

ECONOMICS, ECOLOGY, ETHICS

ESSAYS TOWARD A STEADY-STATE ECONOMY

Edited by

Herman E. Daly
Louisiana State University



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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.

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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 its 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 Demon¹⁵ 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

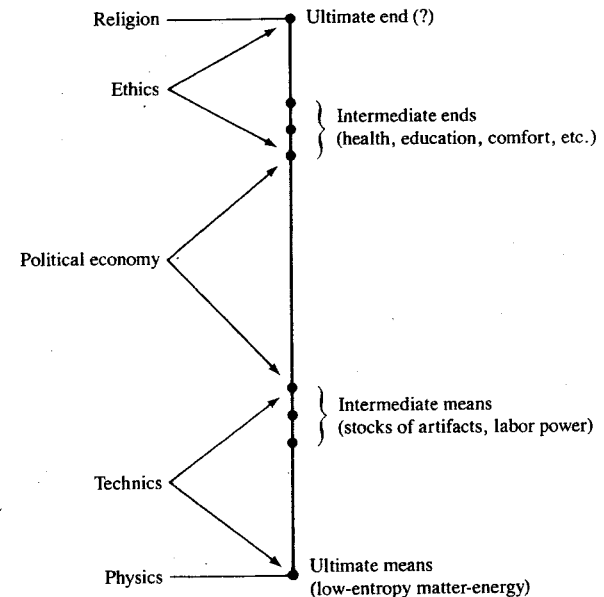


FIGURE I.1

Ends-means spectrum.

procedure as long as we do not forget about other parts of the spectrum in our zeal to solve the problem of one segment.

At the top of the spectrum is the Ultimate End—that which is intrinsically good and does not derive its goodness from any instrumental relation to some higher good. At the bottom is ultimate means, the useful stuff of the world, low-entropy matter-energy, which we can only use up and cannot create or replenish, and whose net production, therefore, cannot possibly be the end of any human activity. Each intermediate category on the spectrum is an end with respect to lower categories and a means with respect to higher categories. Below the Ultimate End we have a hierarchy of intermediate ends, which are in a sense means in the service of the Ultimate End. Intermediate ends are ranked with reference to the Ultimate End. The mere fact that we speak of priorities among our goals presumes a first place, an ordering principle, an Ultimate End. We may not be able to define it very well, but logically we are forced to recognize its existence. Above ultimate means are intermediate means (physical stocks), which can be viewed as ends directly served by the use of ultimate means (the entropic flow of matter-energy, the *throughput*).

On the left of the spectrum line are listed the traditional disciplines of study that correspond to each segment of the spectrum. The central, intermediate position of economics is highly significant. In looking only at the middle

range, economics has naturally not dealt with ultimates or absolutes, which are found only at the extremes, and has falsely assumed that the middle-range pluralities, relativities, and substitutabilities among competing ends and scarce means were representative of the whole spectrum. Absolute limits are absent from the economists' paradigm because absolutes are encountered only in confrontation with the ultimate poles of the spectrum, which have been excluded from the focus of our attention. Even ethics and technics exist for the economist only at the very periphery of professional awareness.

In terms of this diagram, economic growth implies the creation of ever more intermediate means (stocks) for the purpose of satisfying ever more intermediate ends. Orthodox growth economics, as we have seen, recognizes that particular resources are limited but does not recognize any general scarcity of all resources together. The orthodox dogma is that technology can always substitute new resources for old, without limit. Ultimate means are not considered scarce. Intermediate means are scarce, it is argued, only because our capacity to transform ultimate means has not yet evolved very far toward its unlimited potential. Growth economists also recognize that any single intermediate end or want can be satisfied for any given individual. But new wants keep emerging (and new people as well), so the aggregate of all intermediate ends is held to be insatiable, or infinite in number if not in intensity. The growth economists' vision is one of continuous growth in intermediate means (unconstrained by any scarcity of ultimate means) in order to satisfy ever more intermediate ends (unconstrained by any impositions from the Ultimate End). Infinite means plus infinite ends equals growth forever.

A consideration of the ultimate poles of the spectrum, however, gives us a very different perspective, forcing us to ask two questions: (1) What, precisely, are our ultimate means, and are they limited in ways that cannot be overcome by technology? (2) What is the nature of the Ultimate End, and is it such that, beyond a certain point, further accumulation of intermediate means (bodies and artifacts) not only fails to serve the Ultimate End but actually renders a disservice? It will be argued in this volume that the answer to both sets of questions is *yes*. The absolute scarcity of ultimate means limits the *possibility* of growth (Part I). The competition from other ends, which contribute more heavily at the margin toward the Ultimate End, limits the *desirability* of growth (Part II). Moreover, the interaction of desirability and possibility provides the *economic* limit to growth, which is the most stringent, and should be the governing, limit (Part III).

Paradoxically, growth economics has been both too materialistic and not materialistic enough. In ignoring the ultimate means and the laws of thermodynamics, it has been insufficiently materialistic. In ignoring the Ultimate End and ethics, it has been too materialistic.

Critics of growth can be classified into ends-based (moral) and means-based (biophysical). Many writers are, to some extent, in both traditions. This is to

be expected, because the two traditions are not as logically independent as may at first appear. For example, many moral issues regarding distributive justice and intergenerational equity hardly arise if one believes that continual economic growth is biophysically possible. Likewise, if one's arena of moral concern excludes the poor, future generations, and subhuman life, then many biophysical constraints are no longer of interest. To crack the nut of growth mania, it is not enough to hammer from above with moral arguments, because there is sufficient "give" underneath for optimistic biophysical assumptions to cushion the blow (space colonies, green revolutions, breeder reactors, etc.) Hammering only from below with biophysical arguments leaves too much room for elastic morality to absorb the blow. (The interest rate automatically looks after the future; growth itself is the Ultimate End, or as close as we can come to it; our manifest destiny is to colonize space as the earth is a mere dandelion gone to seed; etc.) Growth chestnuts have to be placed on the unyielding anvil of biophysical realities and then crushed with the hammer of moral argument. The entropy law and ecology provide the biophysical anvil. Concern for future generations and subhuman life and inequities in current wealth distribution provide the moral hammer.

Human beings are both material creatures in absolute dependence upon their physical environment and rational beings who have purposes and strive to become better. These two aspects must be consistent with each other. Improvement presupposes survival, and survival in an entropic and evolving world is impossible without continual striving for improvement. Biophysically based conclusions about economic growth, or any other subject, should be in accord with morally based conclusions. A discrepancy indicates a flawed understanding of the natural world or a warped set of values. That ends-based and means-based arguments should converge in their rejection of growthmania is both comforting and not unexpected.

The overall problem is how to use ultimate means to serve best the Ultimate End. We might call this ultimate political economy, or *stewardship*. To state the problem in this way is to emphasize at once both its wholeness and the necessity of breaking it into more manageable subproblems, for the overall problem must be tackled one step at a time. Yet one step is valueless without the others, and one correct step is worse than valueless if the steps it takes for granted were false steps. If our concept of the Ultimate End is evil rather than good, then an inverted ethics is better for us than a consistent ethics. If our ethical priorities are upside down, then an inverted or incorrect imputation of value to intermediate means is better than a correct imputation. If our intermediate means are incorrectly valued, then a technology that efficiently and powerfully converts ultimate means into the most valuable intermediate means is worse than a weak technology. And an erroneous physics that will cause technology to stumble rather than advance an evil end efficiently is better than a correct physics.

The parts of the total economic problem are related not only from the top down but also from the bottom up. Our customary ethical ordering of intermediate ends conditions our perception of the Ultimate End. We tend to take our conventional priorities as given and then deduce the nature of the Ultimate End as that which legitimates the conventional priorities. We tend also to order our intermediate ends in such a way that we can effectively serve them with the existing evaluation of intermediate means. Further, there is a tendency to value the intermediate means according to the technical and physical possibilities for producing them. If it is possible, we must do it.

I do not mean to say that working only in one direction is always proper and in the other always improper. The point is that the parts of the problem are highly interrelated and cannot be dealt with in isolation, and, even though ideally our starting point should be the Ultimate End, we can only see that end dimly and may find clues to its nature in our experience with ethical, economic, and even technical problems encountered on the way.

The total problem of relating the five subproblems—theology, ethics, political economy, technology, physics—is more delicate than any of the subproblems themselves, but not for that reason any less imperative. Surely we must have a vision of the total problem, otherwise we do not understand what our specialties are. It is hoped that the collection of articles in this book will help to fill out such a total vision. Clearly, each stage can be dealt with only in a partial and incomplete manner. But the premise on which this volume rests is that it is better to deal incompletely with the whole than to deal wholly with the incomplete.

Let us now turn to an overview of the particular paradigm this collection seeks to develop, one that will lead to a steady-state economy. The terms *steady state* and *stationary state* are used synonymously. The former is common in physical sciences, the latter common in economics and demography.

THE STEADY-STATE ECONOMY

Any discussion of the relative merits of the steady, stationary, or no-growth economy, and its opposite, the economy in which wealth and population are growing, must recognize some important quantitative and qualitative differences between rich and poor countries and between rich and poor classes within countries. To see why this is so, consider the familiar ratio of Gross National Product (GNP) to total population (P). This ratio, per capita annual product (GNP/P), is the measure usually employed to distinguish rich from poor countries, and, in spite of its many shortcomings, it does have the virtue of reflecting in one ratio the two fundamental life processes of production and reproduction. Let us ask two questions of both numerator and denominator for both rich and poor countries—namely, what is the quantitative rate of growth; and, qualitatively, exactly what is it that is growing?

1. The rate of growth in the denominator, P, is much higher in poor countries than in rich countries. Although mortality is tending to equality at low levels throughout the world, fertility¹⁶ in poor nations remains roughly *twice* that of rich nations. The average Gross Reproduction Rate (GRR)¹⁷ for rich countries is around 1.5, and that for poor countries is around 3.0 (that is, on the assumption that all survive to the end of reproductive life, each mother would be replaced by 1.5 daughters in rich countries and 3 in poor countries). Moreover, all poor countries have a GRR greater than 2.0, and all rich countries have a GRR less than 2.0, with practically no countries falling in the area of the 2.0 dividing point. No other social or economic index divides the world so clearly and consistently into “developed” and “underdeveloped” as does fertility.¹⁸

2. Qualitatively, the incremental population in poor countries consists largely of hungry illiterates; in rich countries it consists largely of well-fed members of the middle class. The incremental person in poor countries contributes negligibly to production but makes few demands on world resources—although from the point of view of his poor country, these few demands of many new people can easily dissipate any surplus that might otherwise be used to raise productivity.¹⁹ The incremental person in the rich country contributes to his country's GNP, and to feed his high standard of living contributes greatly to depletion of the world's resources and pollution of its spaces.

3. The numerator, GNP, has grown at roughly the same rate in rich and poor countries, around 4 or 5 percent annually, with the poor countries probably growing slightly faster. Nevertheless, because of the poor countries' more rapid population growth, their per capita income has grown more slowly than that of rich countries. Consequently, the gap between rich and poor has widened.²⁰

4. The incremental GNP of rich and poor nations has an altogether different qualitative significance. This follows from the two most basic laws of economics: (a) the law of diminishing marginal utility, which really says nothing more than that people satisfy their most pressing wants *first*—thus each additional dollar of income or unit of resource is used to satisfy a less pressing want than the previous dollar or unit; and (b) the law of increasing marginal cost, which says that producers *first* use the best qualities of factors (most fertile land, most experienced worker, and so on) and the best combination of factors known to them. They use the less efficient (more costly) qualities and combinations only when they run out of the better ones, or when one factor, such as land, becomes fixed (nonaugmentable). Also, in a world of scarcity, as more resources are devoted to one use, fewer are available for other uses. The least important alternative uses are sacrificed first, so that as more of any good is produced, progressively more important alternatives must be sacrificed; that is, a progressively higher price (opportunity cost) must be paid. Applied to GNP, the first law means that the marginal (incremental) benefits from equal increments of output are decreasing, and the second law means that the marginal cost of equal increments in output is increasing.

At some point, perhaps already passed in the United States, an extra unit of GNP costs more than it is worth. Technological advances can put off this point, but not forever. Indeed, they may bring it to pass sooner because more powerful technologies tend to provoke more powerful ecological backlashes and to be more disruptive of habits and emotions. To put things more concretely, growth in GNP in a poor country means more food, clothing, shelter, basic education, and security, whereas for the rich country it means more electric toothbrushes, yet another brand of cigarettes, more tension and insecurity, and more force-feeding through more advertising. In sum, extra GNP in a poor country, assuming it does not go mainly to the richest class of that country, represents satisfaction of relatively basic wants, whereas extra GNP in a rich country, assuming it does not go mainly to the poorest class of that country, represents satisfaction of relatively trivial wants.

For our purposes, the upshot of these differences is that, for the poor, growth in GNP is still a good thing, but for the rich it is probably a bad thing. Growth in population, however, is a bad thing for both: For the rich, population growth is bad because it makes growth in GNP (a bad thing) less avoidable. For the poor, population growth is bad because it makes growth in GNP, and especially in per capita GNP (a good thing), more difficult to attain. We shall be concerned in this book mainly with a rich, affluent-effluent economy such as that of the United States. Our purposes will be to define more clearly the concept of steady state, to see why it is necessary, to consider its economic and social implications, and finally to comment on an emerging political economy of finite wants and nongrowth.

THE NATURE AND NECESSITY OF THE STATIONARY STATE

The term *stationary state* (steady state) is used here in its classical sense.²¹ Over a century ago, John Stuart Mill, the great synthesizer of classical economics, spoke of the stationary state in words that could hardly be more relevant today, and they will serve as the starting point in our discussion.

But in contemplating any progressive movement, not in its nature unlimited, the mind is not satisfied with merely tracing the laws of its movement; it cannot but ask the further question, to what goal? . . .

It must always have been seen, more or less distinctly, by political economists, that the increase in wealth is not boundless: that at the end of what they term the progressive state lies the stationary state, that all progress in wealth is but a postponement of this, and that each step in advance is an approach to it . . . if we have not reached it long ago, it is because the goal itself flies before us [as a result of technical progress].

I cannot . . . regard the stationary state of capital and wealth with the unaffected aversion so generally manifested towards it by political economists of

the old school. I am inclined to believe that it would be, on the whole, a very considerable improvement on our present condition. I confess I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, crushing, elbowing, and treading on each other's heels which form the existing type of social life, are the most desirable lot of human kind, or anything but the disagreeable symptoms of one of the phases of industrial progress. The northern and middle states of America are a specimen of this stage of civilization in very favorable circumstances; . . . and all that these advantages seem to have yet done for them (notwithstanding some incipient signs of a better tendency) is that the life of the whole of one sex is devoted to dollar-hunting, and of the other to breeding dollar-hunters.

. . . Those who do not accept the present very early stage of human improvement as its ultimate type may be excused for being comparatively indifferent to the kind of economical progress which excites the congratulations of ordinary politicians; the mere increase of production and accumulation. . . . I know not why it should be a matter of congratulation that persons who are already richer than anyone needs to be, should have doubled their means of consuming things which give little or no pleasure except as representative of wealth. . . . It is only in the backward countries of the world that increased production is still an important object: in those most advanced, what is economically needed is better distribution, of which one indispensable means is a stricter restraint on population.

There is room in the world, no doubt, and even in old countries, for a great increase in population, supposing the arts of life to go on improving, and capital to increase. But even if innocuous, I confess I see very little reason for desiring it. The density of population necessary to enable mankind to obtain, in the greatest degree, all the advantages both of cooperation and of social intercourse, has, in all the most populous countries, been attained. A population may be too crowded, though all be amply supplied with food and raiment. It is not good for a man to be kept perforce at all times in the presence of his species. . . . Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature; with every rood of land brought into cultivation, which is capable of growing food for human beings; every flowery waste or natural pasture plowed up, all quadrupeds or birds which are not domesticated for man's use exterminated as his rivals for food, every hedgerow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture. If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a happier or a better population. I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it.

It is scarcely necessary to remark that a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture, and moral and social progress; as much room for improving the Art of Living and much more likelihood of its being improved, when minds cease to be engrossed by the art of getting on. Even the industrial arts might be as earnestly and as successfully cultivated, with this sole difference, that instead of serving no purpose but the increase of wealth, industrial improvements would produce their legitimate effect, that of abridging labor.²²

The direction in which political economy has evolved in the last hundred years is not along the path suggested by Mill. In fact, most economists are hostile to the classical notion of stationary state and dismiss Mill's discussion as "strongly colored by his social views"²³ (as if the neoclassical theories were not so colored!), and "nothing so much as a prolegomenon to Galbraith's *Affluent Society*" (which also received a hostile reception from the economics profession). While giving full credit to Mill for his many other contributions to economics, most economists consider his discussion of the stationary state as something of a personal aberration. Also his "relentless insistence that every conceivable policy measure must be judged in terms of its effects on the birth rate" is dismissed as "hopelessly dated." The truth is, however, that Mill is even more relevant today than in his own time.

With this historical background, let us now analyze the steady state with a view toward clarifying what Mill somewhat mistakenly thought "must have always been seen more or less distinctly by political economists," namely, "that wealth and population are not boundless."

By *steady state* is meant a constant stock of physical wealth (capital), and a constant stock of people (population).²⁴ Naturally, these stocks do not remain constant by themselves. People die, and wealth is physically consumed, that is, worn out, depreciated. Therefore, the stocks must be maintained by a rate of inflow (birth, production) equal to the rate of outflow (death, consumption). But this equality may obtain, and stocks remain constant, with a high rate of throughput (equal to both the rate of inflow and the rate of outflow) or with a low rate. Our definition of steady state is not complete until we specify the rates of throughput by which the constant stocks are maintained. For a number of reasons we specify that the rate of throughput should be as low as possible. For an equilibrium stock, the average age at "death" of its members is the reciprocal of the rate of throughput. The faster the water flows through the tank, the less time an average drop spends in the tank. For the population, a low rate of throughput (a low birth rate and an equally low death rate) means a high life expectancy, and it is desirable for that reason alone—at least within limits. For the stock of wealth, a low rate of throughput (low production and equally low consumption) means greater life expectancy or durability of goods and less time sacrificed to production. This means more "leisure" or nonjob time to be divided into consumption time, personal and household maintenance time, culture time, and idleness.²⁵ This, too, seems socially desirable, at least within limits.

To these reasons for the desirability of a low rate of throughput we must add some reasons for the impracticability of high rates. Since matter and energy cannot be created, production inputs must be taken from the environment, which leads to depletion. Since matter and energy cannot be destroyed, an equal amount of matter and energy in the form of waste must be returned to the environment, leading to pollution. Hence lower rates of throughput lead to less depletion and pollution, higher rates to more. The limits regarding what

rates of depletion and pollution are tolerable must be supplied by ecology. A definite limit to the size of maintenance flows of matter and energy is set by ecological thresholds which, if exceeded, cause a breakdown of the system. To keep flows below these limits, we can operate on two variables: the *size* of the stocks and the *durability* of the stocks. As long as we are well below these thresholds, economic cost-benefit calculations of depletion and pollution can be relied on as a guide. But as these thresholds are approached, marginal cost and marginal benefit become meaningless, and Alfred Marshall's erroneous motto that "nature does not make jumps" and most of neoclassical marginalists economics become inapplicable. The "marginal" cost of one more step may be to fall over the precipice.

Of the two variables—size of stocks and durability of stocks—only the second requires further clarification. *Durability* means more than just how long a particular commodity lasts. It also includes the efficiency with which the after-use "corpse" of a commodity can be recycled as an input to be born again as the same or a different commodity. Within certain limits, to be discussed below, durability of stocks ought to be maximized in order that depletion of resources might be minimized.

We might suppose that the best use of resources would imitate the model that nature has furnished: a closed-loop system of material cycles powered by the sun (what A. J. Lotka called the "mill wheel of life" or the "world engine").²⁶ In such an "economy," durability is maximized, and the resources on earth could presumably last as long as the sun continues to radiate the energy to turn the closed material cycles.

We can set up an economy in imitation of nature in which all waste products are recycled. Instead of the sun, however, we use other sources of energy because of the scale of our industrial activity. Even modern agriculture depends as much on geologic capital (to make fertilizers, machines, and pesticides) as on solar income. This capital (fossil fuels and fission materials), from which we now borrow, may not last more than a couple of centuries, but there is another possible energy source, controlled thermonuclear fusion, which may someday provide a practically inexhaustible supply of energy with little radioactive waste, thereby alleviating problems of resource depletion and radioactive contamination. At least that is the claim of fusion enthusiasts.

Nevertheless, the serious problem of waste heat remains. The second law of thermodynamics tells us that it is impossible to recycle energy and that eventually all energy will be converted into waste heat. Also, it is impossible to recycle materials with one hundred percent completeness. Some material is irrecoverably lost in each cycle. Eventually, all life will cease as entropy or chaos approaches its maximum. But, the second law of thermodynamics implies that, even before this very long-run universal thermodynamic heat-death occurs, we will be plagued by thermal pollution, for whenever we use energy, we must produce unusable waste heat. When a localized energy process causes a part of the environment to heat up, thermal pollution can

have serious effects on ecosystems, since life processes and climatic phenomena are regulated by temperature.

We have already argued that, given the size of stocks, the throughput should be minimized, since it is really a cost. But the throughput is in two forms, matter and energy, and the ecological cost will vary, depending on how the throughput is apportioned between them. The amount of energy throughput will depend on the rate of material recycling. If we recycle none of our used material goods, then we must expend energy to replace those goods from raw materials, and this energy expenditure is in many instances greater than the energy needed to recycle the product. For example, the estimated energy needed to produce a ton of steel plate from iron ore is 2700 kilowatt-hours, whereas merely 700 kilowatt-hours is needed to produce the same ton by recycling scrap steel.²⁷ However, this is not the whole story. The mere expenditure of energy is not sufficient to close material cycles, since energy must work through the agency of material implements. To recycle aluminum cans requires more trucks to collect the cans as well as more energy to run the trucks. More trucks require more steel, glass, rubber, and so forth, which require more iron ore and coal, which require still more trucks. This is the familiar web of interindustry interdependence reflected in an input-output table.²⁸ All of these extra intermediate activities required to recycle the aluminum cans involve some inevitable pollution as well. If we think of each industry as adding recycling to its production process, then this will generate a whole chain of direct and indirect demands on matter and energy resources which must be taken away from final demand uses and devoted to the intermediate activities of recycling. It will take more intermediate products and activities to support the same level of final output.

As we attempt to recycle more and more of our produced goods, we will reach the point of diminishing returns; the energy expenditure alone will give rise to a ruinous amount of waste heat or thermal pollution. On the other hand, if we recycle too small a fraction of our produced goods, then nonthermal pollution and resource depletion become a severe problem.

The introduction of material recycling permits a trade-off; that is, it allows us to choose that combination of material and energy depletion and pollution which is least costly in the light of specific local conditions. *Cost* here means total ecological cost, not just pecuniary costs, and it is extremely difficult to measure.

In addition to the trade-offs involved in minimizing the ecological cost of the throughput for a given stock, we must recognize that the total stock (consisting of wealth and people) is variable both in total size and in composition. Since there is a direct relationship between the size of the stock and the size of the throughput necessary to maintain the stock, we have a trade-off between size of total stock (viewed as benefit) and size of the flow of throughput (viewed as a cost); in other words, an increase in benefit implies an increase in cost. Furthermore, a given throughput can maintain a constant total

stock consisting of a large substock of wealth and a small substock of people or a large substock of people and a small substock of wealth. Here we have a trade-off in the form of an inverse relationship between two benefits. This latter trade-off between people and wealth is imposed by the constancy of the total stock and is limited by minimal subsistence per capita wealth at one extreme and by minimal technological requirements for labor to maintain the stock of wealth at the other extreme. Within these limits this trade-off essentially represents the choice of a standard of living. Economics and ecology can at best specify the terms of this trade-off; the actual choice depends on ethical judgments.

In sum, the steady state of wealth and population is maintained by an inflow of low-entropy matter-energy (depletion) and an outflow of an equal quantity of high-entropy matter-energy (pollution). Stocks of wealth and people, like individual organisms, are open systems that feed on low entropy.²⁹ Many of these relationships are summarized in Figure I.2.

The classical economists thought that the steady state would be made necessary by limits on the depletion side (the law of increasing cost or diminishing returns), but in fact the main limits seem to be occurring on the pollution side. In effect, pollution provides another foundation for the law of increasing costs, but it has received little attention in this regard, since pollution costs are social, whereas depletion costs are usually private. On the input side, the environment is partitioned into spheres of private ownership. Depletion of the environment coincides, to some degree, with depletion of the owner's wealth and inspires at least a minimum of stewardship. On the output side, however, the waste absorption capacity of the environment is not subject to partitioning and private ownership. Air and water are used freely by all, and the result is a competitive, profligate exploitation—what biologist Garrett Hardin calls the “commons effect,” what welfare economists call “external diseconomies,” and what I like to call the “invisible foot.” Adam Smith's invisible hand leads private self-interest unwittingly to serve the common good. The invisible foot leads private self-interest to kick the common good to prices. Private ownership and private use under a competitive market give rise to the invisible hand. Public ownership with unrestrained private use gives rise to the invisible foot. Public ownership with public restraints on use gives rise to the visible hand (and foot) on the planner. Depletion has been partially restrained by the invisible hand, while pollution has been encouraged by the invisible foot. It is therefore not surprising to find limits occurring mainly on the pollution side—which, of course, is not to deny depletion limits.

It is interesting that the first school of economists, the physiocrats, emphasized human beings' dependence on nature. For them only the “natural” activity of agriculture was capable of producing a net product of value. Indeed, the word *physiocracy* meant rule of nature. Something of the physiocrats' basic vision, if not their specific theories, is badly needed in economics today.

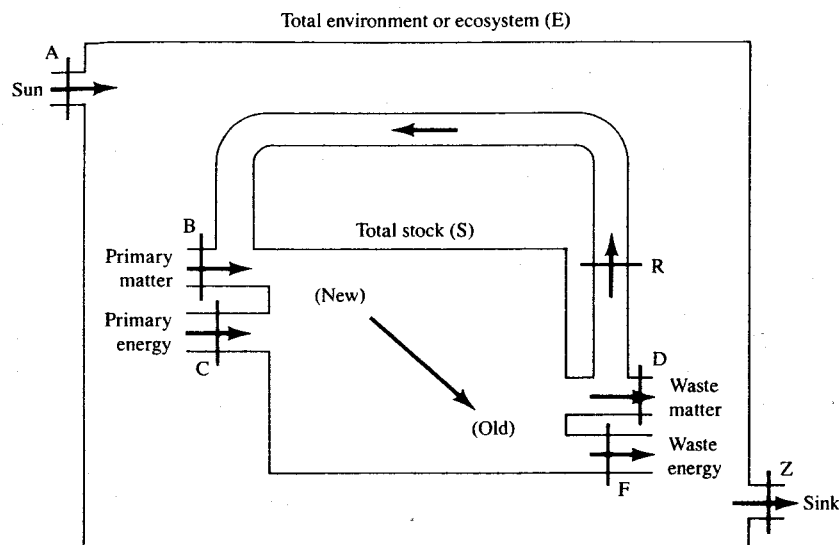


FIGURE I.2

Rectangle (E) is the total ecosystem, which contains the total stock (S) of wealth and people as one of its mutually dependent components. The ecosystem imports energy from outer space (sun, A) and exports waste heat to outer space (sink, Z). The stock contains matter in which a considerable amount of available energy is stored (mined coal, oil in oil tanks, water on high ground, living things, wood products, and the like), as well as matter in which virtually no available energy is stored. Matter and energy in the stock must be separately maintained. The stock is maintained in a steady state when B is equal to D and C is equal to F. In the steady state throughput equals either input (B plus C) or output (D plus F), since input and output are equal to each other. When input and output are not equal, then the throughput is measured by the smaller of the two.

From the second law of thermodynamics, we know that energy cannot be recycled. Matter may be recycled (R), but only by using more energy (and matter) to do it. In the diagram, energy moves only from left to right, whereas matter moves in both directions.

For a constant S, the lower the rate of throughput the more durable or longer-lived is the total stock. For a given throughput, the lower the rate of recycling (R), the more durable are the individual commodities. The optimum durability of an individual commodity is attained when the marginal production cost of increased durability equals the marginal recycling cost of not having increased durability further. *Cost* is total ecological cost and is extremely difficult to measure.

Both the size of the stock and the rate of throughput must not be so large relative to the total environment that they obstruct the natural ecological processes which form the biophysical foundations of wealth. Otherwise, the total stock and its associated throughput become a cancer which kills the total organism.

ECONOMIC AND SOCIAL IMPLICATIONS OF THE STEADY STATE

The economic and social implications of the steady state are enormous and revolutionary. The physical flows of production and consumption must be *minimized, not maximized* subject to some desirable population and standard of living.³⁰ The central concept must be the stock of wealth, not, as presently, the flow of income and consumption. Furthermore, the stock must not grow. For several reasons, the important issue of the steady state will be distribution, not production. The problem of relative shares can no longer be avoided by appeals to growth. The argument that everyone should be happy as long as his absolute share of the wealth increases, regardless of his relative share, will no longer be available. Absolute and relative shares will move together, and the division of physical wealth will be a zero-sum game. In addition, the arguments justifying inequality in wealth as necessary for savings, investment, and growth will lose their force. With production flows (which are really *costs* of maintaining the stock) kept low, the focus will be on the distribution of the stock of wealth, not on the distribution of the flow of income. Marginal productivity theories and "justifications" pertain only to flow and therefore are not available to explain or "justify" the distribution of stock ownership. Also, even though physical stocks remain constant, increased income in the form of leisure will result from continued technological improvements. How will it be distributed, if not according to some ethical norm of equality? The steady state would make fewer demands on our environmental resources but much greater demands on our moral resources. In the past, a good case could be made that leaning too heavily on scarce moral resources, rather than relying on abundant self-interest, was the road to serfdom. But in an age of rockets, hydrogen bombs, cybernetics, and genetic control, there is simply no substitute for moral resources and no alternative to relying on them, whether they prove sufficient or not.

On the question of maximizing versus minimizing the flow of production, there is an interesting analogy with ecological succession. Young ecosystems (early stages of succession) are characterized by a high production efficiency, and mature ecosystems (late stages of succession) are characterized by a high maintenance efficiency. For a given B (biomass stock), young ecosystems tend to maximize P (production flow), giving a high production efficiency P/B ; mature ecosystems, on the other hand, tend to minimize P for a given B, thus attaining a high maintenance efficiency, B/P . According to ecologist Eugene P. Odum, young ecosystems seem to emphasize production, growth, and quantity, whereas mature ecosystems emphasize protection, stability, and quality.³¹ For the young system, the flow of production is the quantitative source of growth and is maximized. For the mature, the flow of production is the maintenance cost of protecting the stability and quality of the stock and is minimized. If we conceive of the human economy as an ecosystem moving

from an earlier to a later stage of succession (from the "cowboy economy" to the "spaceman economy," as Boulding puts it), then we would expect, by analogy, that production, growth, and quantity would be replaced by protective maintenance, stability, and quality as the major social goals. The cardinal virtues of the past become the cardinal sins of the present.

With constant physical stocks, economic growth must be in nonphysical goods: service and leisure.³² Taking the benefits of technological progress in the form of increased leisure is a reversal of the historical practice of taking the benefits mainly in the form of goods and has extensive social implications. In the past, economic development has increased the physical output of a day's work while the number of hours in a day has, of course, remained constant, with the result that the opportunity cost of a unit of time in terms of goods has risen. Time is worth more goods, a good is worth less time. As time becomes more expensive in terms of goods, fewer activities are "worth the time." We become goods-rich and time-poor. Consequently, we crowd more activities and more consumption into the same period of time in order to raise the return on nonwork time so as to bring it into equality with the higher returns on work time, thereby maximizing the total returns to total time. This gives rise to what Staffan Linder has called the "harried leisure class."³³ We use not only work time but also personal consumption time more efficiently, and we even try to be efficient in our sleep by attempting subconscious learning. Time-intensive activities (friendships, care of the aged and children, meditation, and reflection) are sacrificed in favor of commodity-intensive activities (consumption). At some point, people will feel rich enough to afford more time-intensive activities, even at the higher price. But advertising, by constantly extolling the value of material-intensive commodities, postpones this point. From an ecological view, of course, this is exactly the reverse of what is called for. What is needed is a low relative price of time in terms of material commodities. Then time-intensive activities will be substituted for material-intensive activities. To become less materialistic in our habits, we must raise the relative price of matter. Keeping physical stocks constant and using technology to increase leisure time will do just that. Thus a policy of nonmaterial growth, or leisure-only growth, in addition to being necessary for keeping physical stocks constant, has the further beneficial effect of encouraging a more generous expenditure of time and a more careful use of physical goods. A higher relative price of material-intensive goods may at first glance be thought to encourage their production. But material goods require material inputs, so costs as well as revenues would increase, thus eliminating profit incentives to expand.

In the 1930s Bertrand Russell proposed a policy of leisure growth rather than commodity growth and viewed the unemployment question in terms of the distribution of leisure. The following words are from his delightful essay "In Praise of Idleness."

Suppose that, at a given moment, a certain number of people are engaged in the manufacture of pins. They make as many pins as the world needs, working (say)

eight hours a day. Someone makes an invention by which the same number of men can make twice as many pins as before. But the world does not need twice as many pins. Pins are already so cheap that hardly any more will be bought at a lower price. In a sensible world, everybody concerned in the manufacture of pins would take to working four hours instead of eight, and everything else would go on as before. But in the actual world this would be thought demoralizing. The men still work eight hours, there are too many pins, some employers go bankrupt, and half the men previously concerned in making pins are thrown out of work. There is, in the end, just as much leisure as on the other plan, but half the men are totally idle while half are still overworked. In this way it is insured that the unavoidable leisure shall cause misery all round instead of being a universal source of happiness. Can anything more insane be imagined?³⁴

In addition to this strategy of leisure-only growth, and the resulting reinforcement of an increased price of material-intensity relative to time-intensity, we can internalize some pollution costs by charging pollution taxes. Economic efficiency requires only that a price be placed on environmental amenities; it does not tell us who should pay the price. The producer may claim that the use of the environment to absorb waste products is a right that all organisms and firms must of necessity enjoy, and whoever wants air and water to be cleaner than it is at any given time should pay for it. Consumers may argue that the use of the environment as a source of clean inputs of air and water takes precedence over its use as a sink, and that whoever makes the environment dirtier than it otherwise would be should be the one to pay. Again the issue becomes basically one of distribution—not what the price should be, but who should pay it. The fact that the price takes the form of a tax automatically decides who will receive it—the government. But this raises more distribution issues; and the "solutions" to these problems are ethical, not technical.

Another possibility of nonmaterial growth is to redistribute wealth from the low utility uses of the rich to the high utility uses of the poor, thereby increasing total "social utility." Joan Robinson has noted that this egalitarian implication of the law of diminishing marginal utility was "sterilized . . . mainly by slipping from utility to physical output as the object to be maximized."³⁵ As we move back from physical output to nonphysical utility, the egalitarian implications become "unsterilized."

Economic growth has kept at bay two closely related problems. First, growth is necessary to maintain full employment. Only if it is possible for nearly everyone to have a job can the income-through-jobs ethic of distribution remain workable. Second, growth takes the edge off of distributional conflicts. If everyone's absolute share of income is increasing, there is a tendency not to fight over relative shares, especially since such fights may interfere with growth and even lead to a lower absolute share for all. But these problems cannot be kept at bay forever, because growth cannot continue indefinitely.

Growth, by allowing full employment, permits the old principles of distribution (income-through-jobs link) to continue in effect. But with no growth in physical stocks, and a policy of using technological progress to increase

leisure, full employment and income-through-jobs are no longer workable mechanisms for distribution. Furthermore, we add a new dimension to the distribution problem—how to distribute leisure. The point is that distribution issues must be squarely faced and not left to work themselves out as the by-product of full-employment policies aimed at promoting growth.

A stationary population, with low birth and death rates, would imply a greater percentage of old people than in the present growing population, though hardly a geriatric society as some youth worshippers claim. The average age, assuming that current U.S. mortality holds, would change from twenty-seven to thirty-seven. One hears much nonsense about the conservatism and reactionary character of older populations and the progressive dynamism of younger populations, but a simple comparison of Sweden (old but hardly reactionary) with Brazil (young but hardly progressive) should make us cautious about such facile relationships. It is also noted that the age pyramid of a stationary U.S. population would be essentially rectangular up to about age fifty and then would rapidly taper off, and that the age “pyramid” would no longer be roughly congruent with the pyramid of authority in hierarchical organizations, with the result that the general correlation between increasing age and increasing authority would not hold for very many people. Quite true, but a salutary result could well be that more people will seek their personal fulfillment outside the structure of hierarchical organizations and that fewer people would rise to levels of their incompetence within bureaucracies. Since old people do not work, this further accentuates the distribution problem. However, the percentage of children will diminish, so in effect there will be mainly a change in the direction that payments are transferred. More of the earnings of working adults will be transferred to the old, and less to children.

What institutions will provide the control necessary to keep the stocks of wealth and people constant, with the minimum sacrifice of individual freedom? This, I submit, is the question we should be struggling with. It would be far too simpleminded to blurt out “socialism” as the answer, since socialist states are as badly afflicted with growthmania as capitalist states. The Marxist eschatology of the classless society is based on the premise of complete abundance; consequently, economic growth is exceedingly important in socialist theory and practice. Also, population growth, for the orthodox Marxist, cannot present problems under socialist institutions. This latter tenet has weakened a bit in recent years, but the first continues in full force. However, it is equally simpleminded to believe that the present big capital, big labor, big government, big military type of private profit capitalism is capable of the required foresight and restraint and that the addition of a few pollution and severance taxes here and there will solve the problem. The issues are much deeper and inevitably impinge on the distribution of income and wealth.

All economic systems are subsystems within the big biophysical system of ecological interdependence. The ecosystem provides a set of physical constraints to which all economic systems must conform. The facility with which

an economic system can adapt to these constraints is a major, if neglected, criterion for comparing economic systems. This neglect is understandable, because in the past ecological constraints showed no likelihood of becoming effective. But population growth, growth in the physical stock of wealth, and growth in the power of technology all combine to make ecological constraints effective. Perhaps this common set of constraints will be one more factor favoring convergence of economic systems.

Why do people produce junk and cajole other people into buying it? Not out of any innate love for junk or hatred of the environment, but simply in order to earn an income. If, with the prevailing distribution of wealth, income, and power, production governed by the profit motive results in the output of great amounts of noxious junk, then something is wrong with the distribution of wealth and power, the profit motive, or both. We need some principle of income distribution independent of and supplementary to the income-through-jobs link.³⁶ Perhaps a start in this direction was made by Oskar Lange in his *On the Economic Theory of Socialism*,³⁷ in which he attempted to combine some socialist principles of distribution with the allocative efficiency advantages of the market system. However, at least as much remains to be done here as remains to be done in designing institutions for stabilizing population. But before much progress can be made on these issues, we must recognize their necessity and blow the whistle on growthmania.

AN EMERGING POLITICAL ECONOMY OF FINITE WANTS AND NONGROWTH

Although the ideas expressed by Mill have been totally dominated by growthmania, a growing number of economists have frankly expressed their disenchantment with the growth ideology. Arguments stressing ecologically sound limits to wealth and population have been made by Boulding and by Spengler (both past presidents of the American Economic Association).³⁸ Recently E. J. Mishan, Tibor Scitovsky, and Staffan Linder have made penetrating antigrowth arguments.³⁹ There is also much in Galbraith that is antigrowth—at least against growth of commodities for which the want must be manufactured along with the product.⁴⁰

In spite of these beginnings, most economists are still hung up on the assumption of infinite wants, or the postulate of nonsatiety, as the mathematical economists call it. Any single want can be satisfied, but all wants in the aggregate cannot be. Wants are infinite in number if not in intensity, and the satisfaction of some wants stimulates other wants. If wants are infinite, growth is always justified—or so it would seem.

Even while accepting the foregoing hypothesis, we could still object to growthmania on the grounds that, given the completely inadequate definition of GNP, “growth” simply means the satisfaction of ever more trivial wants

while simultaneously creating ever more powerful externalities which destroy ever more important environmental amenities. To defend ourselves against these externalities, we produce even more, and instead of subtracting the purely defensive expenditures, we add them! For example, the medical bills paid for treatment of cigarette-induced cancer and pollution-induced emphysema are added to GNP when, in a welfare sense, they should clearly be subtracted. This should be labeled *swelling*, not growth. The satisfaction of wants created by brainwashing and *hogwashing* the public over the mass media also represents mostly swelling. A policy of maximizing GNP is practically equivalent to a policy of maximizing depletion and pollution.

We may hesitate to say "maximizing" pollution on the grounds that the production inflow into the stock can be greater than the consumption outflow as long as the stock increases, as it does in our growing economy. To the extent that wealth becomes more durable, the production of waste can be kept low by expanding the stock. But is this in fact what happens? In the present system, if we want to maximize production, we must have a market for it. Increasing the durability of goods reduces the replacement demand. The faster things wear out, the greater can be the flow of production and income. To the extent that consumer apathy and weakening competition permit, there is every incentive to minimize durability. Planned obsolescence and programmed self-destruction and other waste-making practices, so well discussed by Vance Packard, are the logical result of maximizing a marketed physical flow.⁴¹ If we must maximize something, it should be the stock of wealth, not the flow—but with full awareness of the ecological limits that constrain this maximization.

But why this perverse emphasis on flows, this "flow fetishism" of standard economic theory? Again, I believe the underlying issue is distribution. There is no theoretical explanation, much less justification, for the distribution of the stock of wealth. It is a historical datum. But the distribution of the flow of income is at least partly explained by marginal productivity theory, which at times is even misinterpreted as a justification. Everyone gets a part of the flow—call it wages, interest, rent, or profit—and it all looks rather fair. But not everyone owns a piece of the stock, and that does not seem quite so fair. Looking only at the flow helps to avoid disturbing thoughts.

Even the common-sense arguments for infinite wants—that the rich seem to enjoy their high consumption—cannot be generalized without committing the fallacy of composition. If all earned the same high income, a consumption limit occurs sooner than if only a minority had high incomes. The reason is that a large part of the consumption by plutocrats is consumption of personal services rendered by the poor, which would not be available if all were rich. Plutocrats can easily spend large sums on consumption, since all the maintenance work of the household can be done by others. By hiring the poor to maintain and even purchase commodities for them, the rich devote their limited consumption time only to the most pleasurable aspects of consump-

tion. The rich only ride their horses; they do not clean, comb, saddle, and feed them, nor do they clean out the stable. If all did their own maintenance work, consumption would perforce be less. Time sets a limit to consumption.

The big difficulty with the infinite wants assumption, however, is that pointed out by Keynes, who, in spite of the use made of his theories in support of growth, was certainly no advocate of unlimited growth, as can be seen in the following quotation:

Now it is true that the needs of human beings may seem to be insatiable. But they fall into two classes—those needs which are absolute in the sense that we feel them whatever the situation of our fellow human beings may be, and those which are relative in the sense that we feel them only if their satisfaction lifts us above, makes us feel superior to, our fellows. Needs of the second class, those which satisfy the desire for superiority, may indeed be insatiable; for the higher the general level, the higher still are they. But this is not so true of the absolute needs—a point may soon be reached, much sooner perhaps than we are all of us aware of, when those needs are satisfied in the sense that we prefer to devote our further energies to noneconomic purposes.⁴²

For Keynes, real absolute needs are those that can be satisfied and do not require inequality and invidious comparison for their very existence; relative wants are the wants of vanity and are insatiable. Lumping the two categories together and speaking of infinite wants in general can only muddy the waters. The same distinction is implicit in the quotation from Mill, who spoke disparagingly of "consuming things which give little or no pleasure except as representative of wealth."

Some two and a half millennia before Keynes, the prophet Isaiah, in a discourse on idolatry, developed the theme more fully.

[Man] cuts down cedars; or he chooses a holm tree or an oak and lets it grow strong among the trees of the forest; he plants a cedar and the rain nourishes it. Then it becomes fuel for a man; and he takes a part of it and warms himself, he kindles a fire and bakes bread; also he makes a god and worships it, he makes a graven image and falls down before it. Half of it he burns in the fire; over the half he eats flesh, he roasts meat and is satisfied; also he warms himself and says, "Aha, I am warm, I have seen the fire!" And the rest of it he makes into a god, his idol; and he falls down to it and worships it; he prays to it and says: "Deliver me, for thou art my god!"

They know not, nor do they discern; for he has shut their eyes so that they cannot see, and their minds so that they cannot understand. No one considers, nor is there knowledge or discernment to say, "Half of it I burned in the fire. I also baked bread on its coals, I roasted flesh and have eaten; and shall I make the residue of it an abomination? Shall I fall down before a block of wood?" He feeds on ashes, a deluded mind has led him astray, and he cannot deliver himself or say, "Is there not a lie in my right hand?" [Isa. 44:14–20]

The first half of the tree burned for warmth and food, the finite absolute wants of Keynes, the bottom portion of GNP devoted to basic wants—these are all approximately synonymous. The second or surplus half of the tree used to make an idol, Keynes's infinite relative wants or wants of vanity, the top or

surplus (growing) portion of GNP used to satisfy marginal wants—these are also synonymous. Furthermore, the surplus half of the tree used to make an idol, an abomination, is symbolic of the use made of the economic surplus throughout history of enslaving and coercing others by gaining control over the economic surplus and obliging people to “fall down before a block of wood.” The controllers of the surplus may be a priesthood that controls physical idols made from the surplus and used to extract more surplus in the form of offerings and tribute. Or they may be feudal lords who, through the power given by possession of the land, extract a surplus in the form of rent and the *corvée*; or capitalists (state or private) who use the surplus in the form of capital to gain more surplus in the form of interest and quasi-rents. If growth must cease, the surplus becomes less important, and so do those who control it. If the surplus is not to lead to growth, then it must be consumed, and ethical demands for equal participation in the consumption of the surplus could not be countered by arguments that inequality is necessary for accumulation. Accumulation in excess of depreciation, and the privileges attached thereto, would not exist.

We no longer speak of worshipping idols. Instead of idols we have an abomination called GNP, large parts of which, however, bear such revealing names as Apollo, Poseidon, and Zeus. Instead of worshipping the idol, we maximize it. The idol has become rather more abstract and conceptual and rather less concrete and material, while the mode of adoration has become technical rather than personal. But fundamentally, idolatry remains idolatry, and we cry out to the growing surplus, “Deliver me, for thou art my god!” Instead we should pause and ask with Isaiah, “Is there not a lie in my right hand?”

NOTES

1. Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed., Chicago: University of Chicago Press, 1969.
2. Arthur Koestler, *The Sleepwalkers*, New York: Macmillan, 1968.
3. Michael Polanyi, *Personal Knowledge*, New York: Harper & Row, 1964.
4. Evesy Domar, “Expansion and Employment,” *American Economic Review*, March 1947, pp. 34–55.
5. This, of course, is a *physical* axiom. If a “quantity” has no physical dimensions, it is not limited by physical finitude. Thus “psychic income” or welfare may increase forever. But the physical stock that yields want-satisfying services, and the physical flows which maintain that stock, are limited. What about GNP? If we choose to measure GNP in such a way that it reflects total want satisfaction, then presumably it could increase forever. However, this is emphatically *not* the way we measure GNP at present. Prices (exchange values) and quantities are the basis of GNP. Prices bear no relation whatsoever to total utility or want satisfaction.
- Quantity probably has borne a direct relation to welfare in the past. Whether it still does today in affluent countries is very debatable. But, in any event, quantities are limited by physical considerations. Even quantities of “services rendered” have some irreducible physical dimension. It is always some *thing* that yields a service—for example, a machine or a skilled person.
6. *Science*, November 19, 1971, pp. 847–848.
7. Kuhn, *Structure of Scientific Revolutions*, p. 92.
8. The high professional reputations of Boulding and Georgescu-Roegen are based on their many contributions within the orthodox paradigm. Their work outside that paradigm has probably diminished rather than enhanced their academic prestige.
9. J. Ruskin, *Unto This Last: Four Essays on the First Principles of Political Economy*, ed. Lloyd J. Hubenka, Lincoln: University of Nebraska Press, 1967, p. 86 (originally published 1860).
10. Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process*, Cambridge, Mass.: Harvard University Press, 1971, p. 21.
11. A. C. Fisher and F. M. Peterson, “The Environment in Economics: A Survey,” *Journal of Economic Literature*, March 1976, p. 1.
12. Robert Solow, “The Economics of Resources or the Resources of Economics,” *American Economic Review*, May 1974, p. 11.
13. Frederick Soddy, *Cartesian Economics: The Bearing of Physical Science upon State Stewardship*, London: Hendersons, 1922, p. 9.
14. Harold Barnett and Chandler Morse, *Scarcity and Growth: The Economics of Natural Resource Availability*, Resources for the Future. Baltimore: Johns Hopkins University Press, 1963, p. 11.
15. Imagine a demon who opens and shuts a window in a partition separating two volumes of gas so as to let the fast-moving molecules go from right to left and the slow-moving molecules go from left to right, thereby sorting the two. If the two compartments were originally at equilibrium (equal temperature), then the sorting action of the demon would cause a “spontaneous” increase in temperature of the left compartment and a decrease in the right compartment. This would contradict the entropy law, which forbids spontaneous movement away from equilibrium. The natural or “downhill” direction is toward more mixing of entities; sorting of entities would be like going uphill, which should use energy rather than liberate energy. The temperature differential created by the demon would provide a source of continuous energy, a kind of perpetual motion machine, which is contrary to the laws of physics.
16. *Fertility* refers to actual reproduction, as opposed to *fecundity*, which refers to reproductive potential or capacity. One measure of fertility is the Gross Reproduction Rate, defined in note 17.
17. GRR is roughly the ratio of one generation to the preceding generation, assuming that all children born survive to the end of their reproductive life. It is usually defined in terms of females only. The length of a generation is the mean age of mothers at childbirth.
18. United Nations, *Population Bulletin of the United Nations*, No. 7, 1963, New York: United Nations, 1965.

19. Goran Ohlin, *Population Control and Economic Development*, Paris: Development Centre of the Organisation for Economic Co-operation and Development, 1967.
20. According to Robert E. Baldwin: "In the 1957–58 to 1963–64 period, the less developed nations maintained a 4.7 percent annual growth rate in gross national product compared to a 4.4 percent rate in the developed economies. The gap in per capita income widened because population increased at only 1.3 percent annually in the developed countries compared to a 2.4 percent annual rate in the less developed economies." (*Economic Development and Growth*, New York: Wiley, 1966, p. 8).
21. The term *stationary state* has been burdened with two distinct meanings in economics. The classical meaning is that of an actual state of affairs toward which the real world is supposed to be evolving; that is, a teleological or eschatological concept. The neoclassical sense of the terms is entirely mechanistic—an epistemologically useful fiction like an ideal gas or frictionless machine—and describes an economy in which tastes and techniques are constant. The latter sense is more current in economics today, but the former meaning is the relevant one in this discussion.
22. J. S. Mill, *Principles of Political Economy*, Vol. II, London: John W. Parker, 1857, pp. 320–326, with omissions.
23. All quotes in this paragraph are from Mark Blaug, *Economy Theory in Retrospect*, Homewood, Ill.: Irwin, 1968, pp. 214–221. Blaug's views are, I think representative of orthodox economists.
24. By *stock* is meant a quantity measured at a point in time; for example, a population census or a balance sheet of assets and liabilities as of a certain date. By *flow* is meant a quantity measured across some actual or conceptual boundary over a period of time; for example, births and deaths per year or an income and loss statement for a given year.
The boundary lines separating the stock of wealth from the rest of the physical world may sometimes be fuzzy. But the main criterion is that physical wealth must in some way have been transformed by human beings to increase its usefulness over its previous state as primary matter or energy. For example, coal in the ground is primary matter and energy; coal in the inventory of firms and households is physical wealth; coal after use in the form of carbon dioxide and soot is waste matter. The heat produced by the coal is partly usable and partly unusable. Eventually, all the heat becomes unusable or waste heat, but, while it is usable, it is a part of the physical stock of wealth. For some purposes, we may wish to define proven reserves in mines as part of wealth, but that presents no problems.
25. Staffan B. Linder, *The Harried Leisure Class*, New York: Columbia University Press, 1970.
26. A. J. Lotka, *Elements of Mathematical Biology*, New York: Dover, 1957. Republication. See especially Chapter 24.
27. Report of the Committee for Environmental Information before Joint Congressional Committee on Atomic Energy, January 29, 1970. Quoted in "The Space Available Report of the Committee for Environmental Information," *Environment*, March 1970, p. 7.
28. Herman E. Daly, "On Economics as a Life Science," *Journal of Political Economy*, July, 1968, pp. 392–406. Reprinted in this volume.