To Grow or Not to Grow: That's Not the Relevant Question

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It is fashionable these days to assert that there are two points of view on the question, "Must we limit economic growth?" (*1*). On the one side is the pro-growth, or business-as-usual, school, which centers around the implicit belief —stated more in actions than in words —that, as a social goal, material economic growth should take precedence over equity in the distribution of income, wealth, and privilege and over concerns about the social and environmental costs of growth. At the other extreme is the no-growth, or scrap-the-system, school, which at times comes close to assuming that these problems will all disappear if only growth disappears.

I believe that both viewpoints are wrong—indeed, that they border on the irresponsible. There can be no doubt that the fruits of economic growth will make the resolution of the social and environmental problems we face much easier to solve. That fact makes it irresponsible to argue for zero economic growth in a world still dominated by poverty. It is equally irresponsible, however, to use this fact as a rationale for the continual postponement of efforts to resolve basic social problems, both domestic and international. The relevant question is not whether to grow or not to grow, but how to channel and redirect economic output, and whatever increases in it come along, in ways that will make it better serve humanity's needs. If this is done, it is quite likely that growth will in fact be restrained. That is as it should be. But such reductions will be far less than the reductions that would be needed to solve the same problems through attacks on growth per se.

What about those persons who remind us that the earth is finite, that if growth continues we will eventually run out of resources and environmental carrying capacity? Should we not stop growth in the consumption of materials and energy before that day comes? Are not these problems so serious that any attempt to correct them, short of stopping all material economic growth, can only be considered a palliative?

If we rule out the possibility of importing materials and energy from outside the earth on an ever-increasing scale, this argument must ultimately be correct. The second law of thermodynamics, the entropy law, makes this certain. Indeed, this same law makes it certain that even a constant rate of economic activity cannot be maintained forever, unless that level of activity is sufficiently low to permit mankind to live within the limits imposed by the flow of solar energy he is able to tap (*2*). Technological breakthroughs may make it appear to be possible to continue growth forever. But this illusion arises from man's myopia. No amount of scientific knowledge can repeal the laws of nature; they can only postpone their consequences. No matter how closely we approach it, there is no such thing as a perpetual motion machine (*3*).

But knowledge that growth must eventually cease is of no practical significance by itself. The relevant question is *when?* It makes an enormous difference for policy today whether the "we" who must limit growth is mankind alive today or some far-off, future generation. Will the law of entropy catch up with us in 100, 1000, or 100,000 years?

One recent study, *The Limits to Growth* (*4*), claims that the relevant limit is more like 100 than 1000 or more years. Indeed, it purports to demonstrate that the only way to avoid cataclysmic increases in worldwide death rates within the next 100 years is to stop all population and material economic growth throughout the world during the next two decades or so. But on at least three counts I find this demonstration to be completely unconvincing.

First, the model used in *Limits* contains few of the important adjustment mechanisms that have helped the world avoid similar catastrophies to date. There is no price mechanism to signal pending shortages, to make it profitable to invest more in exploration and research, or to induce consumers to reduce their consumption and shift to substitutes. There is no government to monitor the situation and to supplement the price mechanism where it does not provide adequate signals. Nor does anyone learn from the experience of others and change his behavior accordingly. As the World Bank Task Force that reviewed *Limits* says:

> Can we really believe that most of the population of Detroit could succumb to persistent pollutants without the rest of humanity making any adjustments in its producer-consumer behavior? Humanity faces these problems one by one, every year in every era, and keeps making its quiet adjustments. It does not keep accumulating them indefinitely till they make catastrophe inevitable. One does not have to believe in the invisible hand to subscribe to such a view of society. One has merely to believe in human sanity and its instinct for self-preservation (*5*, p. 15).

Closely related are the problems arising because of the extreme degree of aggregation incorporated in the model. There is only one composite industrial output, one nonrenewable resource, one "pollutant," and one geographic unit—the world as a whole. Not only does such a formulation greatly reduce the confidence one can have in the postulated relationships between the aggregates, it seriously compounds the problems arising from inadequate adjustment mechanisms. Consumers cannot substitute one output for another; producers cannot substitute one resource for another; society cannot alter the composition of output —for example, deciding to spend less on military and more on research, development, and exploration. Since the model does not allow for these possibilities, there is really no alternative to reductions in population and economic growth.

Third, the study incorporates highly pessimistic assumptions about technological progress, future reserves of nonrenewable resources, the ability to control and absorb pollution, and the extent of population growth that is likely in the next two centuries. In addition to leaving out the possibilities of technological breakthroughs such as

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fusion and solar energy—the omission of which may make sense in a 50-year projection, but not beyond that—the use of shale oil, tar sands, and geothermal sources of energy were ignored. The authors allow for the possibility that reserves of their aggregate resource could increase five times over the next 100 years, a seemingly generous allowance until one recalls that estimates of iron ore reserves increased about five times just between 1954 and 1965, and estimates for copper reserves by 3.5 times since 1935, according to the U.S. Bureau of Mines. Moreover, promising underwater sources of minerals are ignored: in reviewing the possibility of such sources, the World Bank finds that within the next 20 years it should be possible to recover on a commercial basis 100 million tons of nodular materials from the seabed each year and that such recovery could be increased and sustained "indefinitely" at the level of 400 million tons. The smaller of these figures "would add to the annual production of copper, nickel, manganese, and cobalt to the extent of roughly one-fourth, 2 times, 6 times, and 12 times, respectively, compared to the current free-world production levels" (*5*, pp. 7–8). One need not concur entirely with this judgment in order to assert that this possibility should not be ignored.

As far as pollution is concerned, there is no scientific evidence for the functional relationships assumed in the model: for the amount of pollution that can be safely absorbed by the earth's environments, for the effect of pollution on birth and death rates, or for the degree to which treatment and changes in processes can reduce emissions of pollutants per unit of output. And as far as population growth is concerned, the historical relationships between birth and death rates and the level of development cannot blithely be projected into the future. Public health and family planning programs, the availability of modern contraceptives and the spread of knowledge about them, plus changing attitudes toward marriage and sex are all operating to weaken the historic linkages. Indeed, recent census data (not available at the time *Limits* was written) suggest that a slowdown in population growth may have already started in more than half of the 70 or so countries for which data are available.

Contrary to what *Limits* says (*6*), all these factors can make a significant difference in our estimate of when and how growth must stop. First, a correction of the overly pessimistic assumptions could result in a postponement, by several centuries, of the date at which growth must stop, even without introducing additional adjustment mechanisms (*7*). Second, as that limit is approached, all kinds of adjustment mechanisms will come into play to slow down and elongate the decline. Indeed, the whole idea of talking about a specific "date" is wrong. The adjustments are continuous and occur without benefit of any social knowledge that some limit is being approached. Assuming we avoid nuclear war, the world will surely end "not with a bang, but with a whimper."

There is one other study that sheds at least some light on this question of limits. This is the study undertaken by Resources for the Future for the Commission on Population Growth and the American Future (*8*). Concentrating mainly on the United States and only on the next 50 years, it reviews the prospects for more than 20 resources and 14 pollutants and can be interpreted as saying that, if some costs are paid and some adjustments made, no catastrophe is likely to result from continued growth during the next half-century. Indeed, at least as far as the United States is concerned, the results are fairly sanguine. We appear to have the resources and the know-how both to continue growing and to cope with the problems of that growth, if we are willing to adjust our lifestyles a bit. This is not to say that there will be no serious shortages during the next 50 years, but that these shortages are unlikely to arise solely as a consequence of population and economic growth.

These conclusions can be usefully illustrated with reference to energy and pollution, two areas of concern in which many believe we already have serious problems. The so-called energy crisis confronting the United States during the next 10 to 20 years is certainly not a result of a worldwide shortage of energy, nor even the result of an overall domestic shortage of energy sources, given our immense reserves of coal and nuclear materials. Rather, it is better described as a crisis arising from inappropriate policies, compounded by what has been described as "the transitional problems of absorbing environmentalism into the set of shared public values" (*9*). Domestic gas prices have been too low to encourage significant exploration. Oil prices have probably also been too low, but in addition there has been inadequate federal leasing and a failure to couple tax privileges with incentives for additional drilling. Research and development efforts in all areas other than nuclear energy—in particular, coal gasification, shale oil, and solar energy—have been totally inadequate. These factors, coupled with environmental restrictions on the use of high sulfur coal and restraints on the construction of nuclear power plants, have put an excessive burden on oil, leading to rapid increases in imports. The rising demand for imports, in turn, forces us to view with concern the recent successes that the Organization of Petroleum Exporting Countries has had in demanding higher prices.

But given the policy options available to us, these problems need not be long-lasting. During the next 30 years they can be met by moderately reduced demand, brought about by increased prices (*10*), increased use of coal, the development of adequate nuclear power capacity, and expanded imports of oil. Beyond this period, if not before, coal gasification, shale oil, the breeder reactor, and geothermal sources are likely to become available, reducing our dependence on imports. Undoubtedly, social and institutional changes (such as mass transit and apartment complexes permitting significant savings in energy consumption) or fusion, or solar energy, or some combination of these will also come along, or can certainly be made to come along if needed (*11*). Thus, while problems abound, so do solutions short of stopping economic growth—if we are willing to push for them.

The case of pollution is especially interesting because it can be used to illustrate graphically the degree of flexibility present in the socioeconomic system. Figure 1 presents a summary (*12*). The bars labeled A indicate the amounts of various pollutants that were generated in 1970 and those that would be generated in the year 2000 under different assumptions about population and economic growth rates, but assuming no significant changes in technology (*13*). The bar labeled B in 1970 indicates the amount of the pollutant actually emitted, the difference between A and B reflecting the extent to which control and treatment were exercised in that year. For the year 2000, these bars indicate what is likely to occur as

a result of probable changes in technology, without any change in pollution controls and treatment. In contrast, the bars labeled C indicate what would result if the standards being recommended by the Environmental Protection Agency for implementation in 1976 were applied in the year 2000.

The annualized cost of pollution treatment and control in 1970 was $8.5 billion (in 1967 dollars), approximately 1 percent of the gross national product (GNP) in that year. To achieve reductions of the kind envisioned, I estimate that this figure would have to grow to between $33.6 billion and $47.5 billion (for the low population and high population growth cases, high economic growth in both cases) by the year 2000. As large as these figures are, they still amount to less than 2 percent of GNP in that year. To put it differently, we would have to give up less than one-tenth of 1 percent in annual growth of GNP to make room for these expenditures: that is, instead of growing at 4 percent per year, GNP exclusive of these expenditures would grow at something over 3.9 percent per year. Within this time frame, therefore, direct attacks on pollution clearly dominate over restrictions on population and economic growth as means of reducing emissions.

Indeed, for most of the problems associated with economic growth, direct attacks are probably better than indirect ones. To assert otherwise is a bit like junking the family car because the tires have worn out or reducing a boy's food consumption because the sweets are giving him acne. Why use a meat ax when a scalpel will do better?

There are two important exceptions to this general principle. First, in the interest of humanity and world peace, it makes sense for the richer countries of the world to tax themselves and transfer the proceeds to the poorer countries. But this is not the same thing as saying that worldwide economic growth should be restricted. Obviously, if worldwide economic growth did stop, the chances of bringing about such a transfer would be far lower than they are today. Second, some of the costs of growth—particularly those outside the resource and environmental fields—may not be amenable to a direct attack. How can the regulations needed to control the negative spillovers of growth, the hecticness of modern life, and the superficiality of personal relationships that growth seems to generate, be controlled without reducing growth itself? It seems to me that the advocates of no-growth would have a better case if they were to focus their attack on these consequences of growth rather than on the resource and environmental consequences, which, in very large measure, can be managed by other means.

Of course, direct attacks on the resource and environmental consequences of growth will themselves reduce the growth rate, thereby helping to reduce the more general and pervasive costs of growth. If these latter costs are not then reduced sufficiently for our taste, then let us agree to restrict our economic growth by a larger amount. Over time, as we learn more about the earth's reserves and what is technologically possible, and as our tastes and preferences change, the situation will require reassessment. By proceeding in this step-by-step fashion, we will do ourselves and future generations less harm than by applying generalized, meat-ax approaches.

The study by Resources for the Future is quite limited, however. What about problems lying beyond the next 50 years; and what about the environmental threats the study was not able to quantify and analyze in detail? These are areas where ignorance dominates. Should we not, in effect, stop the ship, or at least slow it down, until we know more about what lies ahead in the fog?

It is true that we do not know what kinds of disasters we may be letting ourselves in for by permitting economic growth to continue. But it should be remembered that we are also ignorant of possible technological and institutional breakthroughs that may eventu-

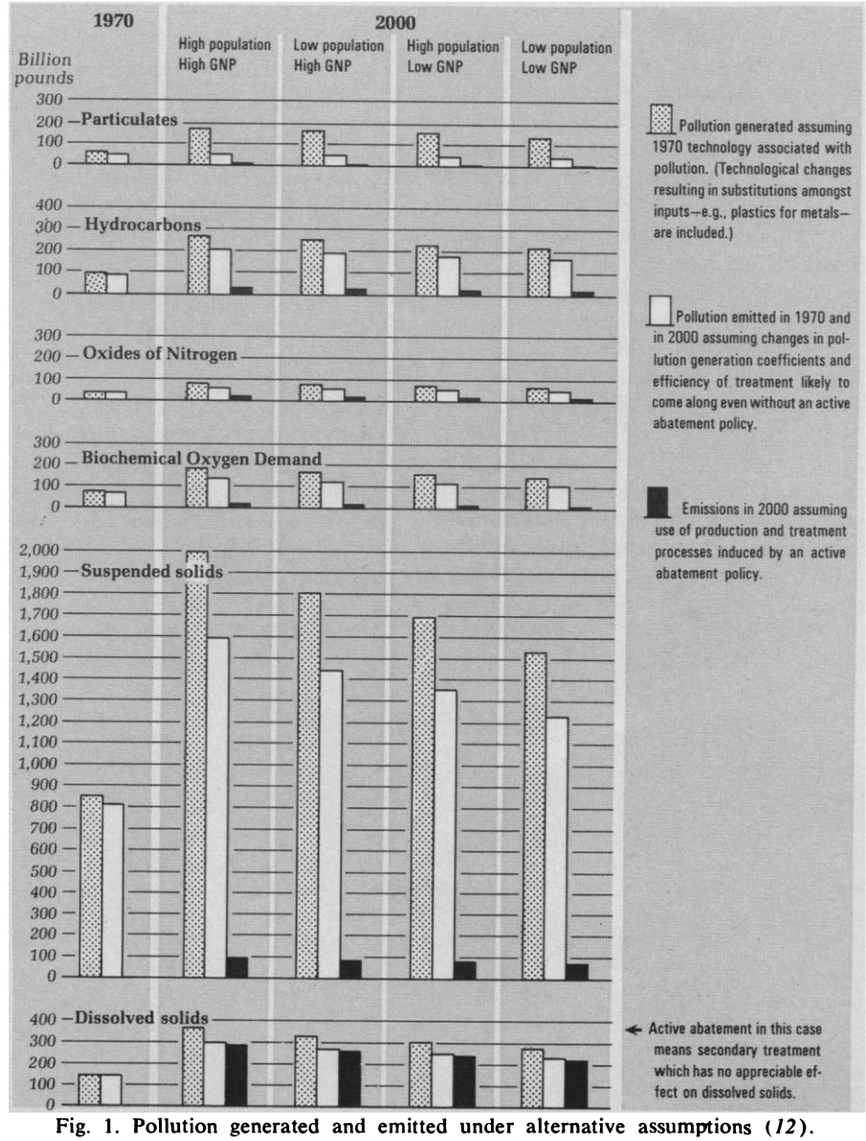

Fig. 1. Pollution generated and emitted under alternative assumptions (*12*).

ally come along, breakthroughs that might not only save future generations from disaster but make them substantially better off than the current generation. In light of this total ignorance about both positive and negative developments that may occur, what is the prudent course? It is not obvious that the prudent course is to save resources for future generations, at least not obvious to any but the most affluent on this earth.

The analogy of stopping the ship until one knows what lies ahead in the fog is an interesting one, conjuring up a picture of passengers sitting comfortably in their staterooms waiting for the fog to lift. It is a rich man's image. The poorer two-thirds of the world's population cannot wait, particularly when it is not clear that future generations will be worse off than people today. If the poor are to wait, the prudent course would be to share the stateroom—that is, the available resources —with them.

These conclusions follow only if we do take advantage of the opportunities available to attack directly the problems associated with growth. If political and institutional constraints make it impossible to apply direct measures forcefully, we are likely, as the figure for pollution indicates, to be faced with an accumulation of very serious problems; in that situation, reductions in economic as well as population growth begin to make more sense. Those who advocate reductions in growth may believe that we will not apply such direct measures with sufficient force. I believe they can be proved wrong. But to do so will require stepping outside the intellectual constraints of the debate over growth and no-growth. As I indicated at the outset, proponents of growth tend to argue that solutions to the world's social and environmental problems should be postponed because economic growth will make them easier to solve, while the proponents of no-growth sometimes appear to argue the reverse, that no-growth will solve our problems or somehow make them easier to solve. Both schools, it seems to me, are cop-outs. What we must do is get on with the solution to the problems that obviously and directly face us. And the sooner the better.

References and Notes

1. I wish to set aside at the outset the question of population growth, which almost everyone agrees must sooner or later be limited. I also set aside the question of whether growth in GNP must also be limited. The GNP is simply a measure of the monetary value that individuals place on final goods and services produced and sold in the market. It is not a physical measure like tons or ergs, but an artifact that changes character and content as people change their notions of what is valuable and what they want to produce and consume. If one allows for the fact that the composition of GNP is not fixed, that services and goods with reduced material content may replace material-intensive commodities, there is no reason that GNP must someday cease to grow. The relevant question is whether the demand for, and use of, resources, space, and environmental carrying capacity can continue to grow unchecked. It is this material content of economic growth on which I focus.
2. The qualification is important, for the amount of solar energy received by Earth is enormous compared to terrestrial stocks of energy. Indeed, the entire terrestrial stock of energy is estimated to be equal to only 4 days of sunlight. In principle, solar energy would permit man to live for another 5 billion years (the remaining estimated active life of the sun) at a reasonably high standard of living, provided population growth ceased during the the next century or so. But as a practical matter, with the technologies and ways of life imaginable throughout the world in the foreseeable future, this indefinitely sustainable standard of living is probably significantly below the level at which most of humanity exists today. A fascinating discussion of these issues can be found in N. Georgescu-Roegen, *The Entropy Law and the Economic Process* (Harvard Univ. Press, Cambridge, Mass., 1971). The estimates in this footnote came from the references in an article by him in *Ecologist* **2**, 13 (July 1972).
3. Another often-mentioned reason growth must eventually stop is environmental deterioration. In the last analysis, however, everything boils down to the availability of energy in useful forms, for with energy man can treat, move, or protect himself from pollution and environmental deterioration. Even space can be increased with sufficient energy—by building upward and outward. A limitation on the use of energy could be the buildup of waste heat, but this depends on the source of energy and the efficiency with which it is utilized. To the extent that reliance is placed on geothermal heat and energy from the sun, a serious buildup of heat is not so certain.
4. D. H. Meadows, D. L. Meadows, J. Randers, W. W. Behrens III, *The Limits to Growth* (Universe, New York, 1972).
5. International Bank for Reconstruction and Development, "Report on *The Limits to Growth*," a study of a special task force of the World Bank, mimeographed, Washington, D.C., September 1972.
6. For example: "Our attempts to use even the most optimistic estimates of the benefits of technology in the model did not prevent the ultimate decline of population and industry, and in fact *did not in any case postpone the collapse beyond the year 2100* [italics added]" (*4*, p. 145). The same point is made about the efficacy of voluntary birth control and more optimistic assumptions about reserves of resources and ability to control pollution.
7. This is easily demonstrated by running the model with different, but equally plausible, assumptions. For example, see R. Boyd [*Science* **177**, 516 (1972)], who demonstrates this on the Forester model.
8. U.S. Commission on Population Growth and the American Future, *Population, Resources, and the Environment*, R. G. Ridker, Ed. (Government Printing Office, Washington, D.C., 1972), vol. 3.
9. J. R. Schlesinger, "Energy, the environment, and society," speech before the Atomic Energy Commission Conference Board, New York, 19 April 1972.
10. K. Watt's statistical analysis indicates that the price of gasoline is a more important determinant of per capita consumption in cities than is use of mass transit, density, or size. While the implied price elasticity of demand is surprisingly high and may not reflect what would occur in practice, this finding is very promising and warrants careful consideration [K. Watt, lecture presented at the AAAS annual meeting, 28 December 1972].
11. On the possibilities of restraining demand, particularly in the short run, see J. Darmstadter, "Energy options: limiting demand," remarks prepared for the Upper Midwest Council Conference on the outlook for energy, Minneapolis, Minnesota, December 1972 (mimeographed copies available from Resources for the Future, Washington, D.C.).
12. Prepared from table 8 (*8*, p. 48).
13. The high population growth rate assumes a three-child family, the low a two-child family. The high economic growth rate assumes a decline in weekly working hours from an equivalent of 40 hours at present to 37 hours in 2000, whereas the low would bring the figure down to 29 hours.