Common Future*, the 1987 report by the United Nations' World Commission on Environment and Development, stamped the modern concept indelibly into the dictionary of debate, with its notion that sustainable development means meeting the needs of the present (for health, environmental integrity, material progress, and so forth) without compromising the ability of the future to meet its needs. Since then many, many writers have produced their own pet definitions; but many others avoid a detailed or even any definition, preferring to allow a meaning of sustainability to emerge from their examples or general context.

Two central and interlocking questions persist in the debate over sustainability. The first question is, Will the combination of using lower-grade or alternative natural resources, substituting away from depleted or polluting resources toward human-made capital and knowledge, increasing exploration and recycling, and developing new production techniques be sufficient to overcome the problems of resource depletion and environmental degradation and make growth automatically sustainable? Second, if growth is not automatically sustainable, what is the ethical case for a society to demonstrate a greater degree of concern for future generations than might be shown by individuals seeking only their own narrow gains?

Noneconomic Perspectives on Sustainability

Economists look at sustainability from a different perspective than do practitioners of other disciplines. Indeed, much of what economists have written on the subject has been a reaction (both positive and negative) to the writings and utterances of others.

Noneconomic perspectives on sustainability generally show concern for a very long time horizon, and advocate some combination of (a) paying more attention to intergenerational equity in the distribution of overall well-being; (b) considering the value of natural environmental and ecological attributes in a way that somehow transcends the standard economic trade-off formulation; and (c) acknowledging and working within inherent limits to how much these attributes can be reduced or degraded. Some philosophers argue that individuals should not be given short shrift just because they will live in the future; others even argue that the future should be implicitly accorded entitlements—but of what remains to be determined.

Psychologists argue that what really determines people's "utility"—their current well-being—is not the simple, endlessly substitutable trade-off of levels of absolute consumption and environmental quality that economics assumes. Rather, it may be the rise or fall of consumption that matters more to people than the absolute level, and what really motivates individuals to save or spend is not just maximizing the discounted value of utility using a constant discount rate. Psychology (or more accurately, neurology) also suggests possible constraints on improved efficiency because of the finite amount of information processing capacity in the human brain.

An important strand of scientific thought on how sustainability may or may not be achievable concerns the intrinsic capacity of the ecological systems containing human society to support continued economic progress. Incompatible and often polarized views on this issue are held with some passion. The mainstream economic view is that substitutability of built (i.e., human-made) capital for environmental and ecological resources is more or less unlimited (though not necessarily perfect). In this view, degradation of specific natural capital is not in itself cause for concern, so long as there are offsetting increases in built forms of capital such that overall well-

being can be maintained or increased over time. In short, people can become better off over time, though the patterns of production and consumption choices will inevitably change.

At the other, pessimistic end of the spectrum are variants of the broad *strong sustainability* view, supported by some economists and many noneconomists, that capital-resource substitutability is either a self-evidently impossible concept, or subject to strict and fairly imminent limits. This view implies that economic growth over a few centuries inevitably requires higher material throughput, not just improved efficiency in the generation of disembodied economic value from the same menu of material inputs. Since these inputs (including energy and waste-holding capacity) are inherently limited in their availability, strong sustainability leads to both a positive and a normative problem in balancing binding physical limits with the aspirations of the population for more output as a way to improve living standards.

Perhaps the best-known summary of this view was expressed by Daly (see Further Readings), who held it as self-evident that sustainability requires that (a) ecological services critical to life support be maintained and pollution stocks prevented from increasing beyond certain critical loads; (b) renewable resource stocks (or at least aggregates of these stocks) be used no faster than they are renewed; and (c) depletion of nonrenewable resources be offset by investment in the production of comparable services from renewable resources (e.g., in the switch from fossil to renewable energy sources). Daly's perspective is a strong version of a broader perspective that the *combination* of technical and physical substitution limits and moral obligations to future generations (the rights-based approach discussed above) implies the need for strong measures to protect or replace specific natural resources.

Natural scientists often criticize economic models of production for not adhering to basic laws of nature. Since matter can only be transformed, not created or destroyed, there is a minimum material input required to produce any material output; we cannot create something from nothing, and there will be potentially harmful residuals from production (we cannot return something back into nothing). But such a limit could also be overcome, in principle at least, by the application of other inputs, including significant energy, to expand the environment's carrying capacity for residuals through storage, neutralization, or reduced exposure. Ausubel (see Further Readings) contends that significant dematerialization of the modern economy has been observed, and that this trend can be expected to continue in the future. Ayres (see Further Readings) argues that although material throughput per unit of gross domestic product has shrunk because of productivity increases (greater embodiment of "information" in final output), total material throughput—and thus the stress on natural environments—has not shrunk and is not likely to without a more deliberate conservation policy.

Even greater controversy and confusion attend the application to sustainability of the idea of entropy—that all transformations of the physical environment inherently degrade high-quality and readily available materials and energy into lower-quality and less available materials and energy. Economists tend to strongly discount the empirical relevance of this issue.

Economic Analysis of Sustainability

Economic approaches to sustainability take a variety of forms, but the common element is that a normative element—a value judgment—is added to the standard economic framework. One simple way to do this is to define a sustainable, and therefore desirable, path of economic development as one in which expected well-being per capita (broadly defined to include more than just

material or market goods) rises over the long term. This approach in fact implies some kind of split between private and public motivations about the far future. People must in some sense be schizophrenic, treating private economic decisions as their self-serving personal domain, and governmental decisions as the domain of the citizen.

As for the feasibility of sustainability, many economists would not just assert that the substitutability of built capital for environmental resources is more or less unlimited, and hence sustainability will not require drastic measures to protect environmental resources (a view widely known as *weak sustainability*). They would go further and hold that substitutability, technical progress (whether caused by investment or just by time passing), and conventional policies that take full account of environmental costs and benefits will together be enough to make conventionally motivated economic development sustainable. There will then be no need for sustainability policy intervention as such.

A less confident view about the future, and broadly our own, is that although there is enough substitutability to make neoclassical analysis meaningful and rising well-being feasible, government intervention beyond conventional environmental policies may well be needed to achieve sustainability. Some physical limits on the availability of resource or environmental services probably exist on a multigenerational time scale. The crucial question is whether, when, where, and how those limits might show themselves. This perspective forces those interested in sustainability to abandon ideology, be it cornucopian or catastrophist, and confront difficult, inherently empirical questions.

There are still some striking and regrettable omissions in the topical coverage of much economic writing on sustainability. It often ignores inequities within the current generation. It also often ignores the many special problems of sustainability in poor countries—such as how to avoid open-access overuse of resources, how to escape from poverty traps, and how to develop institutions to collect relevant data and apply effective policy instruments—even though it was these problems that largely revived interest in sustainability in the late 1980s.

How do we know when an economy is performing sustainably from a conventional (weak sustainability) economic perspective? We next loosely paraphrase one of the most important but often misunderstood and misused theoretical insights from neoclassical sustainability economics, a theoretical "sustainability rule" originally developed by Hartwick (see Further Readings) and subsequently greatly elaborated by him and many other scholars.

If a particular measure of "augmented net national investment" in all market and nonmarket assets is not positive at some time, when investment is "correctly" evaluated at market or implicit prices that reflect real values, then a typical economy is *not* sustainable at that time. That is, the current level of well-being is above what can be sustained over the longer term, meaning that some future decline in well-being is inevitable: the economy is "living beyond its means." As a separate and atypical case, if an economy's augmented net investment is zero *forever*, then per capita economic well-being (broadly defined) is held constant forever.

But even assuming that one could construct the theoretically "correct" measures of net investment, one cannot assume that observing zero or positive augmented net investment at a *particular* time is a sufficient condition for sustainability. And it is not enough for sustainability just to observe nonnegative net investment along a market equilibrium path (after perhaps adjusting for current environmental spillovers), despite frequent suggestions along these lines in the literature. Finally, since prices for environmental spillovers are, by their nature, difficult if not impos-

sible to construct, measurement problems alone limit the practical applicability of these conclusions, even if one accepts the underlying conventional assumptions.

Policies for Sustainability

Practical problems also arise in providing guidance for sustainability policies. Countless government and corporate documents now mention separate notions of economic sustainability, environmental (or ecological) sustainability, and social sustainability, while treating all these together as essential components of an integrated sustainability policy. One might hope that such a "triple sustainability" concept could perhaps lead to an integrated approach that bridges divides between disciplines. However, it is hard to find any clear theoretical basis in the triple sustainability literature for how these three concepts of sustainability are meant to interrelate, other than as prompts to remind decisionmakers of the many variables at stake. There is no guidance on how substitutable they are for each other, and thus how one should make or even frame a choice between having less of one type of sustainability and more of another.

From an economic perspective, sustainability policies designed to achieve some kind of improved intertemporal or intergenerational resource allocation may be complementary to but quite distinct from environmental policies designed to take environmental costs fully into account. In particular, sustainability policies may need to increase saving in general to provide greater wealth to future generations, in addition to policies targeted at preventing the excessive depletion or degradation of specific natural or environmental resources. This depends, as already noted, on the extent to which the accumulation of built capital and improvements in knowledge and technology make it possible to outstrip any increases in natural resource scarcity, including depletion of the planet's natural ability to assimilate and harmlessly hold wastes.

We can extend this reasoning to describe what can be seen as either a policy complementarity or a policy paradox vis-â-vis sustainability and the developing world. Developing countries suffer from a number of market, policy, and institutional failures that handicap economic progress. These include not just environmental problems that harm human health, economic productivity, and cultural wealth. They also include problems of access to financial capital, shortages of human capital, and cross-cutting problems related to the functioning of social institutions (rule of law, transparency of governance, and so forth). Addressing any of these problems effectively is likely to improve material conditions and societal well-being. But policies that increase material well-being over a certain time scale, and thus seem by any reasonable definition to promote sustainable development, also could give rise to longer-term local or global environmental pressures (like climate change) that would be seen as unsustainable.

What then is the scope for "sustainability policy" in the context of economic development? Obviously, policies and programs that promote both current improvements in well-being and improved stewardship of natural assets are, to use overworked parlance, win-win. But that synergy will not always exist. In principle, one could use a portfolio of policies that both promote needed growth and development in the near term and limit damage over the longer term. (Skeptics like Daly would argue that this is impossible, even in principle, and that the only hope for the future is to arrest growth in rich countries and redistribute wealth to poorer countries. This doctrine has won few converts.) But commitments to long-term protection are elusive under the best of conditions. More to the point, the steps that might be needed to effectively forestall long-term re-

source degradation in a less than ideally bountiful world may well be unacceptable to those at the bottom of the international income ladder. We then come back to a question that lingers over a number of the papers in this series: Who is willing to pay for sustainability, and for whom?

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