Steady-State Economics: A New Paradigm*

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That which seems to be wealth may in verity
be only the gilded index of far-reaching ruin.
John Ruskin, Unto this Last, 1862

How is the economy related to its environment, the ecosystem? The economy, in its physical dimensions, is a subsystem of the earth ecosystem. The ecosystem is finite, nongrowing, and closed. A “closed” system is one in which matter neither enters nor exits but in which energy does enter and exit. In the earth ecosystem solar energy enters and exits, and it is this throughput of energy that powers the material biogeochemical cycles on which life depends. Within this earth ecosystem the economy exists as an open subsystem. This means that both matter and energy enter from the larger system, and that both matter and energy exit back to the larger system. All physical processes of life and production are maintained by this metabolic flow-through (throughput) of matter-energy from and back to the environment. The economy lives off the environment in the same way that an animal does—by taking in useful (low-entropy) raw material and energy, and giving back waste (high-entropy) material and energy. The rest of the ecosystem, the part that is not within the economic subsystem (in other words, natural capital), absorbs the emitted wastes and, through biogeochemical cycles powered by the sun, reconstitutes much of the waste into reusable raw materials (see fig. 1a).

As the economic subsystem expands in its physical dimensions it assimilates into itself a larger and larger proportion of the total matter-energy of the earth ecosystem. More and more of total life space is converted into economic space—that is to say, living space for expanding populations and space taken over to provide sources

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Fig. 1a.

Fig. 1b.
of our raw materials and sinks for our waste materials. Consequently less and less life space remains outside the economy to provide the vital function of carrying out the biogeochemical cycles at the rates and through the pathways to which we are adapted (see fig. 1b). The earth develops without growing—that is, it evolves qualitatively without expanding quantitatively. The economy, as a subsystem of the earth, must at some scale adapt itself to this same pattern of "development without growth"—which is what should be understood by the popular term sustainable development. This is the paradigm or pre-analytic vision of steady-state economics.

In sharp contrast, the pre-analytic vision underlying standard economics (the neoclassical-Keynesian synthesis) is that the economy is an isolated system: a circular flow of exchange value between firms and households (see fig. 2). An "isolated" system is one in which neither matter nor energy enters or exits—it has no relation with its environment, and for all practical purposes has no environment. While this vision is useful for analyzing exchange between producers and consumers, and related questions of price and income determination, it is quite useless for studying the relation of the economy to the environment. It is as if a biologist's vision of an animal contained only a circulatory system but no digestive tract. The animal would be an isolated system. It would be completely independent of its environment. If it could move it would be a
perpetual motion machine. As long as the economic subsystem was small relative to the earth ecosystem it was acceptable to abstract from the larger system since its services were not scarce. But now “full world” economics must replace “empty world” economics.

The isolated system pre-analytic vision, the one that supports most economic analysis today, takes the economy as the total system, unconstrained in its growth by anything. Nature may be finite but it is just a sector of the economy for which other sectors can substitute without limiting overall growth of the economy in any important way. If the economy is seen as an isolated system then there is no environment to constrain its continual growth. But if we see it as a subsystem of a larger but finite and nongrowing ecosystem, then obviously its growth is limited. The economy may continue to develop qualitatively without growing quantitatively, just as the planet Earth does, but it cannot continue to grow—in other words, beyond some point it must approximate a steady state in its physical dimensions.

An economy in sustainable development, a steady-state economy, is one whose scale (that is, resource throughput, equal to population times per capita resource use) remains constant at a level that neither depletes the environment beyond its regenerative capacity nor pollutes it beyond its absorptive capacity. Such an economy adapts and improves in knowledge, organization, technical efficiency, and wisdom; and it does this without assimilating or accreting an ever greater percentage of the matter-energy of the ecosystem into itself, but rather stops at a scale at which the remaining ecosystem (the environment) can continue to function and renew itself year after year. The nongrowing economy is not static—it is being continually maintained and renewed as a steady-state subsystem in dynamic equilibrium with its environment.

If we accept the pre-analytic vision of steady-state economics (economy as subsystem), then the first analytic questions that come to mind are: How big is the subsystem relative to the total system? How big can it be? How big should it be? Since these questions do not arise under the standard growth paradigm we have no good answers for them. That is why we need steady-state economics.

Growth of the subsystem is further limited by the complementary relation between manmade and natural capital. If the two forms of capital were good substitutes, then natural capital could be totally replaced by manmade, and the only limit to expansion of manmade capital would be the finitude of the containing system. But in fact manmade capital loses its value without a complement of natural capital. What good is the manmade capital of fishing boats without the natural capital of fish populations? Sawmills without forests?
And even if we could convert the whole ocean into a catfish pond we would still need the natural capital of solar energy, photosynthetic organisms, nutrient recyclers, and so forth. The neoclassical economists’ emphasis on substitution to the eclipse of complementarity in technical relations among factors of production seems a reflection of their preference for competition (substitution) over cooperation (complementarity) in social relations.

There is such a thing as a maximum scale of the economic subsystem—a point beyond which the total system collapses under the demands of its too-large subsystem. Before that point there is an optimal scale—a point beyond which further physical growth, while possible, costs more than it is worth. An optimal scale, beyond which growth is antieconomic, exists even if we think of the non-human part of creation as having only instrumental value to humans and no intrinsic value in its own right. If we recognize intrinsic value in other creatures, in addition to their instrumental value to us, then the optimal scale of the human niche would be smaller than if we recognized only instrumental value. A man is worth many sparrows, but a corollary is that a sparrow’s worth cannot be zero. Since growth beyond the optimal scale increases ecological costs faster than production benefits it makes us poorer, not richer, thereby reducing our ability to cure poverty, and even creating more poverty. The belief that growth is the cure to poverty is an evasion of the real but politically unpopular cures, namely, sharing and population control.

The frequent call for more growth so that we can afford to pay the costs of environmental repair and poverty alleviation simply assumes that growth in GNP is making us richer when that is the very question at issue. No one doubts that all our problems would be easier to solve if we were truly richer—the issue is whether growth as currently measured and from the present margin really makes us richer or is making us poorer.1

Some quantitative idea of the present size of the economy relative to the earth ecosystem is given by the estimate that we humans currently preempt about forty percent of the net primary product of solar energy captured by land-based ecosystems.2 There is abundant evidence that even the present scale of the economic subsystem is unsustainable by the remainder of the ecosystem and that further physical expansion of the economy (current doubling time is about 40 years) is diminishing the capacity of the earth to support life. This destruction of carrying capacity means a reduction in the cumulative number of lives ever to be lived over time in conditions of material sufficiency for a good life. Once “economic” growth
increases ecological costs faster than production benefits, it becomes in truth antieconomic growth, impoverishing rather than enriching, and its measure, GNP, indeed becomes “a gilded index of far-reaching ruin.”

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NOTES

1 For evidence that GNP growth in the United States over the past decade has indeed been associated with declining welfare, see Appendix on the Index of Sustainable Economic Welfare, in Herman Daly and John Cobb, For the Common Good (Boston, 1989).
