ECONOMICS, ECOLOGY, ETHICS

ESSAYS TOWARD A STEADY-STATE ECONOMY

Edited by HERMAN E. DALY

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PREFACE

As students often realize more quickly than their professors, we absolutely must revise our economic thinking so that it will be more in conformity with the finite energy and resource limits of the earth, and with the finite limits of man's stomach. This book seeks to present a single, coherent point of view —that of a steady-state economy—which is based on both physical and ethical first principles. This particular theoretical viewpoint seems to me (and to many other people) to be the one that is fundamentally correct and therefore most likely to yield useful insights and policies.

The development of a steady-state economy will be the product of an unpredictable but conscious social evolution in which many ideas will be tried out. However, just as an auctioneer must begin by calling out some specific price, so it seems we must begin by calling out some specific notions about a steady-state economy, even though we know that they are no more likely to be the final solution than the auctioneer's initial price is likely to be equilibrium price. Yet both initial actions provide starting points for a feedback process of approximation, by trial and error, to something better.

This book began as a second edition of *Toward a Steady-State Economy* but ended up somewhere between a revised edition and a new book. Roughly sixty percent of the material is new, and much of the retained forty percent has been revised. Although most of the book is different, the basic core and

structure are the same. Therefore, "truth in labeling" would seem to forbid calling it either a revised edition or a new book. This dilemma was resolved by giving the book a new title indicating its coverage of subjects while using the old title as a subtitle to indicate both the thrust and the connection with the earlier book.

The dominant perspective of this book is that of economics, but a much expanded economics. Standard economics confines its attention to the study of how best to allocate given means among given ends. It does not inquire very deeply into the nature of means or the nature of ends. Yet, without a clear conception of the basic means at our disposal—of what in the physical world is the ultimately useful stuff that we must use up and cannot ourselves create—our narrow economics is likely to commit the error of wishful thinking (assuming that just because something is desirable it must also be possible). Likewise, unless we inquire into the nature of ends and face the questions of ultimate value, ethics, and the ranking of our ends, we are likely to commit the opposite error, that of technical determinism (assuming that just because something is possible it must also be desirable). Scarcity will still force hard choices among desirable possibilities, so there remains ample scope for standard economics.

The extension of economics into the biophysical world (Part I, on ecology) is a corrective to wishful thinking, while Part II, ethics, is a corrective to technical determinism. Part III, on economics, offers some materials from which we might begin to construct an improved economics free of both wishful thinking and technical determinism.

Each of the articles deals to some extent with all three areas—ecology, ethics, and economics. The grouping of the articles into three parts is according to emphasis rather than total content and is sometimes rather arbitrary. The interrelationships among ecology, ethics, and economics are far from arbitrary, however, and are discussed in the Introduction. Readers will not be surprised to find occasional disagreements among so diverse a group of thinkers. The minimum consensus among them is that economic growth can easily end up costing more than it is worth. Beyond that, especially regarding the alternative to the growth economy, there is a complex mixture of varying degrees of agreement, disagreement, and silence.

As editor, I have provided a relatively long introduction to the general subject, short introductions to each of the three parts, and a postscript for clearing up some misconceptions and replying to several critics of the steady-state position.

November 1979

Herman E. Daly
Baton Rouge, Louisiana

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CONTENTS

INTRODUCTION TO THE STEADY-STATE ECONOMY

Herman E. Daly

PARADIGMS IN POLITICAL ECONOMY

This book is a part of an emerging paradigm shift in political economy. The terms *paradigm* and *paradigm shift* come from Thomas Kuhn's insightful book *The Structure of Scientific Revolutions,*[1] in which Kuhn explores the ways that entire patterns of thought—a kind of gestalt for which he uses the word *paradigm*—are established and changed. Kuhn contends that paradigm shifts—occasional discontinuous, revolutionary changes in tacitly shared points of view and preconceptions of science—are an integral part of scientific thought. They form the necessary complement to *normal science,* which is what Kuhn calls the day-to-day cumulative building on the past, the puzzle solving, and the refining of models that fit within the paradigm shared by all the scientists of a particular discipline. Indeed, science students are taught to accept the prevailing paradigm so their work will adhere to the same designs, rules, and standards, thus assuring the *cumulative* building of knowledge.

Part of the introduction was originally published in *The Patient Earth,* John Harte and Robert H. Socolow, eds. Adapted and reprinted by permission of the editors.

Just as we are unconscious of the lenses in our own eyeglasses until we have trouble seeing clearly, so we are unconscious of paradigms until the clarity of scientific thought becomes blurred by anomaly. Even under the stress of facts that do not seem to fit, paradigms are not easily abandoned. If they were, the cohesion and coherence necessary to form a scientific *community* would be lacking. Most anomalies, after all, do become resolved within the paradigm; they must, if the paradigm is to command the loyalty of scientists. To abandon one paradigm in favor of another is to change the entire basis of intellectual community among the scientists within a discipline, which is why Kuhn calls such changes scientific revolutions. Discontinuous with the preceding paradigm, a new paradigm must at first rely on its own criteria for justification, for many of the questions that can be asked and many of the answers that can be found are likely to be absent from the previous paradigm. Indeed, even logical debate between adherents of different paradigms is often very limited, for proponents of two paradigms may not agree on what is a problem and what is a solution.

The history of science contains numerous examples of anomalies that brought crisis to old paradigms and were answered with new ones. Shall we take the earth or the sun as the center of our cosmos? Does a stone swinging on a string represent constrained fall or pendulum motion? Are species fixed or slowly evolving? And problems arise in political economy that may require more than normal puzzle solving. Shall we conceive of economic growth as a permanent normal process of a healthy economy or as a temporary passage from one steady state to another? Shall we take the flow of income or the stock of wealth as the magnitude most directly responsible for the satisfaction of human wants? Shall we conceive of land, labor, and capital as each being productive, and think in terms of three sources of value, or shall we conceive of labor as the only productive factor, the only source of value, and find that land and capital enhance the productivity of labor?

In a way, it all depends on how we want to look at it. And yet, there is far more to it than that. Which point of view is simpler or more appealing aesthetically? Which removes the intellectually or socially most vexing anomalies? Which is likely to suggest the most interesting and fruitful problems for future research? These kinds of criteria are not reducible to logical or factual differences. They involve a gestalt, an element of faith, personal commitment, and values.

That revolutionary paradigm shifts, both large ones and small ones, are historically and logically descriptive of the physical sciences has been admirably shown by Kuhn in his book and by Arthur Koestler in *The Sleepwalkers*.[2] Michael Polanyi takes a related viewpoint in his admirable book *Personal Knowledge*.[3] The focus of all three writers is physical science, and Koestler focuses especially on astronomy. But scientific revolutions characterize all of science, including political economy. Since values are a larger part of social

science and also influence the acceptance or rejection of paradigms, such shifts may be even more characteristic of the social sciences.

The history of economic thought brings several such shifts to mind.

In the mercantilist paradigm of the Renaissance period, wealth meant precious metal, treasure easily convertible into armies and national power. The way to attain wealth was from mines or from a favorable balance of international trade. The implication of this paradigm was that the way to riches was to devote a nation's labor power to digging up metal that had no other use than as coinage, or to making goods to be given to foreigners in exchange for such minimally useful metal. Moreover, maintaining a surplus balance of trade required low prices on goods exported for sale in competitive markets, which meant low wages to home workers inasmuch as labor was the major cost of production. Making sure that the supply of laborers was large was one means of keeping wages low. The anomalous outcome was that, for a mercantilist nation to be "wealthy," it needed a large number of poor laborers.

The physiocrats of mid-eighteenth-century France—the first economic theorists—tried to explain economics in accordance with natural law and saw agriculture and Mother Earth as the source of all net value. Reproduction of plants and animals provided the paradigm by which all other increase in wealth was understood. Money was sterile. The concept that it "reproduced" through interest was rejected, because it did not fit the paradigm. But the anomaly of interest did not disappear, and the process of tracing all net value back to land became very complex.

The classical economists, witnesses to the problems of mercantilism as well as the beginnings of the Industrial Revolution, saw labor as the source of wealth and division of labor and improvement in the "state of the arts" as the source of productivity. Their main concern was how the product of labor got distributed among the social classes that cooperated to produce it. Adam Smith believed that an "invisible hand"—competition—would control the economy and that a certain natural order would keep atomistic individuals from exploiting each other, thereby harnessing individual self-interest to the social good. Classical economists thought that, over the long run, population growth and diminishing returns would unavoidably channel the entire economic surplus into rent, thus reducing profit to zero and terminating economic growth. What was anomalous about classical economics was not iits long-run implications, however, but the then-existing misery of the working class, misery which gave the lie to the belief that the invisible hand could effectively prevent exploitation.

Karl Marx was largely a classical economist, to the extent that he saw labor as the source of net economic product. But in place of atomistic individuals acting in natural harmony and short-run cooperation among three classes —landlords, laborers, and capitalists—Marx saw two classes in direct day-to-day conflict: the owners of the means of production and the nonowners. The

owners kept the net product of labor, paying the workers only what their replacement would cost. Atomistic competition would continue to exist *within* each class; but the essential idea of Marxist economics is the exploitative relation *between* classes, which Marx believed would lead to revolution. The earlier classical economists recognized the likelihood of long-run class conflicts, but Marx emphasized this as a central economic factor. This emphasis constituted a paradigm shift.

The neoclassical economists shifted the paradigm back to atomism, though adding an analysis of imperfect competition as they did so. Their big change, however, was to conceive of net value as the result of psychic want satisfaction rather than the product of labor. The origin of value was subjective, not objective. The focus was not on distribution among classes but on efficiency of allocation—how could a society get the maximum amount of want satisfaction from scarce resources, *given* a certain distribution of wealth and income among individuals and social classes? Pure competition provided the optimal allocation.

John Maynard Keynes, observing the economic problems of the 1930s, could not accept the anomaly presented by the wide disuse of resources that were supposed to be optimally allocated. He was less concerned that resources be "optimally" allocated in some refined sense than that they should not lie unused. Classical and neoclassical economics, with Say's Law among their premises, required that unemployment be viewed as an aberration. Social reality, however, insisted that unemployment was central. Keynes changed the theoretical viewpoint accordingly.

The present-day Keynesian-neoclassical synthesis seeks full macroeconomic employment and optimal microeconomic allocation of resources. The *summum bonum* to be maximized is no longer psychic want satisfaction, which is unmeasurable, but annual aggregate real output, GNP—Gross National Product—a value index of the quantity flow of annual production. Distribution recedes into the background; the goal becomes to make the total pie bigger, thereby enabling everyone to get absolutely more without changing the relative size of parts. Both full employment and efficient allocation serve to increase the growth of real GNP. Conversely, and perhaps more importantly, growth of GNP is necessary to maintain full employment. In one of the first important contributions to growth theory, Evesy Domar stated the issue very well:

> The economy finds itself in a serious dilemma: if sufficient investment is not forthcoming today, unemployment will be here today. But if enough is invested today, still more will be needed tomorrow.
>
> It is a remarkable characteristic of a capitalistic economy that while, on the whole, unemployment is a function of the difference between its actual income and its productive capacity, most of the measures (i.e., investment) directed toward raising national income also enlarge productive capacity. It is very likely that the increase in national income will be greater than that of capacity, but the

> whole problem is that the increase in income is temporary and presently peters out (the usual multiplier effect), while capacity has been increased for good. So far as unemployment is concerned, investment is at the same time a cure for the disease and the cause of even greater ills in the future.[4]

Thus, continual growth in both capacity (stock) and income (flow) is a central part of the neoclassical growth paradigm. But in a finite world continual growth is impossible.[5] Given finite stomachs, finite lifetimes, and the kind of man who does not live by bread alone, growth becomes undesirable long before it becomes impossible. But the tacit, and sometimes explicit, assumption of the Keynesian-neoclassical growthmania synthesis is that aggregate wants are infinite and should be served by trying to make aggregate production infinite, and that technology is an omnipotent *deus ex machina* who will get us out of any growth-induced problems.

To call the ideas and resultant changes hastily sketched above *paradigm shifts* is to use Kuhn's term with a bit of poetic license. In the physical sciences, to which Kuhn applied the term, reality does not change except on an evolutionary time scale. The *same* things are perceived in different ways. But social reality changes more rapidly. This, however, can be viewed as an additional reason for the periodic necessity, in the social sciences, of regrinding our lenses to a new prescription.

Ideology, ethical apology, and ethical criticism are also sources of paradigm shifts in the social sciences. As Marx said, the goal is not just to interpret the world but to change it. And he was right. Even if we wish to be neutral or "value-free," we cannot, because the paradigm by which people try to understand their society is itself one of the key determining features of the social system. No one denies that the distinction between *is* and *ought* is an elementary rule of clear thinking. To say *is* when we should say *ought* is wishful thinking. To say *ought* when we should say *is* (or never to say *ought* at all) is apology for the status quo. But these distinctions belong in the mind of the individual thinker. They are not proper lines for division of labor between individuals, much less between professions. Attempts to divide thought in this way contribute heavily to the schizophrenia of the modern age.

Kuhn notes that paradigm shifts are usually brought about by the young or by people new to a discipline, those relatively free of the established preconceptions. Accordingly, we find that thought on a steady-state economy has been more eagerly received by physical scientists and biologists than economists and by the relatively young among economists. The interests of the physical and life sciences in the issue of growth versus steady state is evident from the program of the American Association for the Advancement of Science (AAAS) 1971 meetings. Consider the following report:

> Another way of interpreting the content of the AAAS meeting is to describe major themes that keep recurring. . . . Three topics appear this year in a variety of forms and contexts. They seek answers to:

> How to live on a *finite* earth?
> How to live a *good life* on a finite earth?
> How to live a good life on a finite earth *at peace and without destructive mismatches?*[6]

The many sessions in which these themes appear are then listed, including the presidential address.

Simultaneously with the AAAS meetings in Philadelphia, the American Economic Association (AEA) held meetings in New Orleans, where, judging from the detailed program, not one of these questions was even on the agenda. Yet the question "How to live a *good* life on a *finite* earth?" would seem to be of more direct concern to economists than to physicists and biologists. Why this striking discrepancy? Do economists have more important questions on their minds? I think not. It is simply that economists must undergo a revolutionary paradigm shift and sacrifice large intellectual (and material?) vested interests in the perpetual growth theories and policies of the last thirty years before they can really come to grips with these questions. The advantage of the physical scientists is that, unlike economists, they are viscerally convinced that the world is a finite, open system at balance in a near steady state, and they have not all invested time and energy in economic growth models. As Kuhn points out,

> Scientific revolutions . . . need seem revolutionary only to those whose paradigms are affected by them . . . astronomers, for example, could accept X-rays as a mere addition to knowledge, for their paradigms were unaffected by the existence of the new radiation. But for men like Kelvin, Crookes, and Roentgen, whose research dealt with radiation theory or with cathode ray tubes, the emergence of X-rays necessarily violated one paradigm as it created another. That is why these rays could be discovered only by something's first going wrong with normal research.[7]

A steady-state economy fits easily into the paradigm of physical science and biology—the earth approximates a steady-state open system, as do organisms. Why not our economy also, at least in its physical dimensions of bodies and artifacts? Economists forgot about physical dimensions long ago and centered their attention on value. But the fact that wealth is measured in value units does not annihilate its physical dimensions. Economists may continue to maximize value, and value could conceivably grow forever, but the physical mass in which value inheres must conform to a steady state, and the constraints of physical constancy on value growth will be severe and must be respected.

Perhaps this explains why many of the essays in this volume on political economy were written by physicists and biologists. But lest I be unfair to my own profession, I must observe that some leading economists, particularly Kenneth Boulding and Nicholas Georgescu-Roegen, have made enormous contributions toward reorienting economic thought along lines more congruent with a finite physical world. It is time for the profession to follow their lead.[8]

ENDS, MEANS, AND ECONOMICS

Chemistry has outgrown alchemy, and astronomy has emerged from the chrysalis of astrology, but the moral science of political economy has degenerated into the amoral game of politic economics. Political economy was concerned with scarcity and the resolution of the social conflicts engendered by scarcity. Politic economics tries to buy off social conflict by abolishing scarcity—by promising more things for more people, with less for no one, for ever and ever—all vouchsafed by the amazing grace of compound interest. It is not politic to remember, with John Ruskin,

> the great, palpable, inevitable fact—the root and rule of all economy—that what one person has, another cannot have; and that every atom of substance, of whatever kind, used or consumed, is so much human life spent; which if it issue in the saving present life or the gaining more, is well spent, but if not is either so much life prevented, or so much slain.[9]

Or, as Ruskin more succinctly put it in the same discussion, "there is no wealth but life."

Nor is it considered politic economics to take seriously the much more compelling demonstration of the same insight by Georgescu-Roegen, who has made us aware that

> the maximum of life quantity requires the minimum rate of natural resources depletion. By using these resources too quickly, man throws away that part of solar energy that will still be reaching the earth for a long time after he has departed. And everything that man has done in the last two hundred years or so puts him in the position of a fantastic spendthrift. There can be no doubt about it: any use of natural resources for the satisfaction of nonvital needs means a smaller quantity of life in the future. If we understand well the problem, the best use of our iron resources is to produce plows or harrows as they are needed, not Rolls Royces, not even agricultural tractors.[10]

Significantly, the masterful contribution of Georgescu-Roegen is not so much as mentioned in the *Journal of Economic Literature*'s 1976 survey of the literature on environmental economics. The first sentence of that survey beautifully illustrates the environmental hubris of growth economics: "Man has probably always worried about his environment because he *was once* totally dependent on it" (emphasis added).[11] Contrary to the implication, our dependence on the environment is still total, and it is overwhelmingly likely to remain so. Nevertheless, Robert Solow suggests that, thanks to the substitutability of other factors for natural resources, it is not only conceivable but likely that "the world can, in effect, get along without natural resources."[12] In view of such statements, it is evidently impossible to insist too strongly that, in Frederick Soddy's words,

> life derives the whole of its physical energy or power, not from anything self-contained in living matter, and still less from an external diety, but solely

> from the inanimate world. It is dependent for all the necessities of its physical continuance primarily upon the principles of the steam-engine. The principles and ethics of human convention must not run counter to those of thermodynamics.[13]

Lack of respect for the principles of the steam engine also underlies the basic message of the very influential book *Scarcity and Growth,* by Harold Barnett and Chandler Morse. We are told that "nature imposes particular scarcities, not an inescapable general scarcity," and we are asked to believe that

> advances in fundamental science have made it possible to take advantage of the uniformity of matter/energy—a uniformity that makes it feasible, without preassignable limit, to escape the quantitative constraints imposed by the character of the earth's crust. . . . Science, by making the resource base more homogeneous, erases the restrictions once thought to reside in the lack of homogeneity. In a neo-Ricardian world, it seems, the particular resources with which one starts increasingly become a matter of indifference. The reservation of particular resources for later use, therefore, may contribute little to the welfare of future generations.[14]

Unfortunately for the politic economics of growth, it is not the uniformity of matter-energy that makes for usefulness but precisely the opposite. If all materials and all energy were uniformly distributed in thermodynamic equilibrium, the resulting "homogeneous resource base" would be no resource at all. It is nonuniformity—differences in concentration and temperature—that make for usefulness. The mere fact that all matter-energy may ultimately consist of the same basic building blocks is of little significance if it is the *potential for ordering those blocks* that is ultimately scarce, as the entropy law tells us is the case. Only at Maxwell's Sorting Demon[15] could turn a lukewarm soup of electrons, protons, neutrons, quarks, and whatnot into a resource. And the entropy law tells us that Maxwell's demon does not exist. In other words, nature really *does* impose "an inescapable general scarcity,'' and it is a serious delusion to believe otherwise.

The differences in viewpoint cited above could hardly be more fundamental. It seems necessary, therefore, to start at the very beginning if we are to root out the faddish politic economics of growth and replant the traditional political economy of scarcity. Standard textbooks have long defined economics as the study of the allocation of scarce means among competing ends; thus a reconsideration of ends and means will provide our starting point. Modern economics' excessive devotion to growth will be explained in terms of an incomplete view of the total ends-means spectrum. The arguments of the two main traditions—the "scarce means arguments" and the "competing higher ends arguments"—provide the basic organizing principle for this volume.

In the largest sense, humanity's ultimate economic problem is to use ultimate means wisely in the service of the Ultimate End. It is thus not hard to understand our tendency to divide up the single, overwhelming problem into a number of smaller subproblems, as illustrated in Figure I.1. This is a good