

SUSTAINABILITY CONCEPTS IN ECOLOGICAL ECONOMICS

John M. Gowdy

Department of Economics, Rensselaer Polytechnic Institute, Troy, New York, USA

Marsha Walton

New York State Energy Research and Development Authority, Albany New York, USA

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Summary

The difference between the neoclassical and ecological economics approach to environmental problems can be seen clearly by examining the definitions and concepts used in the on-going debate over "weak" and "strong" sustainability. Weak sustainability sees the human use of the environment as a purely economic problem. An economy is sustainable if the value of economic output is non-declining over time. The key assumption of weak sustainability is that the contributions of environmental features to economic activity may be replaced by human made substitutes. An economy is weakly sustainable so long as economic value, measured by market prices, is maintained. Due to the law of diminishing returns, weak sustainability must ultimately collapse when affordable substitutes are exhausted. Strong sustainability sees sustainability not only as an economic problem, but also a problem of maintaining essential, non-replaceable and non-substitutable, environmental features. A strong sustainability premise is to preserve critical levels of all natural capital even when it can be substituted because of the underlying uncertainty of substitution. Substituting human made capital for natural capital may have unforeseen consequences that could undermine the health of an entire ecosystem. Strong sustainability links ecological and economic concepts to extend the realm of economics beyond the narrow confines of short-term market exchange.

1. Introduction

The most widely used definition of sustainable development is from the Brundtland

Report (Our Common Future), “development which meets the needs of the present without compromising the ability of future generations to meet their own needs.” It is a good starting point to examine sustainability concepts in ecological economics and how they differ from those of neoclassical economics. Interestingly, both the ecological and neoclassical economics views of sustainability fit comfortably within the Brundtland definition. Under neoclassical economic thinking the needs of future generations are met by assuring that they have as much economic product, measured in monetary units, as the current generation. Ecological economists argue that the welfare of future generations depends on maintaining non-market and non-quantifiable attributes of nature and human institutions. The two views are called “weak sustainability” and “strong sustainability”, respectively.

For most economists sustainability means sustaining consumer welfare through time which, in turn, is sustained by maintaining economic output, measured by Net National Product (NNP). The Nobel laureate Robert Solow writes: “net national product measures the maximum current level of consumer satisfaction that can be sustained forever.” He assumes that exhaustible resources pose no limit on environmental growth if it is easy to substitute other human-made or natural factors for them. The weak sustainability perspective optimistically assumes that as specific resources are exhausted technology will provide manufactured capital or discover natural substitutes so that no decline in human welfare will occur. Solow, like most economists, equates sustainability with human welfare and equates human welfare with the consumption of economic goods. As long as economic output is non-declining the needs of future generations are met and sustainability is achieved. Weak sustainability means sustaining the consumption of market-traded goods. This is the standard economic view of sustainability.

The ecological economic version of sustainability, “strong sustainability,” is a term hard to define but in general means sustaining the life support systems of the planet including the evolutionary potential of the biosphere. Some advocates of strong sustainability do not challenge the basic assumptions of welfare economics and cast the argument for preserving nature solely in terms of the economic services it provides. Others step outside the framework of market efficiency and call for stewardship toward nature, environmental ethics, or environmental regencies in the form of bequests to future generations.

Three key points of conflict between weak and strong sustainability are (1) the substitutability of manufactured and natural capital, (2) whether human well-being can be subsumed under the category of economic well-being, and (3) whether economic growth can continue indefinitely. The debate about these questions has centered on the concept of capital (an economy’s means of producing economic output) and the degree of substitutability between human-created capital goods and the services of nature. Capital is characterized either as natural, manufactured (human-made), or human capital. Natural capital refers to the services nature contributes to economic welfare. Manufactured capital includes the machines and techniques used in production processes and human capital refers to the characteristics of the labor force relevant to economic production. For economic output to be sustained, the ability of the economy to produce output must be maintained. This ability is embodied in the economy’s total

capital stock. Advocates of weak sustainability argue that only the total capital stock needs to be maintained. It is permissible, even desirable based on relative costs of inputs, to substitute one form of capital for another in order to maximize economic output while minimizing production costs. Advocates of strong sustainability argue that natural capital possesses essential, unique, and non-reproducible characteristics and should not be subject to wholesale substitution by human-made, manufactured capital.

On one level this debate can be seen as a purely empirical question about the degree of substitutability between natural and manufactured capital in the production process. Herman Daly points out that if human-made capital is a perfect substitute for natural capital, then natural capital is a perfect substitute for human-made capital. If this were true there would be no need to convert natural into manufactured capital in the first place. The fact that manufactured capital exists, and the law of diminishing returns and rules for maximizing output while minimizing cost, demonstrates the complementarity of manufactured, natural, and human capital. On another level the debate between strong and weak sustainability advocates is about the ability of the market economy to provide for the welfare and long-run survival of the human species and the world's ecosystems.

2. Weak Sustainability

At the heart of weak sustainability is neoclassical utility theory and the concept of economic man or *Homo economicus*. Economic man is a strictly rational individual, devoid of social and cultural conditioning and oblivious to ethical responsibilities to others or to the environment. Economic man's singular goal is to maximize his happiness (measured by consumption) subject to his budget constraint. This notion of economic man, described by the axioms of utility theory, is arguably the oldest and most well-developed part of neoclassical economic theory. Utility theory explains individual human behavior within the context of well-defined markets. It is consumer behavior and its consequences that underlie the economic concept of sustainability.

A direct chain of reasoning leads from the characteristics of *Homo economicus* to the neoclassical economic concept of weak sustainability. The logical steps from economic man to maximizing NNP are these: (1) *Homo economicus* is a strictly rational individual with well-defined and unchanging preferences and always prefers more to less. (2) The goal of *H. economicus* is to allocate his/her limited resources in such a way as to maximize utility. (It is assumed that there exists a single-valued function by which utility may be measured.) (3) A reasonable approximation is that utility is derived from consuming goods and services. The larger the amount of goods and services consumed the larger is total utility. (4) The utility derived from consuming goods and services is accurately reflected in their market prices, or if not, prices can be adjusted to correct for the various sorts of market failure. (5) If more is always preferred to less, and if utility is equated to the monetary value of market goods, then it follows that the larger is NNP, the greater is the sum total of society's utility.

Economists are well aware of the limitations of the steps involved in moving from individual welfare maximization to a social welfare function based solely on market consumption. Robert Solow, for example, is quite specific that environmental goods

must be properly priced and all external effects of production and consumption must be accounted for. Although many conceptual difficulties are involved, in many situations and for many goods the above simplifications are not fatal. It is perhaps the success of the model of economic man in many market situations that has led economists to overlook the limitations of the analysis when applied to environmental features or human institutions. Before discussing this in more detail we need to take the final steps needed to reach the economic conditions of weak sustainability.

NNP is a measure of sustainable income given the state of the economy, including manufactured capital, natural resources, and human capital, at a particular moment in time, and therefore (6) NNP can be seen as the rate of return to society's investment in various kinds of capital. NNP is the interest on total capital stock (natural, manufactured, and human capital). If this is true, then (7) sustainability is achieved by maintaining the ability of the economy's capital stock to produce NNP (the so-called Hartwick-Solow rule for maintaining inter-generational equity). And, so the argument goes, just as the market for goods and services will "self-organize" to insure that the flows of economic goods go to their highest and best uses (if the prices are right), so too will the invisible hand of the market insure that capital investment will be efficiently distributed among the different kinds of capital stock.

Given the assumption that all types of capital are substitutable for one another, sustainability is not a biological or physical resource problem but rather a problem in portfolio management. Again, the only criteria for weak sustainability is that total capital stock--the ability of the economy to produce economic goods--must be non-decreasing. It allows for substitutability between natural, manufactured, and human capital, as long as there is no decline in welfare. From the perspective of an individual acting in a market context this may seem to be a rational approach to sustainability. As members of that particular form of human society centered around pervasive and well-organized economic markets, most of us do indeed receive our well-being from the output of the market economy. And since a dollar can be exchanged for a yen or a peso, these monetary units can be quickly transformed into the vast array of consumer goods and services that make us happy. Money as a universal medium of exchange institutionalizes the commensurability of wants.

Wilfred Beckerman points out that weak sustainability is a superfluous concept. There is nothing in its definition that adds anything to the basic neoclassical theory of welfare economics. In standard theory, a perfectly competitive economy, given the right price signals, will assure the Pareto optimal production and distribution of resources including environmental goods. In the weak sustainability framework there is nothing unique about features of the natural world. The services of nature are only valuable insofar as they contribute to economic output. They are mere commodities on the same footing as any other market good or productive input. The allocation of resources consistent with weak sustainability is no different than that achieved by a perfectly competitive economy with all externalities internalized. Weak sustainability does not impose any additional constraints on economic activity.

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Biographical Sketch

John M. Gowdy is professor of economics and director of the Ph.D. program in ecological economics at Rensselaer Polytechnic Institute in Troy, New York. He has been a Fulbright scholar in Vienna, Austria, and a visiting scholar at the Free University in Amsterdam, the University of Queensland, Australia, Tokushima University and Doshisha University, Japan, and the University of Zurich. He is the author of over 100 academic papers and eight books, including *Paradise for Sale: A Parable of Nature* (with Carl McDaniel; University of California Press, 2000), *Limited Wants, Unlimited Means: A Reader in Hunter-Gatherer Economics and the Environment* (Island Press, 1998), and *Economic Theory for Environmentalists* (with Sabine OHara; St. Lucie Press, 1995). His articles have appeared in the *Cambridge Journal of Economics*, *Ecological Economics*, *Environment and Planning A*, *Land Economics*, *The Journal of Regional Science*, *Structural Change and Economic Dynamics*, and *Review of Income and Wealth*.

Professor Gowdy's current research includes economic valuation of biodiversity and environmental theory and policy, economic anthropology, evolutionary models of economic change, and regional sustainable

economic development using social accounting matrices. His current work in regional sustainable development is funded by the Hudson River Foundation, the National Science Foundation, and the Center for Economic Growth of the Rockefeller Institute. The Hudson River project is a pilot program constructing an integrated assessment model of the interactions between economic change, land-use change, and ecosystem integrity in a tributary of the Hudson River. Professor Gowdy is also involved in a sustainable development project in the rural village of Umuluwe in southeastern Nigeria where he is investigating the interrelated issues of climate change, globalization, and poverty.

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