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U.S. ECONOMIC GROWTH FROM 1976 TO 1986: PROSPECTS, PROBLEMS, AND PATTERNS

Volume 10—The Quality of Economic Growth

STUDIES

PREPARED FOR THE USE OF THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

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Printed for the use of the Joint Economic Committee

U.S. GOVERNMENT PRINTING OFFICE
84-286 WASHINGTON : 1977

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

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LETTERS OF TRANSMITTAL

MAY 18, 1977.

To the Members of the Joint Economic Committee:

Transmitted herewith is the tenth volume of the Joint Economic Committee study series entitled "U.S. Economic Growth From 1976 to 1986: Prospects, Problems, and Patterns." This series of over 40 studies forms an important part of the Joint Economic Committee's 30th anniversary study series, which was undertaken to provide insight to the Members of Congress and to the public at large on the important subject of full employment and economic growth. The Employment Act of 1946, which established the Joint Economic Committee, requires that the committee make reports and recommendations to the Congress on the subject of maximizing employment, production and purchasing power.

Volume 10 comprises three studies which examine various dimensions of the quality of economic growth. One focuses on how the natural environment and growth interact, another on alternatives other than the GNP to measure economic progress and the final one examines how economic growth relates to the quality of life for Americans. The authors are Prof. Harold Barnett, Dr. F. Thomas Juster, and Dr. Nestor Terleckyj. The committee is indebted to these authors for their fine contributions which we hope will serve to stimulate interest and discussion among economists, policymakers, and the general public, and thereby to improvement in public policy formulation.

The views expressed are those of the authors and do not necessarily represent the views of the committee members or committee staff.

Sincerely,

RICHARD BOLLING,
Chairman, Joint Economic Committee.

MAY 12, 1977.

Hon. RICHARD BOLLING,
Chairman, Joint Economic Committee, U.S. Congress,
Washington, D.C.

DEAR MR. CHAIRMAN: Transmitted herewith are three studies entitled "Natural Environment and Growth" by Prof. Harold J. Barnett, "Alternatives to GNP as a Measure of Economic Progress" by Dr. F. Thomas Juster, and "Economic Growth and the Quality of Life: Some Past Trends and Implications for the Future" by Dr. Nestor Terleckyj. These three studies comprise volume 10 of the Joint Economic Committee's study series "U.S. Economic Growth From

1976 to 1986: Prospects, Problems, and Patterns." This series forms a substantial part of the Joint Economic Committee's 30th anniversary study series.

The rate of economic growth has long been a subject of great concern. It is only in recent years that quality of growth considerations have come to the forefront. These papers examine three very important features of this new concern: how economic growth interacts with the natural environment, whether the GNP is an accurate measure of economic progress, and to what extent economic growth contributes to an enhanced quality of life.

In his paper, Prof. Barnett observes that increases in environmental pollution levels can be avoided and, in fact, be reduced in our growing economy. The requisite expenditures are well within our means and need not appreciably affect rates of growth in income and output per capita. Thus, his basic conclusion is that improvements in environmental quality of air, streams, and land are quite compatible with economic growth. In examining the two recent views that the United States faces economic impoverishment from the "law of diminishing returns" and also that the United States faces deterioration of the natural environment due to pollution and growth, he concludes that neither view is well founded in evidence, economic reasoning, or logic. His primary argument is that our so-called problems of growth, resources, and environmental quality are really a melange of social problems. He does see nuclear hazards as being very serious societal problems for which no solutions are in sight.

A principal conclusion of Dr. Juster's paper is that the measures of aggregate economic performance contained in the National Income and Product Accounts are seriously deficient from the point of view of measuring either real economic growth or economic welfare, but he finds that no modification of the present accounts would appreciably improve their usefulness for measuring economic welfare. His reason is that significant dimensions of both economic growth and economic welfare are not completely amenable to objective determination. He recommends a combination of economic and social accounts to best measure both economic growth and economic welfare. Such supplementary statistical measures, expanding the scope of the present accounts but linked to them, would be better adapted he argues for purposes of growth analysis and welfare analysis.

Terleckyj explores the correlation between patterns of economic growth and the patterns of change in a series of selected "economic" and "noneconomic" indicators of well-being. From his examination of these patterns, he concludes that the relationship between economic growth and quality of life, over the long run, has varied with different aspects of quality of life expectancy, freedom from crime, level of consumption, and growth of leisure time. The paper concludes by indicating ways in which the future trends in the selective indicators for the different domains of the quality of life could be projected.

The committee is deeply grateful to these authors for these informative papers. Professor Barnett is on the economics faculty at Washington University, Dr. Juster is the director of the Institute for Social Research at the University of Michigan and Dr. Terleckyj is with the National Planning Association. The committee is indebted

to these authors for their fine contributions which we hope will serve to stimulate interest and discussion among economists, policymakers, and the general public, and thereby to improve in public policy formulation.

Dr. Robert D. Hamrin of the committee staff is responsible for the planning and compilation of this study series with suggestions from other members of the staff. The administrative assistance of Christal Blakely of the committee staff is also appreciated.

The views expressed are those of the authors and do not necessarily represent the views of the members of the committee or the committee staff.

Sincerely,

JOHN R. STARK,
Executive Director, Joint Economic Committee.

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NATURAL ENVIRONMENT AND GROWTH

By HAROLD J. BARNETT*

SUMMARY

There is widespread contemporary interest in growth, resources, and environmental quality.

The view is held that the U.S. faces economic impoverishment from the "law of diminishing returns," related to limited natural resources and growth in population and economic size. The view is also widely held that we face deterioration of the natural environment due to pollution and growth. The first view—declining productivity or increasing cost—is the more fundamental dilemma. If it were valid, we should be too poor to clean up the environment, and, moreover, should face increasing costs in our efforts at pollution abatement.

Neither of the views is well founded in evidence, economic reasoning, or logic.

In the United States for the past 100 years we have had increasing returns of extractive goods to inputs of labor and capital. Advances in knowledge, technology, and arts have improved economic availability of agricultural and mineral products at an exponential rate of several percent a year. The clear prospect is for continued improvements in productivity. The "law of diminishing returns" view is thus invalid in this application.

During the past half dozen years, the U.S. has decided, as a matter of policy, to reduce environmental pollution levels and maintain an improved natural environment. To this end, increased expenditures on environment have been mandated currently and prospectively. The annual pollution abatement expenditure levels, in real terms, more than doubled from 1970 to 1974, will double again by 1983, and may double again by year 2000. Such increases are at faster rates than the growth of real gross national product (GNP). The ratio of annual environmental improvement costs thus rises from 1 percent of the GNP to 3 percent in year 2000. This is not a large portion of our increase in income. We give up only a tenth of one percentage point in annual growth of national output to pay for the active abatement policy.

Already there have been significant environmental quality improvements, reported by the Council on Environmental Quality. In air pollution, the national ambient levels of particulates, sulfur dioxide, and carbon monoxide have declined significantly. In the Nation's rivers, aquatic life protection and drinking water suitability have been appreciably bettered. These have occurred in just the very few years

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since the environmental protection policies were decided, and further major gains and improvements are inevitable under existing policies. We enjoy the prospect of environmental quality improvements because we have the resources and productivity to pay for them.

Recent years have heard multiple, related alarms against economic and population growth, industrial activity, energy use, new technologies, capitalism, and other attributes of U.S. society. Some of the questions asked are important and searching, although sometimes loaded. However, the simple answers we hear from the alarmists are frequently simple-minded; most are not well researched or are irrational. The Forrester-Meadows doomsday thesis is discussed and found wanting.

Nuclear hazards are very serious societal problems for which no fully satisfactory solutions are yet in sight.

Many contemporary writers state that environmental deterioration and economic impoverishment are inevitable in consequence of growth in population and the economy. This is allegedly because of the operation of the "law of diminishing returns" and increasing relative scarcity of natural resources. The so-called law and natural resource scarcity are economic propositions, so we must test them primarily with economic measurements, rather than by analogies with fruit flies, stockpiles, entropy, English commons, or spaceships.

Natural resources become economically more scarce and diminishing returns occur only if natural resources become economically harder to get or use. We should test this by asking whether agriculture, mineral, and other extractive goods cost more in labor and capital to produce, per unit. Environmental quality declines only if the levels of environmental pollution and damage increase. We should test this by observing whether society is capable of preventing increases in pollution levels, and indeed reducing them, at costs which do not significantly obstruct growth in income per capita.

We must first test whether "diminishing returns" have reduced our productive ability, because on productive ability we rely for the resources to clean up pollution. We focus on productivity in extractive goods because it is here that diminishing returns, if they occurred, would be most visible.

1. Cost of Extractive Goods

We define real economic costs to be man days and capital inputs to produce a unit of output. In the United States the unit costs of producing extractive goods have been declining. This has been true for at least the 100 years for which we have data, since the Civil War [1].[1]

In agriculture the cost per unit of products in terms of real units of labor and capital, after appropriate allowance for purchased materials, declined. By 1957 it had fallen by more than 50 percent from the aver-

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[1] Reference [1], by Barnett and Morse (cited at end of paper), presents real cost and relative price data from 1870 to 1957. Professor F. Bell has extended the Barnett-Morse labor plus capital cost data to 1970–72 and Prof. R. Manthy has extended the Barnett-Morse relative price data to 1970–72. The trends continue to these later dates. Both the Bell and Manthy works are in preparation for publication. Preliminary observations from Bell and Manthy data were made at the Ford Foundation—Resources for the Future Conference on Natural Resources and Growth, October 18–19, 1976, by G. Brown, B. Field, V. Smith, and H. Barnett.

age real cost in 1870–1900. We got our additional units of agricultural commodities at declining real cost per unit. Declining costs were pervasive over the whole agricultural sector, contrary to the increasing resource scarcity hypothesis.

What has happened to the cost of mineral commodities, as the nation has grown and mineral use has increased forty-fold? We find that here also diminishing returns did not appear. By 1957 the cost per unit of mineral products had declined by three quarters from the turn of the century. Declining unit cost is pervasive, and very rapid for some products.

In forestry we do find an appearance of diminishing returns in the first part of our period. As a result, the unit cost of forest products, measured in days of labor and units of capital goods, with appropriate allowance for purchased materials, increased by approximately one half from the late 1800's to 1957.

If we appropriately combine all of these extractive products—agricultural, mineral, forestry—we can arrive at a measure of cost of extractive products as a whole. We made such a combination giving each of the sectors, and each of the products within sectors, their weighting of economic importance. The real cost per unit of extractive goods overall declines by more than one half, i.e., the industry shows strong increasing returns, not diminishing returns. The declining trends have continued, to at least 1970–72.

We then divide the period of almost 100 years from the Civil War to 1957 into two parts. We characterize the subperiod from approximately the Civil War to the first World War as one in which the physical U.S. was still expanding, even moving its frontier. It was not pressing strongly upon its resource base. We then hypothesize that the period from 1919 to 1957 was one in which the nation's resource base was more fixed, in which there would seem to be less physical accommodation to growth. The results are surprising. The favorable record of declining unit costs of extractive products improves in the second subperiod as compared with the first subperiod.

In agriculture and minerals, the two major resource sectors, unit costs declined only moderately from 1870–1900 to 1919, but precipitously from 1919 to 1957. By way of illustration, in minerals cost declined by approximately 25 percent in the first subperiod and by about 70 percent in the second subperiod. Similarly, in agriculture the decline was less than 20 percent in the first subperiod, but almost 50 percent in the second subperiod. Forestry tells the same story of a more favorable record in the second subperiod, than in the first. In the first subperiod the unit costs index of forest products rises from about 60 to about 106, but in the second subperiod the unit costs index declines slightly, from 106 to 90.[2]

Why has the diminishing returns hypothesis been wrong in the U.S., at least to the extent of data availability, to the early 1970's? Essentially the reason is that the "progress of civilization" (J. S. Mill's phrase) persistently improves the availability of resources in economic terms. As measured by real costs, resource availability improves

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[2] Charts of these data appear in reference [1]. Concerning the years since 1957, some of the Bell and Manthy data (see footnote above) suggest slowdown in the rates of declines of real costs during the 1960's to 1970–72. But the decline continue. World commodity markets have been in turmoil since 1973, and data have not been collected or interpreted relative to increasing scarcity hypotheses. See the forthcoming H. Barnett paper, presented at Ford Foundation—RFF Conference, Oct. 18–19, 1976.

exponentially, at a rate of several percent per year. The individual causes are discussed at length in reference [1]. They include discovery, other new knowledge, and diverse technological changes in resource conversion, transportation, substitution, etc. These more than offset exponential growth in population and per capital consumption. Unit costs of agricultural goods have declined as rapidly as unit costs in the overall economy, and unit costs of minerals have declined even faster. These are the primary reasons for relatively declining labor force in agriculture, mining, forestry, and fishing, shown in Figure 1, below [1].

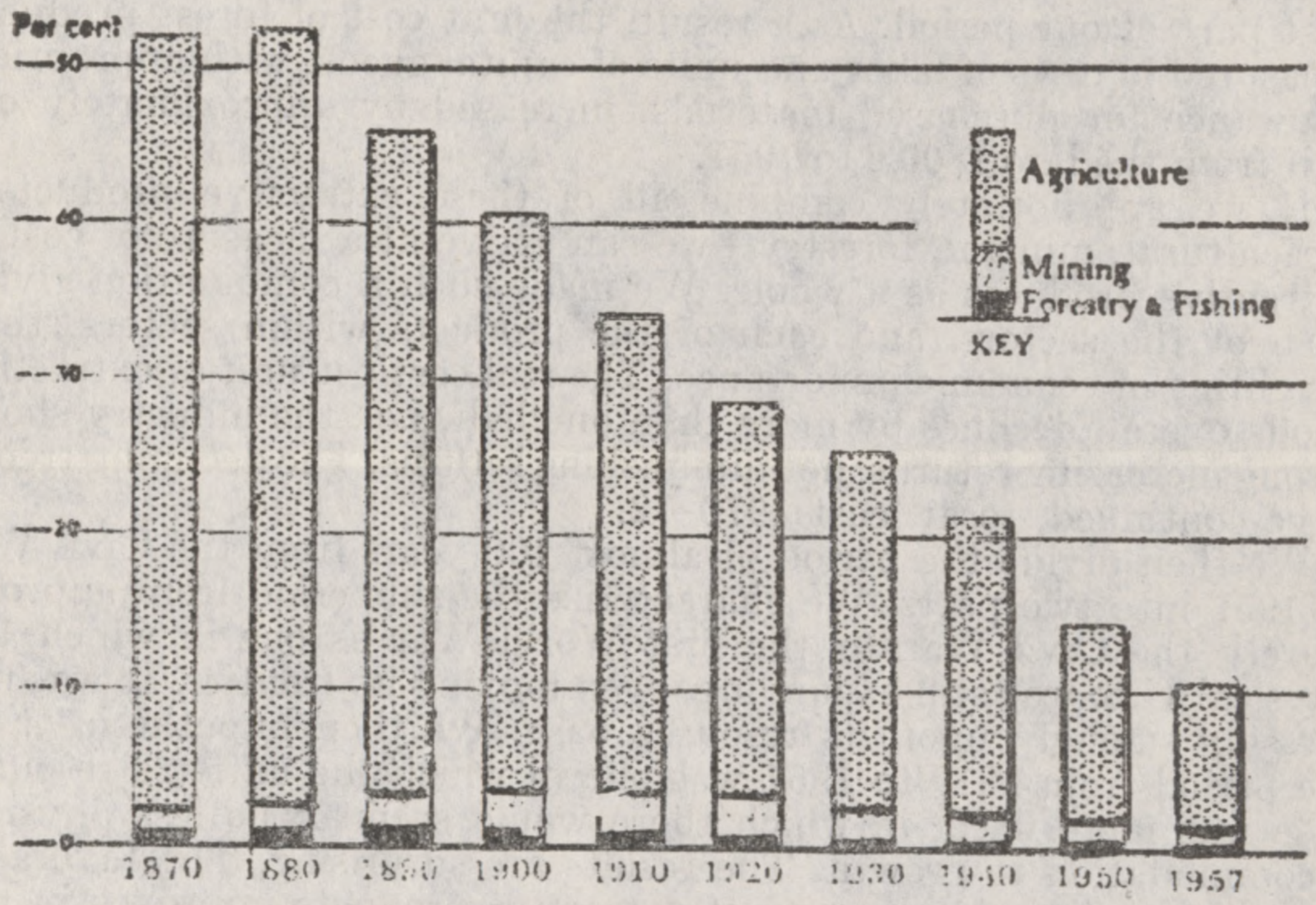


FIGURE 1.—U.S. extractive workers as a percentage of all workers, 1870–1957

So much for the historical record, and failure of the hypothesis that continued economic growth presses too heavily on the natural resource base for food, fiber, and minerals. Now I want to consider the outlook for U.S. growth and environmental quality [2, 8, 9].

2. Environmental Quality

A decade ago we did not have appropriate data on U.S. environmental pollution relative to economic growth. Today we do, due to the massive environmental monitoring efforts of the Environmental Protection Agency and the Annual Reports of the Council on Environmental Quality [8, 9].

The major findings of these and other studies relevant to our topic are these:

(i) There are strong propensities toward continued economic growth in our economy. The tendency is for growth in output and income per capita of perhaps 2 to 3 percent per year, consistent with past growth rates in the U.S. [8, 10, 11].

(ii) The tendencies concerning population growth are more ambiguous. Projections range from 2.1 to 3.1 children per woman. The first figure is equivalent to eventual zero population growth;

the second figure is equivalent to population growth of 1.5 percent per year [8].

(iii) Active policies of pollution abatement are successful and expensive. If the economy were subject to diminishing returns, it would be very difficult to support them [9].

(iv) In the U.S. economy in which productivity per capita grows at 2 percent or more a year, active and increasingly successful pollution abatement policies can be accommodated without significantly slowing the rate of growth in income per capita.

I now elaborate on the last two statements. In 1970, annualized costs of pollution abatement, both public and private, were about $10 billion. At this level of outlay the public believed it had unsatisfactory levels of water, air and land pollution. Moreover, if the policies and technology of the 1960's continued to the year 2000, air and stream pollution would become very much worse as the economy grew. The increased pollution would be quite unacceptable to most of us [2, 8, 9, 10, 11].

Prompted by this outlook, remedial measures have been taken. These were officially put forward in the standards of the early 1970's and in the 1973 water and 1975 air emission standards of the Environmental Protection Agency (EPA). They are all technologically very feasible without any dramatic technical breakthroughs. But, of course, they entail substantial costs.

In annual terms such policies would raise abatement costs from the $10 billion in 1970 and $28 billion in 1974 to about $55 billion (1974 prices) in 1983. Annual costs would then rise to perhaps $75–$120 billion (1974 prices) in the year 2000, depending on the rate of population growth. Put another way, annual pollution abatement costs would rise from 1 percent of the nation's output in 1970 to 2 percent in 1974 to 2.5 or 3 percent by the end of the century. Large though these figures are, they are yet small relative to our income and economic growth. We would have to give up only about a tenth of one percentage point in annual growth of national output to pay for this active abatement policy [8, 9].

What would we get—what are we getting—for this large absolute but small relative payment. The data in the Annual Reports of the Council on Environmental Quality show that already the environmental quality is significantly improving, and further gains are in prospect. For example, from 1970 to 1974, the national ambient levels of the major air pollutants—particulates, sulfur dioxide, and carbon monoxide—declined significantly (Sixth Annual Report, Figure 4, page 311). From 1961 to 1974, river quality—aquatic life protection and drinking water suitability—in the Nation increased significantly (*ibid*, Figure 19, p. 352). The data on air, stream, and land pollution are generally favorable, but not uniformly so over every pollutant and region. As some problems are solved, others become more apparent and are addressed. We have now become aware of problems of fine particulates, synergistic reactions, and trace chemical and metal contaminations. In some quarters there is concern that the pace of improvement is not rapid enough, and that public support for the costs of environmental cleanup may be waning. For our purposes here, however, we observe that increases in environmental pollution levels can be avoided and, in fact, be reduced in our growing economy. The expenditure levels are well within our means and need

not appreciably affect rates of growth in income and output per capita. Indeed the probable situation may be more favorable than I have described. Some technical breakthroughs in pollution control will in fact occur, some cost reductions will occur, and improved policies can be adopted as necessary [8, 9].

In summary, improvements in environmental quality of air, streams, and land are quite compatible with economic growth. This may be seen in the following table in which we show real GNP and environmental maintenance and improvement costs in years 1974 and 2000:

[Dollar amounts in billions]

	1974	2000	Comments
Real GNP before deducting environmental costs	$1,407	$3,900	$(1.04)^{26}=277$ percent.
Less environmental maintenance and improvement costs	28	120	Based on CEQ data in Annual reports.
Real GNP remaining after paying environmental costs.	1,379	3,780	Increase to 274 percent.

Indeed, once we accept that we do not face diminishing returns, we see that growth in per capita income and improvement in technology provide the social interest and the economic and technical means to seek improvement in the environment.

I now discuss the nature of social cost functions for pollution abatement. The "dooms-day sayers" concerning environmental pollution are pessimistic about pollution abatement. They have stated that environmental clean-up cannot run a winning race against pollution from economic growth. The argument goes as follows. The atmosphere or waters have a limited capacity to be self cleaning, dictated by their natural characteristics. Abatement efforts must remove all pollution emissions above this rate of discharge. Pollution emissions, however, are proportionate to economic activity, and increase in proportion to real GNP. Therefore, abatement efforts must remove larger and larger percentages of the pollutants in gross emissions, in order to keep the net emissions below the volumes which the atmosphere and waters can cleanse by nature's processes. The abatement cost function, these people allege, is exponential with respect to percentage of pollutants to be cleaned from emissions:

Cost rises asymptotically to infinity as we approach 100 percent cleansing [5, 6].

The argument is essentially the same as Malthusian-type limits on natural resources for agriculture, forestry, or minerals production. See *Scarcity and Growth* [1]. In conventional Malthusian-type models, the natural resource and socio technical parameters are viewed as fixed, there is only one other factor (labor or "doses" of labor plus capital), and the production function is constant returns to scale with constant quality factors. And so, after a point, output does not rise proportionate to the increase in the variable input. In this pollution model, gross emissions are of constant quality in parts per million pollutants relative to pure air or water. But the emissions have to be "cultivated" or "mined" more and more intensively to remove more of the impurities, in order that the total pollutant discharges to air and water should not exceed the fixed limit of nature's capacity to clean itself. Inevitably, given the Malthusian assumptions, costs eventually rise.

If it is viewed (properly) as a Malthusian model, the increasing cost pollution function argument is subject to all the deficiencies of the Malthusian model when applied to agriculture, forestry, and minerals. These are discussed at great length in Parts 2 and 3 of *Scarcity and Growth* [1]. Actually, Malthusian pollution models may be even more defective than other Malthusian models.

One aspect relates to space. Some of the man-made enterprises which emit pollution can be concentrated, or their emissions concentrated, so that pollutants become concentrated in sewers or area sectors. Thus, particular water courses can be made sewers, with the sludge eventually extracted for chemical processing.

Other enterprises, such as power plants, can be concentrated in regions where the ambient air is capable of self-cleaning very large discharges. Or tall smokestacks can disperse dilute pollutant discharge over large areas, not exceeding the satisfactory self-cleaning level. The oceans, except at some coastal points, have enormously greater self-cleaning capacity than is being used. The concentrations of population and production in urban places aggravate pollution problems initially. But then, when substantial abatement efforts are undertaken, they may provide important economies of scale or conjuncture for remedy.

Another possible error in the allegations of Malthusian pollution cost functions is the omission of technological changes and innovations. Here the opportunities are much wider than in, say, Malthusian agriculture models. Our chief air pollution offenders are 4-cycle private auto engines and coal power plants. The increasing cost argument assumes that we must make stack and car pipe discharges cleaner and cleaner by after-burners, catalysts, and filters. But, of course, we need not have gasoline engines in cars, nor even private cars, and the fuel that goes into power plants need not be high sulfur coal. The chief offenders for water pollution are electric power thermal discharge and chemical plant and municipal sewer discharges. Cooling towers, settling tanks, and secondary sewage treatment are not subject to increasing costs under constant technology, and actually would be subject to declining costs per unit of economic activity from technological change.

The complete substitution of new products and processes denies that it is necessary to increase pollution emissions proportionate to GNP or to traverse an increasing cost curve. But even if for some commodities and processes, the cost curve would increase, there is no reason to assume a priori that the product is large in the social bill of goods. Unless it is large, cannot be substituted for, and cannot be made more efficient, it need not be troublesome. Except for nuclear hazards (discussed below), the air and water pollutants and environmental hazards from power plants, autos, and sewers, and other industrial activities are merely social costs to be taken care of from the growing GNP, in the many ways which we know. An advancing economy can select among the services or functions it wants from its GNP; among the products to provide the services; among numerous processes and branches to provide products; among basic resources; among locations for each of many stages of economic activity; and among innumerable pathways through time. To assume constant ratios of pollutants to GNP and increasing cost functions for pollution abatement is excessively simple minded in economic analysis [5, 6].

3. Forrester-Meadows (F–M) Doomsday Thesis

A diametrically opposed thesis to the several views above, has recently been presented by a group of computer specialists, led by J. Forrester and D. Meadows [3, 5, 6]. In this view, Mankind now faces Doomsday. We are fast running out of agricultural and mining resources, rapidly poisoning ourselves to death by pollution, and crowding ourselves to suffocation. Moreover the crisis of near extinction is virtually unavoidable. These adverse developments reinforce each other, and some, such as excessive birthrate, exert baneful effects over very long periods. Mankind is very near to the point of no-return, if indeed we have not passed it.

F–M do not present detailed support for their conclusion. In essence, they present, rather, a classical, mathematical idea of grandeur, ultimate truth, and absolute power. It is that no world of physically finite resources can contain physical resource pressures if these expand exponentially through infinite time. When viewed in the cosmic perspective of the beginning of creation to the end of Man's time, there is little ground for quarreling with this view. The Forrester-Meadows error is to assert that this ultimate truth is relevant and specifically descriptive for present and near-term societies. They give no evidence.

F–M further trap themselves in a minor motion of limited validity, which is also inapplicable to contemporary human society. This is the concept that an exponentially growing social variable approaches a ceiling at full speed, without brakes. It smashes at the ceiling limit and then catastrophically declines. This is not a general truth. It is at variance with evidence of social resilence and adaptation to physical conditions. For example, in economies, when supplies of a commodity become short, we shift to others; in engineering, when a technology becomes obnoxious, we choose another. "Collapse models" from physical limits do not characterize modern societies, as demonstrated by the complete absence of historical exemplary cases.

A third F–M error is in the defining of the mineral and agricultural resource limits which are relevant for economic analysis. F–M fail

to see that economic resources must be measured in economic terms, not in acres or tons. They assert, for example, that mineral resource availability is limited to the stock which was known in 1900, and is likely to last 250 years. This is not economically sensible. Real costs of incremental supplies and of substitutes and alternatives determine resource availability, not acres of Iowa farmland, or tons of Arkansas bauxite, or pounds of egret feathers or whale blubber, or board feet of Virginia cherry wood (1, Ch. VIII; 6). Had F–M seen that the economic limits relate to costs and substitutes, they would have found that resource availability has been improving, rather than the reverse, and that economic welfare has been advancing [1, 3, 8].

Knowledge, technology, capital and need create resources (1, Ch. XI; 10). Using F–M methodology, a study performed in 1700 would probably have shown that Mankind would have exhausted resources by 1900!

A fourth error is the absence of economic thought and evidence from their economic analysis of pollution. They think that pollution control will persistently require sharply increasing costs, absorbing ever increasing fractions of the national product. They think that these costs may be beyond our capacity to bear, with the result that length of life will decline. The fact, as shown elsewhere, is that only small fractions of the annual increase in output will be required to maintain environmental quality. Under conditions of technological and knowledge improvements in a dynamic society, pollution emissions need not increase proportionate to GNP and cost functions for environmental protection are no more likely to be increasing than in the production of goods. (See above, section 2). We can have both cleaner air and water and enlarged economic welfare [1, 8, 9].

Finally, in summary, F–M fail to see the full significance of technological advance, in association with affluence, enlarged capital and knowledge, improved labor, and substitutions among inputs and products. They see only that technology spawns more products, more capital, more waste discharge and crowding. They have not noticed that technology and affluence also provide desire and means to limit births; to maintain or improve environment; to create and supply substitutes for scarce agricultural and mineral resources; and for avoidance of other resource and environmental limits as these become visible. Moreover, our improved technology and productivity have been growing exponentially, and the rate gives no sign of retardation.

4. Nuclear Hazards

Nuclear dangers are sometimes classed with other environmental quality pollution problems. It is not sensible that we do this. With respect to origins, kinds and magnitudes of problems and solutions, nuclear hazards differ from environmental pollution from automobiles, fossil fuels, and sewage. The roots of the nuclear nightmare are in military affairs, not economic growth. The dangers are societal terrorism, violence, and mass destruction, and related political problems, not the cleansing of air and stream pollutants.

The nuclear problem began 30 years ago and intensifies year by year: the accumulations of potent nuclear materials. Already the "nuclear club" has expanded from two to six or more nations with

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respect to nuclear weapons, and much more with respect to nuclear installations and wastes. The world is hostage to the judgment, wisdom, and sanity of increasing numbers of political and military leaders in avoidance of use and accidents. We have already moved to very large and wide-spread use of nuclear power, and are now moving to reprocessing of wastes and to breeder reactors. The numbers of fission and hot waste sites and the volumes of materials will expand enormously. All nations are joining this "club." The probabilities of accidents escalate. But, even more, the probabilities of illicit use of weapons and wastes increase. In scores of nations, subject to thousands of leaders, in each century there will accumulate great stocks of nuclear weapons, fission materials and hot wastes, potent for an hundred thousand years. Moreover the nuclear Genie is out of the bottle. It is no longer possible to decide to forego the benefits from nuclear energy, in order to avoid its dangers. Already there exist tens of thousands of nuclear bombs, hundreds of nuclear reactors, and tons of fissle and radioactive materials. How to use nuclear energy and yet avoid nuclear catastrophes—this is a major societal problem for which no satisfactory solutions are visible.

5. Conclusions

Our problems do not derive from economic or physical incompatibility of growth, environment, and resources. Our so-called problems of growth, resources, and environmental quality are really a melange of social problems:

The fact that the market economy and the government sectors do not properly assess the costs of pollution when the environment is free for the dumping of wastes;

The fact that there is incompatibility between our traditional strong individualism, on the one hand, and the popular support of greatly enlarged central political decision-making, on the other;

The fact that monopoly forces and market controls are growing rapidly in the natural resource sectors, and these are damaging rational decisions, efficiency, and social relations; and

The fact that we are confusing environment and natural resources with quality of life.

We seem to be pouring into the environmental quality bottle all our individual and social yearnings for peace, stability, and quiet; for social justice in the world; and for more meaningful lives. To these we have added our passions for reform of values and improved quality of life generally; and our antagonism toward modern industrial growth and abuses by private enterprise. [4, 7]. We are misled by the environmental crusaders. Environmental quality is only a lesser element in these problems, not the whole of them [2, 7].

The world has become more dangerous and the near future more precarious from spread of nuclear weapons, materials, and violence. In view of this problem, it is odd that there should be new alarms about resource exhaustion and industrial and urban pollution. These we are now handling tolerably well. Moreover, their possible hazards in the future are smaller, less certain, and far more distant in time than the dangers from an uncivilized world society and nuclear violence.

References

1. H. J. Barnett and C. Morse, *Scarcity and Growth*, (Baltimore: Johns Hopkins University Press for Resources for the Future, 1963, 1965.

2. H. J. Barnett, "Environmental Policy and Management," Social Sciences and the Environment, ed. M. Garnsey and J. Hibbs. (Boulder: U. of Colorado Press, 1967); "Pressures of Growth Upon Environment," *Environmental Quality in a Growing Economy*, ed. H. Jarrett (Baltimore: Johns Hopkins University Press, 1966). "The Changing Relation of Natural Resources to National Security," *Economic Geography*, 1958.

3. R. Boyd, "World Dynamics: A. Note," *Science*, Aug. 14, 1972, pp. 516–519; H. J. Barnett, "Book Review of World Dynamics, by J. W. Forrester," *Journal of Economic Literature*, Sept. 1972, pp. 851–854; R. Gillette, "Book Review of Limits to Growth by D. Meadows and Others," *Science*, March 10, 1972, pp. 1088–1092; T. Humphrey, "The Dismal Science Revisited," *F. R. Bank of Richmond Monthly Review*, March 1973, pp. 2–13; C. Kaysen, "The Computer that Printed Out W*O*L*F*," *Foreign Affairs*, Vol. 50, July 1972, pp. 660–668; A. Kneese and R. Ridker, "Book Review of *Limits of Growth*, by D. Meadows and others," *Washington Post*, March 2, 1972; T. Oerlemans, M. Tellings, & H. DeVries, "World Dynamics: Social Feedback May Give Hope for the Future," *Nature*, Aug. 4, 1972, pp. 251–255; M. Shubik, "Book Review of World Dynamics," by J. W. Forrester, *Science*, December 3, 1971, pp. 1014–15; W. Nordhaus articles.

4. H. Brown, J. Bonner, J. Weir, *The Next Hundred Years* (New York: Viking Press, 1957, 1963); also see Brown, *The Challenge of Man's Future* (New York: Viking Press, 1954).

5. J. W. Forrester, *World Dynamics*, (Cambridge, Mass.: Wright-Allen Press, 1971).

6. D. H. Meadows and other, *Limits to Growth* (New York: Universe Books, for the Club of Rome, 1972).

7. G. Pinchot, *The Fight for Conservation* (New York: Doubleday, Page & Co., 1910).

8. U.S. Commission on Population Growth and the American Future, vol. III, *Population Resources and the Environment*, ed., R. G. Ridker (Washington, U.S. GPO, 1972).

9. U.S. Council on Environmental Quality, *Environmental Quality*, Third-Sixth Annual Reports (Washington: U.S. GPO, 1972–1975).

10. U.S. President's Materials Policy Commission, *Resources for Freedom*, 5 volumes (Washington: U.S. GPO, 1952).

11. U.S. Congress, Joint Economic Committee, *Hearings on Research Scarcity, Economic Growth, and the Environment, Statement by Professor Harold J. Barnett*, (Washington: Government Printing Office, 1974), pp. 171–190.

ALTERNATIVES TO GNP AS A MEASURE OF ECONOMIC PROGRESS*

By F. Thomas Juster**

Summary

This paper sketches out some of the principal difficulties of using measures derived from the National Income and Product accounts for assessments of economic growth and economic well-being. The principal conclusions are:

1. That the measures of aggregate economic performance contained in the NIP Accounts are seriously deficient from the point of view of measuring either real economic growth or economic welfare.

2. That significant modification of the scope, coverage, and composition of the present National Income and Product Accounts would go a long way toward making the Accounts a more accurate reflection of economic growth and growth potential, but would not appreciably improve on their usefulness for measuring economic welfare.

3. That modification of the National Income and Product Accounts to provide a more accurate reflection of economic growth potential, which involves both significant reclassification of expenditures as well as new imputations, may tend to make the accounts less useful for other purposes. In particular, expansion of the list of imputed items, and the increased element of arbitrariness reflected by these imputations, would bring the Accounts further away from the transactions basis than is now the case. Still, sophisticated users should have no difficulty in avoiding these problems, especially if modifications are designed to enable users to include or exclude certain imputations.

4. That significant dimensions of both economic growth and economic welfare are basically perceptual rather than objective, and no transformation or modification of the present structure of Accounts is able to incorporate these types of data.

These conclusions suggest that measurement of economic growth and economic welfare would be best served by a combination of economic and social Accounts. The present transactions-based Accounts are extraordinarily useful, have historical consistency, and in general should not be much tampered with in an attempt to improve their usefulness for other purposes than the ones for which they were designed. But one could envision a significant

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*This paper grows out of research supported by Grant No. GSOC 74–2026 from the National Science Foundation.

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amount of effort going into the production of supplementary statistical measure, expanding the scope of the present Account but linked to them, and better adapted for purposes of growth analysis and welfare analysis. Finally, there seems to be no good substitute for supplemental measures totally outside the scope of the present Accounts, based on perceptual measures of well-being.

On the latter issue—perceptual measures of well-being—an interesting way to proceed might be to focus on illfare rather than welfare. Some of the data already in hand suggest that significant sources of personal dissatisfaction arise from circumstances which can be thought of as representing adverse changes in either economic status, social status, family situation, etc. Perhaps the same is true in a broader sense, in that one of the most useful ways to look at welfare may be to look at some of the principal sources of illfare. If the social welfare function really consists of a multiplicative "production function" where low levels of any one of the relevant input variables is sufficient to reduce the value of the whole function to a low level, measurements designed to identify these sources of illfare, as well as policies designed to ameliorate them, would rank high on any agenda of public policy.

Introduction

In recents years, the usefulness and validity of the National Income and Product Accounts as measures of economic growth and economic welfare has been actively debated among economists and other social scientists. Indeed, a series of full dress conferences organized by the National Bureau of Economic Research has been addressed specifically to this topic.

There is nothing mysterious about the relation between conventional measures of output and income, such as the National Income or the Gross National Product, and economic welfare or economic growth. The best known such measure, or at least the one most widely used both in the popular press and among academics, is the Gross National Product (GNP). Technically, GNP measures the total flow of goods and services produced within the economic system, and after correction for price inflation, GNP is the most commonly used indicator of real income growth.

The deficiencies of the GNP as a measure of economic growth are well-known. And its deficiences as a measure of material well-being are even more substantial, and are beginning to be as widely recognized.

If we define economic growth in its narrowest possible terms, as reflecting the production of real goods and services that take place through the market, the GNP needs only modest amendment. The GNP essentially double counts investment activity, thus overstating the level of real income and output and possibly biasing the estimated growth rate. Not all investment is of course double counted, but the part that reflects the replacement of capital stock used up in the production process is not appropriately included in net output or growth. The correction of GNP accounts for this bias is accomplished via use of the Net National Product series, which simply subtracts an estimate of economic depreciation from total output.

But that does not begin really to get at the basic problem, which is a series of conventional treatments in the present National Income and Product Account which serve to make either the GNP or the

NNP an inefficient and inaccurate measure of even narrowly defined economic growth, let alone a reliably measure of broadly defined economic welfare. While the problems have been long recognized, their solution is beset with both conceptual difficulties and measurement problems.

The Measurement of Growth

The principal problems in measuring growth can be summarized as follows:

1. Good measures of real economic depreciation of capital stock have not been available: tax-based estimates of depreciation are often not good estimates of economic depreciation.
2. The Accounts are seriously inadequate in their treatment of capital stock in the form of national resources. At present, natural resources enter into the Accounts framework only when investments are undertaken to discover and utilize their potential value as future sources of output, and then only in terms of the costs of these investments.
3. Some forms of investment are not at present recognized in the ways the Accounts are kept, in particular business outlays for research and development (which add to the stock of knowledge and thus to the total stock of useful capital), consumer outlay for durable goods (which also add to the stock of wealth and the flow of future services), and investments in human skills.
4. Substantial sectors of the accounts do not really measure output but instead reflect intermediate product "indicators" of output. This is an especially severe problem in the government sector, and has been the subject of a long, lively but inconclusive discussion about what s desirable, what is feasible, whether certain alternatives are any better than existing practice or only appear to be better, etc.

It should be recognized that modification of the present National Income and Product Accounts to provide a better reflection of (narrowly defined) real economic growth is far from straightforward, and from some points of view, may seriously weaken one of the principal purposes of the Accounts. It is argued by many economists that the Accounts should not be concerned so much with an attempt to provide empirical proxies to conceptually appropriate concepts, but ratner with simply describing the market transactions behavior of economic units in terms appropriate to the decision processes of these units. For example, government budget decisions are in the first instance made in terms of expenditure programs, not in terms of the outputs to be expected as a consequence of those programs. We cannot directly make decisions about the level of health in the economy as a consequence of government action. Rather, decisions are made about various inputs—the number and size of hospitals, monetary payments to the elderly or the poor, etc. Thus to try and make the Accounts reflect changes in the health status of the population, which is presumably what medical inputs are designed to accomplish, runs the risk of distorting the kind of financial decisions made by households, governments, and business firms. Thus one can make the case that transactions actually taking place in the market are what the Accounts should reflect, and that elaborate transformation of the data designed

to provide a better measure of economic growth should be carried on outside the basic transactions framework of the Accounts.

Household and Government Capital Accounts

As indicated above, some of the changes that would transform the Accounts into a better measure of economic growth are actually in process at the present time. In the household sector, for example, estimates have been prepared of the stock of consumer durable goods, and active discussion is underway at the Department of Commerce about how these data, and the implicit flows of services produced by household capital stocks, should be incorporated into a revised set of National Income and Product Accounts. As a minimum, it seems likely that consumer expenditures for some categories of durable goods will become classified as household capital formation rather than consumption in the relatively near future, although estimates of imputed flows of services may not be made. Similarly, data exist on stocks of government capital, and a similar distinction between investment and consumption in the government sector is one modification that would provide a better measure of economic growth than the present undifferentiated treatment of government spending on goods and services.

It should be noted that the steps necessary to convert expenditure flows for the household and government sectors into capital and current account sectors are in part relatively straightforward and in part quite arbitrary. No difficulty arises with deciding whether a particular expenditure is more appropriately described as producing a current flow of output or producing a piece of capital which will produce at least part of its output in future years: the durability of the good in question is the relevant criterion, and that test applies equally well to both consumer and government expenditure as to business expenditure. The difficulty arises with imputing a flow of services to the capital assets so defined. In the business sector, the services of capital assets are measured by interest payments and gross profits, and both are reflected by transactions in the market. In the household sector, many transactions involving the acquisition of capital goods take place in the market, in that the capital goods are acquired with borrowed funds and there is a market counterpart to gross returns, and similarly with government spending on either capital or current output. But households do not generate profits and neither do governments.

The basic difficulty is in deciding how to estimate gross and then net return to these household and government assets; the problem is not a simple one. One can of course use a rate of return criterion based on market borrowing costs, and estimate gross returns over the useful life of the asset as being approximated by borrowing costs: if the asset lasts longer than the loan, as is usually true for consumer assets, that calculation implicitly replaces interest costs with "profits" as the loan is repayed. For some consumer markets there are alternative methods of estimation: the existence of rental markets for some consumer durables provides an alternative way of estimating service flows. But that is only true for durables like automobiles, and is not widely applicable throughout the range of consumer durable assets.

The same procedure would in principle be applicable to certain kinds of government assets, especially those types of assets that have precise counterparts in the business sector where rental markets exist. But the problem is complicated, and the estimation and assignment of imputed value for the service flows of both household and government capital assets will run into strong objections from those concerned with having a set of Accounts that faithfully reflect transactions and not the judgment of social accountants about the meaning of activities that do not involve actual transactions.

Intangible Capital

Aside from the tangible capital assets used in the household and government sectors, the principal problems with measuring economic growth in the present accounts have to do with the way other (intangible) forms of capital are treated. The principal sources of bias, in the sense of proper representation of growth, lie in the treatment of research and development outlays (principally by business) and the treatment of investment in human skills in the household (in the form of parental inputs), in schools, and in the labor market (in the form of on-the-job training).

Research and Development Outlays

In the case of research and development outlays, the principles are clear enough and the appropriate transformation of the Accounts relatively straightforward. Business firms who invest in the production of scientific knowledge via the expenditure of funds on both basic research and applications are just as much investing as firms that invest in the stock of capital equipment by building a new structure or acquiring a new piece of equipment. Such investments are made with an eye to producing future returns in the form of new products, different uses for existing products, etc.

Typically, such expenditures are charged as a current cost against output, thus tending to reduce both profits, national income, and national product. The alternative is to capitalize such outlays and depreciate them over time as their economic value declines because of obsolescence. The practical issues involve questions about the appappropriate rate of depreciation and the appropriate scope of such investments: Should expenditures designed to maintain consumer brand loyalties be regarded as investments in knowledge? Should market research designed to better understand consumer brand preferences, or the likely reaction of consumers to a new product or a different price, be viewed as investments in knowledge?

At one end of the spectrum there is a set of activities that unambiguously involve the production of additional knowledge—knowledge that is in the public domain and cannot be appropriated by the firm developing that knowledge. At the other end are activities simply designed to insure that consumers are persuaded to purchase a particular product because of its real or alleged advantages over competing products. In between are activities of a partly or wholly proprietary nature, which produce significant gains in the form of new products, new applications of old products, etc.

Although it is not easy to decide where an appropriate line should be drawn on the inclusion of research and development outlays by private business, it is entirely clear that such activities do take place and that they are of quantitative significance to the growth of real output. Perhaps the best illustrations are developments in computing and medicine, where substantial research outlays are made by private firms that result in rapid rates of increase in technology (of computing power and the prevention of disease, respectively). No one doubts that the research and development activities of major computing and drug firms adds significantly to future output, and that these activities are better described as investments than as expenses of producing current output. The result of the conventional treatment is to overstate business costs and understate profits, and since this form of capital investment has grown relative to other forms, to understate the growth rate of real output as well.

Similar analyses could be made of government expenditures for certain kinds of purposes, the clearest illustration being various forms of research and development outlays in agriculture. Government experimental stations, extension programs and other forms of support to the farming community clearly represent investments in knowledge that provide high payoffs in the form of better crop yield, greater returns to other forms of capital, etc. In this case, however, estimated total output is not affected because all government expenditures are part of final demand and hence output: only the distribution between government "consumption" and "investment" is at issue.

Human Capital Investments

Even more important to analysis of real economic growth is the treatment of investment in human skills. To the extent that these are registered in the present set of Income and Product Accounts, they are represented as consumption outlays in the form of direct schooling costs—teachers' salaries, supplies, etc. Although that is probably the most important single form of investment in human skills, two other types of investments are relevant in principle and are likely to be of quantitative importance. The first is investments by adults (primarily parents) in preschool and school-age children, which take place mainly in the home, consists primarily of investments of time, and is not included as output in the Accounts. Parents also make investments designed to expand the cultural and social skills of their children—summer camps, music lessons, etc., as well as investments designed to provide learning opportunities—books, games and puzzles, etc. While these latter "investments" show up in the Income and Product Accounts, they show up as expenditures for consumption and not as investments in human skills and talents.

A quite different aspect of investment in human skills consists of "on-the-job" training. After people finish formal schooling, they typically enter the job market. But learning and training does not cease when school is completed and work begins. Rather, and depending on the characteristics of the job, most people continue to expand their marketable skills by engaging in activities which have the effect of increasing future income at the expense of present income. In a general sense, one can think of jobs as offering different

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combinations of current income and training opportunities geared to future income. To the extent that people select jobs with a high training and future income component and a low current income component, they can be thought of as "investing" in future income by foregoing some present income. These foregone earnings are of course not included in output as currently measured.

Economic Welfare and GNP

Even if the present National Income and Product Accounts were redesigned to go very far in the direction of being better measures of economic growth, they would still be seriously deficient as measures of economic welfare. Two kinds of deficiencies can be identified. First, deficiencies in measuring the flow of goods and services throughout the system, for which extensive modification of the present Accounts could in principle be a solution; second, deficiencies in representing the fact that it is not just total flows of goods and services that matter, but their distribution among the population as well. And both of these issues leave entirely out of consideration another proposition: that welfare itself may not be adequately reflected by objective measures of flows of goods and services, whether produced within the market or produced elsewhere, but may have to take into account the fact that welfare is at bottom a subjective concept in which the flow of goods and services simply represent inputs. The perceived flow of utilities or satisfaction is what really matters so far as welfare is concerned, and objective measures of material inputs are best viewed as an intermediate product in the social welfare function.

Market and Nonmarket Output

One of the interesting movements in developed economic systems over the past several decades is the changing relative importance of households and the market as producers of goods and services. Present systems of Economic Accounts essentially stop at the household door: once a good or service is purchased by a household, it ceases to be of interest to social accountants and becomes simply an item of final consumption. But the household itself is of course a producer of goods and services. In the early stages of industrial development, a significant part of economic activity took place within the household—clothes making, food production, food preparation, housing construction, etc. As commercially produced goods became relatively cheaper and the market sector expanded, many of these functions were taken over by the commercial sector, with a resulting freeing-up of the time of household family members to take part in paid market activity, to enjoy increased leisure, or to turn to other productive activities within the household. And the trend has continued during recent decades, e.g., in the form of medical services and care for the elderly being more a function of services provided by specialized institutions than by members of the household.

There have been some important "reverse flows"—activities formerly done routinely through the market which are now being done to a greater degree within the household. At one point in our economic history, the use of commercial laundries and cleaning estab-

lishments was much more widespread than it is now. But technical changes in the composition of clothing, accompanied by an enormous increase in the stock of household-owned capital good, have combined to transfer a great deal of cleaning and laundry production out of the enterprise sector into the household sector. In a similar way, much commercial entertainment has given way to television viewing, which is apparently seen by most consumers as a very good substitute for commercially purchased forms of entertainment. Thus in these areas, production within the household has increased, and total production both in the household and in the market has increased more than would be reflected by data covering market activities.

Finally, some portion of the rising amount of leisure time available to U.S. families may be being put to productive uses that, in other circumstances, were supplied through the market. The growth of various forms of volunteer activity would be in that category, and possibly some of the do-it-yourself activities revolving around home maintenance and repair might previously have been done through the market or not done at all.

On the whole, it seems likely that the net impact of sectoral shifts in the production of goods and services have been from the household to the market sector, resulting in a modest overestimate of the rate of economic growth and of the gain in economic welfare: goods which were provided without compensation within the home, and thus made no measured contribution to output, are now being provided by the market and being included in measures of total output. Thus some fraction of the gain in real output is illusory, in that it simply represents a transfer of economically productive activities from sectors where output is not measured to sectors where a similar or in many cases identical output is produced and measured.

The generalization that production has generally shifted from the household to the market needs to be interpreted cautiously. It is not the case that households have ceased to produce goods and services as some of their functions have been taken over by the market sector. Rather, households produce a different collection of goods and services, in addition to taking a substantial part of the total real income gain in the form of increased leisure. But households themselves probably produce more housing output than in former years, in the form of a better maintained and substantially larger stock of housing and home furnishings: they produce substantial amounts of laundry and dry cleaning services, in the form of a larger stock of well maintained clothing. And they continue to produce substantial amounts of child care services, although much of the custodial services formerly provided by members of "extended families" are no longer as common because of different family living arrangements and the attendant flow of service facilities designed to take care of dependent members of society—both nursing home care for the elderly and day care or nursery school care for the very young.

Fringe Benefits and Conditions of Work

Another important and largely ignored dimension of economic growth and welfare can be found in developments within the structure of job market compensation. It is well documented that the propor-

tion of total compensation that takes the form of "fringe benefits" rather than current money income has grown appreciably over time, partly as a consequence of the favorable tax treatment of fringe benefits and partly because fringe benefits reflect a desire to ensure against various kinds of catastrophes that are less highly valued when people are poor but more highly valued as they become richer—medical benefits, pension benefits, etc. Many of these benefits are embodied in conventional Accounts.

However, a substantial change in the conditions under which most American work has been associated with the rising proportion of compensation in the form of fringe benefits. Some of these conditions are reflected in higher costs absorbed by employers—in the form of facilities with better lighting, heating, ventilation, comfort areas, recreational and other facilities, etc.; while the benefits to the working population are thus indirectly reflected in the present Account, as elements of costs, they are not reflected as output or consumption and they clearly have elements of both.

Moreover, and perhaps more importantly, other dimensions of the conditions of work for most Americans have change dramatically. It is no longer true that most American workers (whether male or female makes no difference) spend their days in hard physical drudgery, with the prospect of a meager paycheck and a short life as a consequence of job-related illness. Technology has made major changes in the nature of production processes, and most people (but not all) now spend their working time in relatively pleasant surroundings and on work activities characterized more by the need for expertise than for physical strength. These changes, if we had the appropriate measures, would show up as modifications over time in the degree to which people find the work that they do intrinsically satisfying as opposed to disagreeable, boring, or unpleasant.

Much has been made in recent years of the so-called "blue collar revolt"—presumably a rising degree of dissatisfaction on the part of blue collar workers with jobs that are uninteresting, disagreeable, and intrinsically undesirable. The available data, derived from studies of the quality of employment being conducted at the Survey Research Center, do not show much evidence of such a revolt. Rather, they show that the vast majority of American workers regard the time spent at work as satisfying and enjoyable, and perhaps about as satisfying and enjoyable as time spent either in household production or in leisure activities. In fact, results from one study show clearly that the least satisfying kind of work is housework, and that the apparent blue collar revolt actually reflects little more than a rising dissatisfaction among women with the uninteresting nature of housework rather than a rising dissatisfaction with market work.

Although no data are available, it is hard to believe that attitudes toward the satisfactions derived from work are not appreciably different now than would have been found in the early part of this century or in the previous century. To the extent that this is true, economic welfare has grown by appreciably more than measured growth in output would suggest: changes in the physical characteristics of working conditions are counted as costs of output and not output, while intrinsic satisfactions derived from work activities are clearly additive to the satisfactions derived from the income earned from working.

It has long been an article of faith with academics (allegedly derived in part from the need to explain the low level of compensation paid to highly trained professionals), that academic employment had a large nonmarket component in the form of a job that was challenging, interesting, and at least as enjoyable as leisure. Generally speaking, most Americans are now engaged in market activity that is better characterized as having the traditional nonmarket attractions attributed to academic employment than by the older idea that work is unpleasant and that wages must be set at a sufficiently high level to overcome that unpleasantness and induce participation.

Income Distribution

Quite independently of what one concludes about the trend in the flow of either market goods and services related to economic growth or in a broader concept of production which includes output produced within the household as well as in the market, the question of how the distribution of that output relates to well-being needs to be faced. Available data suggest that the distribution of real income among U.S. families has not changed very much over many decades. During the Second World War and shortly thereafter, the evidence suggested that income distribution was becoming more equal as a consequence of the better labor force opportunities open to less well trained people. But since the 1950's, little if any change appears to have taken place in income distribution despite massive programs designed to transfer resources toward the less fortunate part of the population. Two questions are relevant: first, what is the optimum distribution of income within a society like the U.S.; second, are we presently close to or far from that optimum?

Various pieces of evidence suggest the propositions that:

1. The optimum income distribution, as reflected by the preferences of the members of society, does not call for an equal distribution of resources among families.

2. An optimum income distribution would provide a greater amount of resources to those at the low end of the income distribution, and somewhat less to those at the upper end of the income distribution, than presently appears to be the case.

Evidence on these points comes from studies of preferences, which is after all the only basis for evaluating income distribution policies. People view an income distribution policy based at least to some degree on the productive contribution of individuals, that is, on the kind of inputs ordinarily associated with significant differences in market earnings, as equitable, and therefore, a policy of equal distribution as less equitable. In addition, people report a willingness to tax themselves in order to insure that the less fortunate part of the population have standards of living higher than could be earned by their own efforts. But between the preference for something more unequal than completely equal and less unequal than the present level of income inequality, there is little hard evidence on where U.S. society is relative to where it wants to be.

An important issue in this context is the degree to which adequate measures of income inequality exist at the present time. We know that there is somewhat less inequality in hourly earnings than in

weekly or annual income, largely because of the positive correlation between hourly earnings and hours worked. In addition there may may be a certain amount of self-selection; some people enter occupations characterized by relatively low earnings but other compensating benefits—greater opportunity for consumption on-the-job, greater opportunity for on-the-job leisure, etc. The issue is not a trival one, and research just now getting underway will begin to provide at least some tentative answers.

Probably the most important distributional issue is one that is rarely addressed when the subject is under debate—inequality in lifetime income. Society is not really much interested or concerned about income inequality arising from factors such as differences in age: since young workers earn substantially less than more experienced ones and older workers are apt to earn less than those still in their prime, age-related differences will account for some part of observed income inequality. But inequality during a single year associated with age does not represent inequality over the relevant time span—the earnings lifetime—since everyone has a chance to be young, then middle aged and eventually old. The same is not true for sources of inequality that persist throughout the earnings lifetime of individuals, such as differences in educational level, differences in opportunities, differences due to discrimination against women or minorities, differences due to people's taste for risky occupations, etc.

In a general way, the income inequality issues that are and should be of public concern are those concerned with differentials in opportunity and differentials arising out of various forms of discrimination. It is not at all clear that earnings differentials associated with educational differences warrant social action or are even represented in public concerns: those who invest heavily in formal schooling forego income during the years of training and schooling, and earn higher incomes thereafter. Except in cases where training opportunities are limited by a supply or licensing monopoly—as has been alleged in the medical industry, or where opportunities are limited by capital market imperfections or lack of knowledge, preferences for different paths of lifetime earning resulting from different investment rates seem to be a matter of tastes and not of social policy. The same might be said of income differences associated with differential risk: given the fact that most people seem to be risk averse, occupations with a large variance in possible outcomes are likely to generate higher than average earning and of course imply a substantial amount of income inequality. But as long as everyone knows the odds going in, there seems little cause for social concern about the resulting inequality.

These comments may seem unduly sanguine about an issue which disturbs a large number of people, and is often judged to be a matter of important social policy which is badly handled by existing institutional arrangements. It may be true that the personal income distribution is very far from a social optimum, that significant numbers of people do not in fact have equal opportunity, and that factors like the level of educational attainment and taste for risks reflect little more than a better knowledge of opportunities and therefore a competitive advantage over those that are less fortunate. But it seems to me that so little is really known about the optimum level of income inequality, about the relative importance for observed inequality of

differences due to tastes and differences due to opportunities, and about where we are relative to the optimum, that careful investigation rather than anyone's dogmatic conclusions is the appropriate stance.

Subjective Welfare

Research on perceived well-being is not as yet in as advanced a stage of development as work on objective flows of goods and services, but important generalities are beginning to emerge. Measuring perceived well-being by the difference between satisfaction with life as it is compared to the satisfactions associated with the "best possible" life for people in their particular time and place, we find that satisfactions differ in expected ways—people in affluent societies see a smaller gap between what they have and the "best possible" life than people in impoverished societies. And as would be expected given the relative nature of perceptions of well-being, affluent individuals in any particular society report that their lives are more pleasant and satisfying than less affluent people in the same society, a relationship that holds for societies at all levels of economic development.

Two additional findings about perceived well-being are significant. First, the relation between subjective well-being and the flow of material goods and services, while consistent both among countries and within countries, is not very strong: most of the variance in well-being is determined by factors other than real income. Second, for the one country where we have comparisons of the same measures over a significant period of time, there turns out to be no association between rising material well-being and increased perceptions of well-being: In the United States, satisfaction with life generally did not rise during the decades of the 1950's and 1960's, despite a dramatic rise in real income per household.

We also know something of the mechanism by which perceived well-being changes. As societies grow in material wealth, perceptions of what is a reasonable standard of living change also, and people are as likely to be dissatisfied with greater wealth as they were with less once they have become accustomed to the higher levels of wealth. It is likely that public aspirations to economic rewards are subject to a "ratchet" mechanism, rising as economic circumstances improve, but then not dropping back as circumstances deteriorate. Thus a general decline in material well-being in any country, and perhaps a decline in the rate of increase in material well-being, might be expected to produce an increased sense of unfulfilled aspiration and a decline in subjective well-being.

The importance of adversely changing circumstances on perceptions of welfare can be illustrated by the marked difference between overall life satisfactions for the population as a whole and the satisfactions reported by those who are unemployed, those who are divorced, and those who are widowed. The common denominator in all three cases can be thought of as reflecting a deterioration, relative to the circumstances of other members of the population, in significant dimensions of life satisfaction: those who are employed obviously have a reduced flow of material goods and services as well as of the satisfaction arising from the ability to find useful work; those who are divorced, especially women, are likely to find their economic circumstances significantly

poorer than they had been previously, and both their less favorable economic status and their general societal status reflects a kind of "capital loss" resulting from termination of a relationship in which they had invested heavily; and those who are widowed would show the same kind of capital loss as those who are divorced, although perhaps with less intensity.

The notion that adverse changes relative to the population as a whole have a particularly important impact on perceptions of welfare contains an interesting implication for studies of subjective well-being. Typically, we tend to concentrate on the measurement of satisfactions—positive elements of well-being. But perhaps illfare is more important than welfare in the production of well-being, in that a significant element of dissatisfaction in any of the domains relevant for global well-being is of sufficient importance to dominate overall satisfaction. For example, an individual with a job that is grossly unsatisfactory, or a person with a bad marriage, or one who lives in a deteriorated neighborhood with a constant threat to physical safety, may have much lower values of an appropriate social welfare index than would be suggested by an additive treatment of the various dimensions of welfare. In short, there may be critical values—satisfactions above some minimum—without which overall welfare is perceived to be at low levels regardless of satisfactions with other aspects of life. If that is true, the appropriate policy calls for a greater focus on removing sources of illfare than on expanding resources of welfare.

ECONOMIC GROWTH AND THE QUALITY OF LIFE: SOME PAST TRENDS AND IMPLICATIONS FOR THE FUTURE

By Nestor E. Terleckyj* **

Summary

The paper attempts to explore the correspondence between patterns of economic growth and the patterns of change in a series of selected "economic" and "noneconomic" indicators of well-being. There are relatively few long-term statistical series for which such comparisons can be made. However, a few indicators exist which reflect major and distinct dimensions of the quality of life and for which the desirable direction of their changes is reasonably well apparent. The dimensions of well-being for which significant indicators of average well-being could be included in the present exploration are health, personal safety, leisure, standard of living (consumption) and economic equality between major population groups.

The indicators measuring at least some important aspects of those concerns include: The average life expectancy at birth, the rate of violent crimes (extended over a longer time period by means of the homicide rate), the average work week, the real (constant dollar) consumption per capita—an indicator of economic well-being—and the ratio of median income of non-white families to white families. Clearly, the levels of indicators such as life expectancy, crime rate etc., do add significantly to the information regarding the average well-being beyond what a traditional economic indicator such as average consumption can provide.

The analysis was conducted by comparing changes measured over ten year intervals in the gross national product (GNP) and in output per man-hour with corresponding changes in the indicators of well-being over the same time intervals going back to 1900 for most indicators.

This analysis did not reveal any correlation between long-term rates of economic growth and changes either in the life expectancy or in the level of public safety reflected in the crime rates. Both life expectancy and the gross national product (and productivity) grew throughout the 75 years of the present century but their rates of growth over 10 years intervals did not show any association. The rates of violent crime have risen, fallen and risen again during the period, also without any correlation with the rates of economic growth.

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**The author would like to thank David M. Levy and Everard Munsey for their helpful comments on the draft of this paper. The research work reflected in this paper was supported in part by the research grant No. SOC76–15876 from the National Science Foundation.

On the other hand, changes in the real consumption per capita, not surprisingly, show a correlation with changes in the GNP.

The average work week has been declining in every subperiod analyzed, but the rates of decline were correlated negatively with the rates of economic growth. However, the growth in productivity permitted simultaneously long-term increases in leisure time and in real consumption.

The rate of convergence of incomes of non-white and white families appears to be highly dependent on the rate of economic growth. In the absence of growth the relative incomes might even tend to diverge.

Examination of these patterns suggests the conclusion that the relationship between economic growth and quality of life—at least over time periods on the order of decades—has not been unique. Rather it has been different for the different domains of the quality of life: Positive, negative and no associations. Thus, at the level of the American economy attained in this century and with the existing social relationships there does not seem to be any dependence of life expectancy or of the crime rate on the long-term economic growth. (This does not rule out the possibility of some short term interactions). On the other hand, some important areas of social well-being such as equalization trends in the economic position of population groups and, of course, the level of consumption are clearly dependent on the rate of economic growth. The availability of leisure time has been dependent on the level of productivity growth, which historically has been the main component of the economic growth. Otherwise, in the absence of productivity growth, the trade off between the amount of leisure and the level of consumption could not be avoided.

The paper concludes by indicating ways in which the future trends in the indicators for the different domains of the quality of life could be projected to the extent that they depend on the future rates of economic growth and on demographic change, i.e., change in the age, sex, etc., composition of population. In this way a baseline may be obtained for evaluating the effects of other factors, including those of prospective policies on the future levels of well-being in the different domains.

1. Conflict or Reinforcement?

While the possible dangers of population growth for the quality of life have been perceived and debated for a long time, continued economic growth has been, until recently, generally regarded as beneficial and desirable. Its cost, when considered at all was usually viewed as small compared to its benefits. However, in the last 10 years or so, questions have been raised whether the cost of growth, especially in terms of pollution damage or environmental degradation may not be high or even prohibitive, compared to its benefits,[1] whether continued growth trends are at all possible in view of the finite supply of natural resources, and whether continued growth would not necessarily lead to a world-wide catastrophe in a few generations.[2] On the other hand, questions have also been raised whether the environmental improvements or social programs intended to raise the quality of life may not seriously slow, or even stop, the future economic growth.

Is there really a conflict, possibly an inherent conflict, between economic growth and the quality of life? And in particular is there a

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[1] Mishan (1967).
[2] Meadows et al. (1972).

conflict between the present trend in the rate or direction of growth of the American economy and the quality of life in the United States insofar as it can be measured by broad indicators of social well-being?

Unambiguous conclusions about the relation between economic growth and quality of life cannot be made.

Quality of life is not a uniquely measurable one-dimensional entity. Rather, it embraces a multiplicity of distinct categories. Over any time period, the levels of satisfaction of these distinct human concerns as reflected in their specific indicators can move in different directions and at different rates. These concerns are not reducible to a single monetary valuation which would permit judgments on the basis of net economic benefits by subtracting costs from benefits and reformulating growth on a net, quality of life, basis.

Economic growth, too, is not a single unambiguous consideration for relating it to quality of life. Economic growth is generally taken to mean the rate of growth in the gross national product (GNP) or a related magnitude, such as national income or net national product. The GNP is a measure of the annual production of goods and services in the economy compared over time as a price adjusted value of the goods and services delivered to the final consumers or other end uses. What exactly constitutes an end product is defined by the conventions of national income accounting, and alternative formulations are possible. Indeed, in the past, important debates concerned the primacy of economic welfare versus level of production in the formulation of the national product.[3] Recently, various modifications of the GNP concepts have been advanced, containing a number of major reformulations, such as a monetary valuation of gains in leisure time, identification of cost of environmental pollution, or rearrangement of consumer expeditures into separate categories representing real increases in economic well-being and those reflecting increasing costs.[4]

In addition to the rate of economic growth, regardless how measured, the mode of economic growth (i.e., its sources and patterns) may also be important for the quality of life. For example, it makes a difference whether growth occurs as a result of an increase in working time or as a result of an increase in productivity (output per work hour). Furthermore, if growth results from increases in output per manhour it may make an important difference for the quality of life (for example for the environment) if the growth in productivity came about as a result of additions to the capital stock of a given technology or through introduction of a resource saving innovation. There are many other possibilities of how the locus and the source of a given amount of economic growth may have different impacts on the quality of life (for example, through its effects on population density, through its geographical patterns or through its economic sector locus, e.g., in agriculture versus service industries.)

The data on the quality of life which might permit inferences about the relationship between particular forms of economic growth and the different dimensions of the quality of life is very limited. Only a few indicators can be examined over a significantly long time span.

This paper attempts to examine the association between economic growth and changes in selected aspects of the quality of life in the United States over the period 1900–1975, using the few indicators representing certain generally recognizable aspects of the quality of

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[3] Kuznets (1951) ; Jaszi (1958).
[4] Nordhaus and Tobin (1973) ; Japan, Economic Council (1973) ; Juster (1973).

life for which sufficiently long time series of data exist to permit such a comparison. Changes in these particular indicators are also compared to changes in productivity. Following this examination of the historical changes, is a discussion of the potential use of some of the relationships, both positive and negative, between quality of life and economic growth in projecting possible future trends.

2. Dimensions of the Quality of Life

"Quality of life" has been variously defined to mean a wide range of different things: Abstract and concrete, unmeasurable and measurable, subjective and objective. Measurable formulations have ranged from a simple index of economic well-being such as the GNP per capita or a modified measure of average family income to reports on the subjective evaluations of states (e.g., with respect to marriage, job, etc.) by the individuals responding to surveys.

While highly personal or metaphysical conceptions of the quality of life are quite valid in the ethical and philosophical domains they cannot be related to economic growth in a meaningful fashion because they do not share with it either the substantive operational relationships or the normative scope of decision making. Moreover, as a practical matter, quality of life at that level is unobservable and therefore unquantifiable.

On the other hand, it has been recognized for some time that measurement of quality of life by income or consumption or any combination of economic criteria alone is insufficient because it leaves out important personal, social, and environmental conditions, such as the state of health or quality of the neighborhoods, which cannot be included in a meaningful way in income and other economic indicators. Also, as noted, economic indicators are limited even as measures of economic well-being. Thus, growth of consumer expenditure for certain items may indicate deterioration of quality of life (for example, rising replacement of pollution damaged clothing) rather than improvement in the living standard, i.e., in the true economic welfare. Attempts to reformulate measures of economic output mentioned earlier, go part of the way and provide important new information but they cannot deal with many of the fundamental dimensions of the quality of life for which no valid price can be even approximated.

Thus, in order to discuss the quality of life in an operational and possibly policy relevant sense, it is necessary to define it at some middle ground between the extremes of the transcendental or intimately personal values on the one hand, and one dimensional economic indicators based either on the conventional or on modified concepts of income or consumption on the other. In fact, a series of such indicators may be identified among the existing statistics. Information on the state of health is given by data on life expectancy and the prevalence of disabilities. Information on public safety is given by the statistics for violent crime (and by less adequate data on fires, accidents and environmental hazards). Similar information exists for a few other fields. In recent years, development and improvement of such data has been stimulated by the lively interest in the field of social indicators.[5]

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[5] Sheldon and Parke (1975).

A number of indicators reflecting different aspects of the quality of life are shown in Table 1 which is reproduced from a recent study by the author.[6] These indicators have been selected to represent a series of "basic goods," private and public, i.e., goods more basic than the specific objects of private and public expenditures such as the consumer goods and services and the specific objectives of the individual public programs. It was intended that these indicators have a generally recognizable desirable direction of change, i.e., that other things being equal a change of an indicator in a given direction, (such as increase in life expectancy), is considered desirable.[7] While such may actually be the case for most of these indicators, for some the general desirability of change in the particular direction may be less evident and may require special assumptions.

TABLE 1.—A SUMMARY LIST OF CONCERNS AND CORRESPONDING INDICATORS

Concerns	Principal indicators	Indicator levels		
		1960	1973 estimate	1983 projection
I. Health and safety:				
Health	Average life expectancy at birth, years	69.7	71.3	72.7
	Percent of population with activity limiting disabilities.	15.0	17.5	16.8
Public safety	Number of violent crimes per 100,000 persons per year.	265	668	668
II. Education, skills and standard of living:				
Basic education	Index of performance in grade 12 based on standard tests, 1973=100.	(1)	100	105
	Percent of students 3 or more years behind 1973 average.	(1)	24	19
Higher education	Number of persons completing college, thousands	392	957	1,342
Ability to earn	Number of persons not in the mainstream of labor force, millions.	(1)	11.1	8.8
General level of earnings	Median annual wage and salary earnings of individuals, thousands 1973 dollars.	4.8	5.9	7.8
III. Income:				
Adequacy of income	Percent of population below present poverty standard.	22.1	11.4	8.7
	Percent of population in near-poverty conditions	8.1	4.8	3.5
Continuity of income	Percent of population with living standard loss of over 30 percent.	(1)	8.6	8.7
IV. Economic equality:				
General economic equality.	Income ratio: 20th as percent of 90th percentile	20	25	25
Economic equality of races.	Mean family income, blacks as a percent of whites	56	65	70
Economic equality of sexes.	Hourly earnings of women as percent of earnings of men.	(1)	60	60
V. Human habitat:				
Housing	Percent of persons living in adequate houses	(1)	88	92
Neighborhoods	Percent of persons living in satisfactory neighborhoods.	(1)	77	87
Pollution control	Percent of population exposed to bothersome pollution.	(1)	62	46
Outdoor recreation	Percent of persons 12 yr and older regularly taking part in outdoor recreation.	(1)	21	54
Preservation	Index of preservation of life and natural forms	(1)	100	110
VI. Art, science, and free time:				
Discretionary time	Hours per person per year	(1)	2,111	2,199
Science	Number of scientists active in basic science, thousands.	(1)	81	139
The arts	Number of active artists, thousands	206	265	323

[1] Not available.

[6] Terleckyj (1975).

[7] Recognition of a desirable direction of change does not imply absolute desirability of changes in that direction but simply that in and by itself the given change is better than no change. However, any given change may be viewed as less desirable than a change in another domain which would have the same resource cost, or, it may result in a large undesirable change in another domain of the quality of life.

Also, any particular event may have a positive effect on some of the dimensions of the quality of life, negative effect on others, and may leave still other indicators unaffected. For example, lowering of the average retirement age would increase the amount of leisure but it may also reduce the average levels of consumption, and in particular may entail after some time, increased incidence of seriously reduced living standards among the older population.

Finally, the relationships between economic growth and specific aspects of the quality of life may vary depending on the time interval. Some modes of economic growth may have opposite effects over time. For example, a sufficiently massive investment activity may reduce the living standards in the short run by withdrawing resources from consumption and perhaps through environmental disruption but improving the living standards and the environmental quality in the long run after the new capital begins to yield productive results and replaces the productive alternatives which had fewer (or negative) environmental benefits.

3. Measuring Long-Term Changes in the Quality of Life

For comparisons with economic growth, long time series are needed for the indicators of the quality of life. But few of the indicators in Table 1 have data even for 1960. Also, in some cases where the data is available, as in the case of higher education (number of college completions), the desirability of continued increase over the next ten years is not certain. Therefore, this indicator is left out of the present comparison.

For some key indicators for which the data extend back at least to 1950, the data are shown in Table 2. All these indicators reflect national aggregates. They include one indicator of the general economic well-being (real consumption per capita), indicators for three non-economic domains of the quality of life: health (measured by life expectancy), public safety (measured by violent crime rate for part of the period and homicide rate for the whole period), and leisure time (measured, partially, by the average work-week); and one indicator of economic equality or perhaps, equality of economic opportunity among major population groups (the ratio of median family income among non-white and white families). No attempt was made in this paper to develop consistent long term data from partial information or to utilize all the long term time series that might be obtained, but which might have ambiguous meaning for the quality of life.[8]

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[8] In addition to the number of persons completing higher education two other indicators with an entry for 1950 in Table 1 are omitted from the present analysis because the long-term desirability of their direction of change may be ambiguous: the income ratio of the 20th to the 90th percentile and the number of artists. The second indicator for health has been omitted, and the median earnings have been replaced by the consumption per capita. Because of the technical and conceptual difficulties no attempt has been made in this paper to extend the poverty and the near-poverty indicators back to 1900.

TABLE 2.—SELECTED INDICATORS OF THE QUALITY OF LIFE IN THE UNITED STATES, 1900–75

Year	Life expectancy at birth, (years)	Rate of violent crime per 100,000 population: All violent crimes [1]	Rate of violent crime per 100,000 population: Homicides	Real consumption per capita: NBER [2] 1929 dollars	Real consumption per capita: BEA [3] 1958 dollars	Average workweek (hours): NBER [2]	Average workweek (hours): BLS [4]	Ratio of median income of nonwhite families to that of white families
1900	[5] 49.3	([6])	1.2	359	----------	53.2	----------	([6])
1910	51.6	([6])	4.6	455	----------	52.1	----------	([6])
1920	56.5	([6])	6.8	495	----------	49.8	----------	([6])
1930	59.3	[7] 294.7	8.8	606	1,145	47.7	----------	([6])
1940	62.9	191.2	6.3	----------	1,178	43.9	----------	([6])
1950	68.2	221.2	5.3	----------	1,520	41.2	41.7	0.54
1960	69.7	265.3	4.7	----------	1,749	----------	40.5	.55
1970	70.9	601.2	8.3	----------	2,324	----------	39.1	.64
1975	[8] 72.4	802.5	[8] 9.6	----------	2,567	----------	36.1	[9] .62

[1] The rate of violent crimes reported to the police as published by the FBI adjusted for underreporting by dividing by 0.6, the 1966 ratio of crimes reported to the police to crimes reported by the victimization survey.
[2] National Bureau of Economic Research, Inc.
[3] Bureau of Economic Analysis, U.S. Department of Commerce.
[4] Bureau of Labor Statistics, U.S. Department of Labor.
[5] 1901.
[6] Not available.
[7] 1933.
[8] Preliminary.
[9] 1974.

SOURCES

The data for the period 1900–70, were obtained from the following sources:

Life expectancy at birth: Executive Office of the President, Office of Management and Budget, Social Indicators, 1973, table 1/1, p. 26. From Public Health Service, National Center for Health Statistics, Vital Statistics of the United States, 1968, vol. II, pt. A, and unpublished data and 1970, vol. II, pt. A.

All violent crimes: Executive Office of the President, op. cit., table 2/1, p. 64. From Federal Bureau of Investigation, Uniform Crime Reports for the United States, annual issues and unpublished data.

Homicide: U.S. Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1970, pt. 1, series H–972, p. 414.

Real consumption per capita: NBER: U.S. Department of Commerce, Bureau of Economic Analysis, Long Term Economic Growth 1860–1970, series A–25, pp. 186–187. BEA: Ibid., series A–26, pp. 186–197.

Average work week: Moore, Geoffrey H., and Janice Neipert Hedges, "Trends in Labor and Leisure," Monthly Labor Review, February 1971, table 1, p. 5 .

Ratio of median income: Executive Office of the President, op. cit., table 5/2, p. 175. From U.S. Bureau of the Census, Current Population Reports, series P–60, No. 85.

The data for 1975 represent the latest data available from the reporting agencies as of the writing of this paper.

For these indicators to represent quality of life requires making some normative assumptions which appear to be reasonable, i.e., that decreases in crime and in the average work week and increases in life expectancy, in the ratio of income of non-white to white families, and consumption per capita represent the desired direction of change. Health, safety and real consumption probably would be generally recognized as desirable, as would the increases in leisure time through reductions in the work week, though perhaps with less generality. Also a widely held consensus could be demonstrated in favor of the desirability of convergence of the average levels of economic well-being among the different population groups.

Data for life expectancy at birth, for average work week (a major component of discretionary time), and consumption per capita are available back to 1900. For the other two indicators, statistics do not go back as far: For violent crime data are available back to 1933, but for homicides to 1900 (from the Vital Statistics); data on relative incomes of white and non-white families is available back to 1947.

Some of the time series in Table 2 are available in segments from two different sources, and have different values of overlapping years. Both values used for the linking of segments are shown in the table.

This compilation does not permit any extensive examination of the relationship between economic growth and changes in quality of life.

It does permit, however, a very simple examination of the possible existence of clear-cut statistical relationships, one way or the other, between the changes in these indicators one at a time on the one hand and economic growth on the other. The usefulness of such simple comparisons is limited because they cannot cope with complex relationships involving additional variables or time lags not reflected in contemporaneous changes over ten year intervals. On the other hand, there are no complex analytical models available at present which would unrevel these complex relationships, and thus the identification of strong relationships for pairs of variables may constitute a useful first step.

Changes in the indicators are shown in Table 3 by decade in comparable terms for the period 1970–75. Changes in the real consumption per capita and in rate of violent crime are shown in annual compound rates of change calculated between the beginning and terminal years of the respective periods. However, changes in the other three indicators are shown in absolute differences, each for a reason of its own. Thus, changes in life expectancy are limited by biological constraints; reductions in the work week represent additions to an initial amount of leisure time that is unknown, and the ratio of median incomes of non-white to white families are already expressed in percentage terms. Also, because of the large size of their units of measurement relative to their annual changes, changes in these three indicators are expressed as rates for ten year periods rather than in annual rates.

TABLE 3.—CHANGE IN SELECTED INDICATORS OF THE QUALITY OF LIFE IN THE UNITED STATES, 1900–75

[Total change for the decade unless otherwise indicated]

Decade	Life expectancy at birth, change in years	Violent crime per 100,000 population annual rate of change (percent)		Real consumption per capita (percent of change)	Average work week, change in hours worked	Change in the ratio median income of nonwhite families to that of white families (percentage points)
		All violent crime	Homicide			
1900 to 1910	[1] 2.6	n.a.	14.4	2.4	−1.1	([2])
1910 to 1920	4.9	n.a.	4.0	.8	−2.3	([2])
1920 to 1930	2.8	n.a.	2.6	2.0	−2.1	([2])
1930 to 1940	3.6	[3] −6.0	−3.3	1.3	−3.8	([2])
1940 to 1950	5.3	1.5	−1.7	2.6	−2.7	([2])
1950 to 1960	1.5	1.8	−1.2	1.4	−1.2	1
1960 to 1970	1.2	8.5	5.9	2.9	−1.4	9
1970 to 1975	3.0	5.9	3.0	2.0	−6.0	−5

[1] 1901–10 adjusted to a 10-yr rate.
[2] Not available.
[3] 1933–40.

Source: See table 2.

Because of continuous growth over each interval of the 75 year period in life expectancy and in consumption per capita and continued secular decline in the average work week, the levels presently achieved (1975) for the quality of life with respect to health, standards of living, and leisure are the highest ever (since 1900) achieved in these

regards. On the other hand, the level of public safety has been fluctuating: The highest levels of public safety as given by the violent crime indicators prevailed at the beginning of the century and the lowest are the ones now prevailing (but levels nearly as low also occurred around 1930). The family income ratio was highest in 1970.

The data in Table 3 reveal that there has been no uniformity in the patterns of change over successive periods among the different indicators. Thus, the greatest improvements in health, as measured by life expectancy at birth, occurred during the 1940's (almost as large improvement occurred during the 1910's); the greatest reduction in crime occurred in the 1930's; the most rapid increase in real consumption per capita in the 1960's; and the largest increment to discretionary time resulting from reduction in work week, in the 1970–75 period and on a full decade basis, in the 1930's.[9]

4. The Rate of Economic Growth and the Quality of Life

The basic indicators of economic growth for the period 1900–75 are shown in Table 4. Their rates of change are tabulated in Table 5. As measured by the GNP, the economy has grown at different rates over different decades of the century. The highest rate of growth in GNP between the decennial years occurred in the 1940's while the lowest growth was in the 1930's, and again in the period 1970–75. These patterns of growth differ somewhat from the historical patterns derived between the successive peak years in the cycles of economic activity. The years used here were chosen for comparison with the rates of change in social indicators.

TABLE 4.—SELECTED INDICATORS OF ECONOMIC ACTIVITY IN THE UNITED STATES, 1900–75

Year	GNP (billions 1958 dollars)		Output (billions 1958 dollars)		Man-hours		Output per man-hour	
	NBER	BEA	NBER	BEA	1958=100 NBER	1967=100 BLS	1958=100 NBER	1967=100 BLS
1900	$77.8	----------	$70.8	----------	62.5	----------	27.0	----------
1910	115.1	----------	104.5	----------	79.7	----------	31.3	----------
1920	149.4	----------	133.3	----------	87.4	----------	38.1	----------
1930	192.8	$185.3	170.0	$168.6	91.1	80.4	46.8	34.3
1940	----------	227.2	----------	204.6	----------	76.9	----------	43.3
1950	----------	355.3	----------	322.9	----------	87.9	----------	59.7
1960	----------	487.7	----------	441.7	----------	92.0	----------	78.2
1970	----------	720.2	----------	655.4	----------	102.6	----------	104.1
1975	----------	787.2	----------	720.9	----------	107.4	----------	109.4

Source: All the data for the years 1900–70 were obtained from the compilation of the original Time Series in U.S. Department of Commerce, Bureau of Economic Analysis, Long Term Economic Growth 1860–1970, series A–25, pp. 185–187.

GNP: NBER, series A–1, pp. 182–183; BEA, series A–2, pp. 182–183.
Output: NBER, series A–13, pp. 184–185; BEA, series A–14, pp. 184–185.
Man-hours: NBER, series A–68, pp. 192–193; BLS, series A–69, pp. 192–193.
Output per man-hour: NBER, series A–167, pp. 210–211; BLS, series A–168, pp. 210–211.
The data for 1975 were obtained from the reporting statistical agencies.

[9] The lack of data precludes an examination of long-term changes in the quality of the living environment here. The quality and quantity of housing for the average American probably improved substantially since 1900. Also the larger living environment probably improved considerably as a result of replacement of animal power and coal with the electric power and oil and natural gas. On the other hand there probably was some decline in the quality of neighborhoods at least in the more recent decades which in part may correspond to the trend in the violent crime rates but probably depends on other factors as well.

TABLE 5.—GROWTH IN THE SELECTED INDICATORS OF ECONOMIC ACTIVITY IN THE UNITED STATES, BY PERIOD, 1900–70

[Annual rates of change between initial and terminal years of the period; in percent]

Period	GNP	Private domestic economy		
		Output	Man-hours	Output per Man-hour
1900 to 1910	4.0	4.0	2.5	1.5
1910 to 1920	2.6	2.5	.9	2.0
1920 to 1930	2.6	2.5	.4	2.1
1930 to 1940	2.2	2.0	—.4	2.4
1940 to 1950	4.6	4.7	1.4	3.3
1950 to 1960	3.2	3.2	.5	2.7
1960 to 1970	4.0	4.0	1.1	2.9
1970 to 1975	1.8	1.9	.9	1.0

Source: Table 4.

In addition to the overall measure of economic growth given by the rate of growth of GNP, also included in Table 4 are the rates of growth in output, in man-hours worked and in productivity (output per man-hour), in the private domestic economy.[10]

The patterns of growth in the United States economy for the periods since 1900 can be compared with changes in the indicators of the quality of life for which historical data are available. The data base is obviously quite limited, but it does reflect a number of important quality of life considerations. In any case, there are at present not many more additional indicators that could be used for long-term comparisons. One might be able to add an indicator (or indicators) for schooling (e.g., high school completions), perhaps some data on housing and, after some basic research, on poverty. However, a considerable amount of work is now underway which is likely to expand the range of the indicators available in the future and to provide methods for their evaluation, but it will be some time before historical series will be compiled.[11]

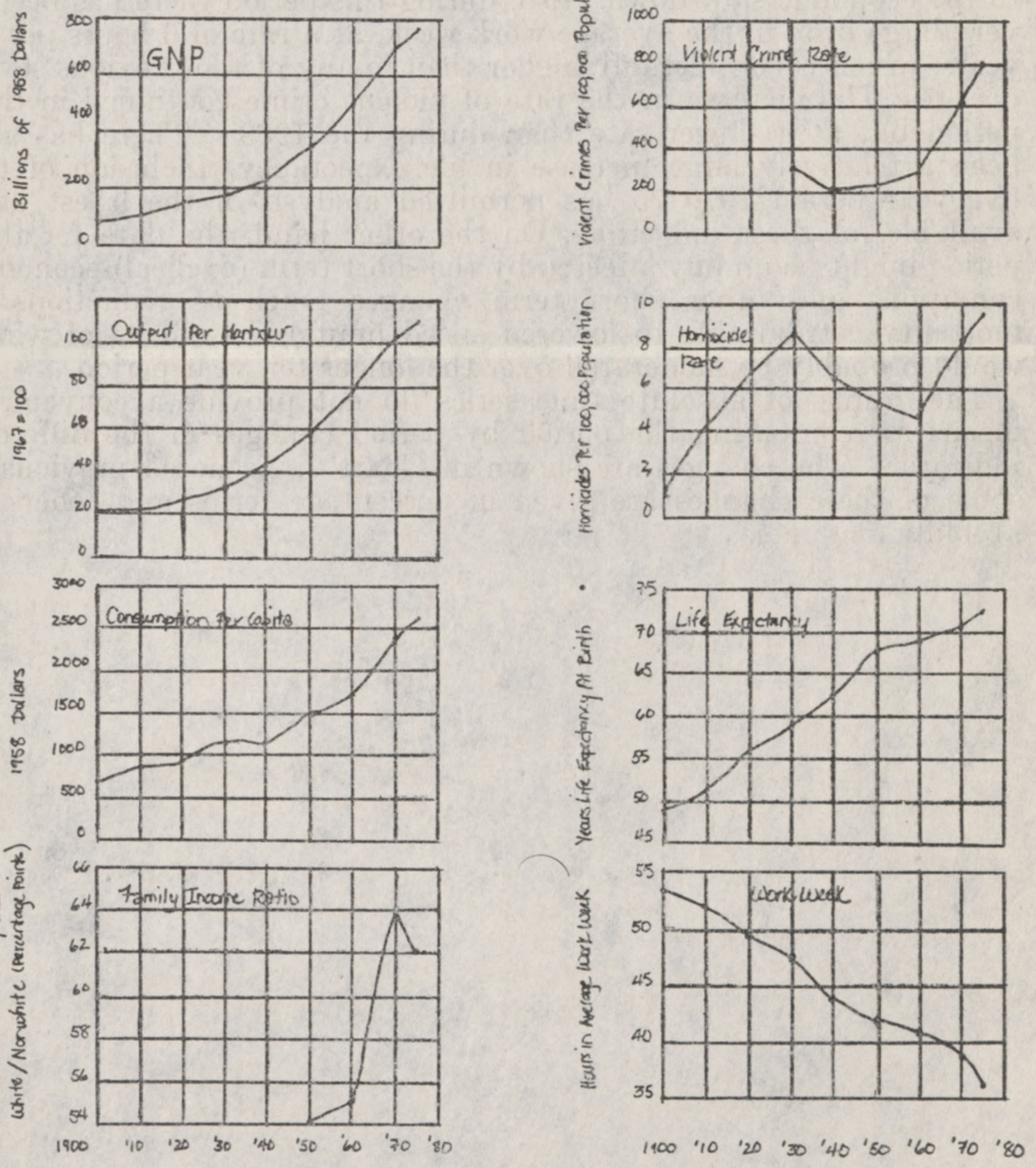
The absolute levels of the economic and quality of life indicators are shown graphically in Chart 1. The time series are plotted so that the desirable direction is up. As is apparent from the chart all the indicators show continuous improvement with the exception of crime and the family income ratio. The series for all violent crimes shows an improvement in the 1930's, slight deterioration in the 1940's and the 1950's and a rapid deterioration after 1960. The series for the homicide rate, which is available back to 1900, shows a period of deterioration from 1900 to 1930, followed by improvement between 1930 and 1960,

[10] Productivity is estimated only for the private domestic economy. The growth of private domestic output is shown for comparison with the growth of GNP, which, in addition to the output of the private domestic economy, also includes the public sector and the net export balance. Because the private economy constitutes a large portion of the whole economy, the rate of growth of output in the private domestic economy has been very close to the rate of growth of GNP.

[11] Considerable amount of work has been done in a number of agencies of the Federal Government to give their statistics an "output" or "quality of life" orientation, notably at the Council on Environmental Quality (see the Annual Report of the Council for 1974, 1975 and 1976), the National Science Board/National Science Foundation (see Science Indicators, 1974) and the Office of Education (see the Condition of Education, 1976). Also, very substantial bodies of information obtained through surveys dealing with attitudes and with uses of time have been accumulated and analyzed at the Institute for Social Research of the University of Michigan.

and also a rapid deterioration after 1960.[12] The economic and the economy-related series shown on the left side which, in addition to GNP and productivity, include consumption per capita and the change in the ratio of median incomes of non-white to white families, show largest growth in the decade of the 1960's, identifying that decade as one of the largest absolute economic improvements.

CHART 1.—Selected indicators of economic growth and quality of life in the United States, 1900–1975.



Sources: Tables 3 and 5. The series for output per manhour and for real consumption have been linked.

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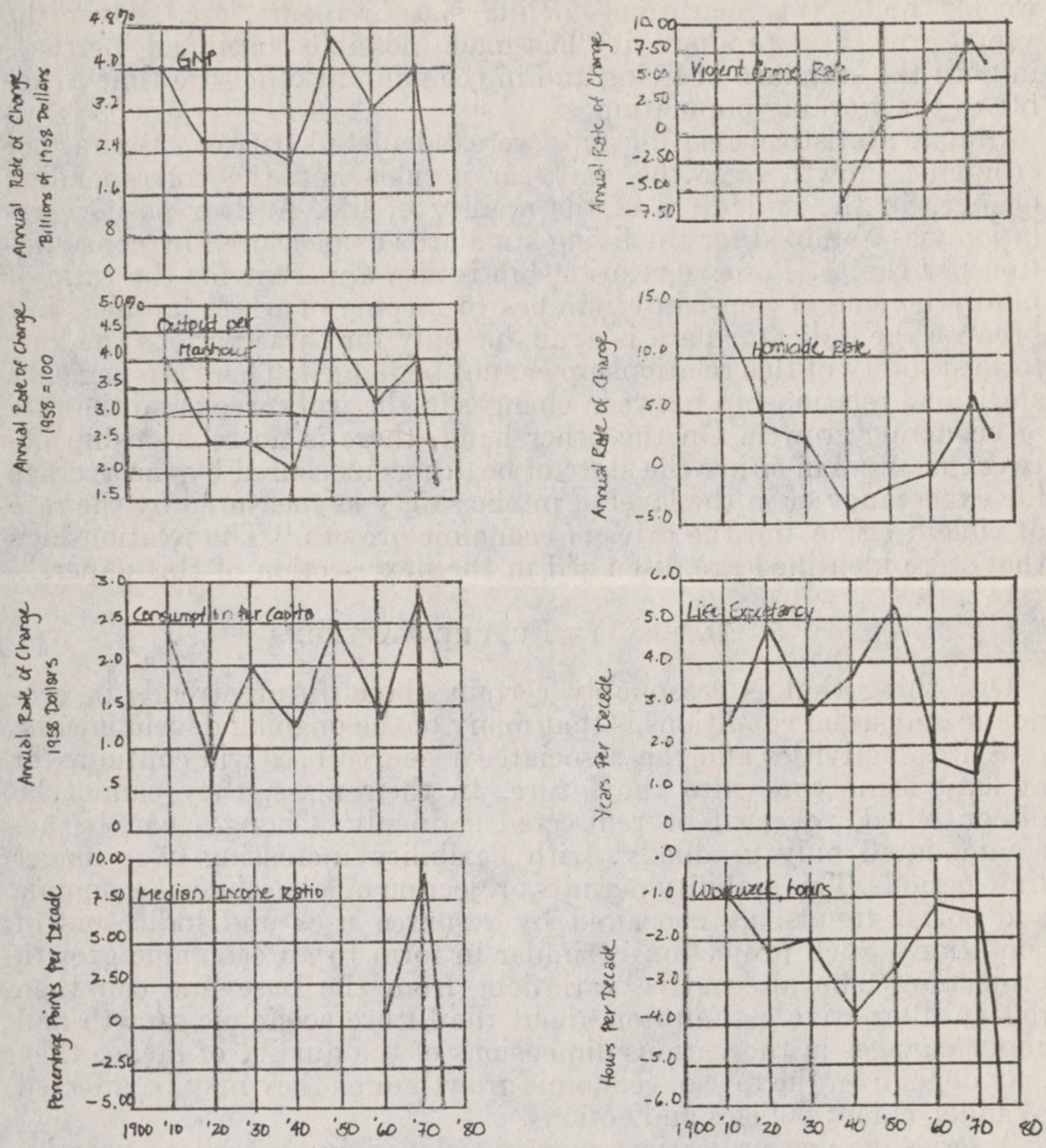
[12] The growth in all violent crimes may include increases in the reporting of crimes by the police but there might have been offsetting declines in the reports to the police. Results of the victimization surveys indicate, that between the mid 1960's and the early 1970's, the growth in the actual number of violent crimes probably paralleled the growth in the crime reported to the police which forms the basis of the statistical series used. There were no comparable surveys which might help in evaluating the trends before the mid-1960's. The homicide data are probably not affected by changes in the reporting of crimes. Its movements are generally consistent with the movements of the series for all violent crimes.

On the other hand, while growth in life expectancy and reductions in the work week continued throughout the 75-year period, in both cases the improvements were much slower in the 1950's and 1960's than in the first half of the century. Regarding crime, the decade of the 1960's was one of marked deterioration.

The period 1970–75 was characterized by very slow growth in productivity and in GNP. Because of the slow growth in the economy there was also little growth in the living standards (real consumption per capita). The decline in the ratio of median incomes of non-white to white families during the period can probably be also attributed to the economic slow-down. Also, during this period there has been a very large drop in the average work week, at a rate of 6 hours per 10 years, which is considerably higher than in any of the previous seven decades. The increase in the rate of violent crime continued in that period but at a slower rate than during the 1960's. There has also been a relatively large increase in life expectancy. Inclusion of the five year period 1970–75 has permitted analysis of the latest data available for these indicators. On the other hand, the data for that period might be unduly affected by the short term (cyclical) economic conditions and other short term changes (such as reductions in mortality attributable to lowered speed limits) the effects of which would probably be moderated over the longer ten year period.

The graphs of absolute time series do not provide a convenient means for comparing the period by period changes in the different indicators. The changes are shown in Chart 2. As noted previously, some of these changes are given in percentage terms and others in absolute amounts.

CHART 2.—Changes in selected 10-year economic and quality of life indicators in the United States, 1900–1975.



Sources: Tables 2 and 4. *Note:* Period ending in the year shown.

Changes in consumption per capita, an indicator of general economic well-being, correspond to the trend of changes in productivity (output per man-hour), but they also reflect the fluctuations in the growth rate of GNP. Changes for the ratio of median family incomes of non-white to white families is available only for the three periods after 1950. Thus the base for comparing trends in this indicator with the rates of economic growth is very slim. The pattern of changes for the three periods suggest that the income ratio may be quite sensitive to economic growth.[13]

Declines in the work week have been related negatively to economic growth, but this relationship is probably not simple. It involves in most likelihood also the growth of labor force (through population

[13] In an earlier study by the author, the annual data for the family income ratio which are available for the years since 1947, were found to be highly correlated with the unemployment rate, which reflects the short term economic conditions, *Op. Cit.*, pp. 181–184.

growth, immigration, or increased labor force participation), productivity growth, and changes in working time other than changes in weekly hours (i.e., vacations, holidays, retirements, etc.). Over the years, growth in productivity has made possible continued increases in both the standard of living and in the amount of leisure time available to the working population.

Simple statistical relationships were calculated between the rate of economic growth over the ten year periods and the corresponding changes in the indicators of the quality of life. A clear positive relation was obtained for the living standards as measured by consumption per capita. Positive relationship is also apparent for the ratio of family income of non-white families to income of white families, but because the indicator data is available only for three periods the long term stability of this relationship cannot be judged. There is a negative statistical relationship between changes in the work week and the rate of economic growth. On the other hand, there is no relationship between changes in either the state of health as measured by the average life expectancy or in the level of public safety as measured by the rate of violent crime and the rates of economic growth.[14] The relationships that were identified are discussed in the next section of this paper.

5. Alternate Future Patterns

One thing that is reasonably certain about future trends in economic and social conditions is that many of the ongoing developments, practices, activities and the associated resource uses will continue for at least some time into the future. In their mass, they cannot be discontinued, reversed or redirected suddenly. Changes can be accommodated only gradually, with flexibility increasing over longer time periods. This stability permits projection of a baseline of economic and social trends, as measured by resource uses and indicators of conditions. Such projection is similar in form to an economic growth projection. The alternative variations from the base line can then reflect alternative assumption about the future economic growth and about changes in the various dimensions of the quality of life, as they may depend on the rate of economic growth or as they may be affected by independent policies and actions.

A series of such projections were developed in an earlier study by the author. The 10-year baseline trends in 21 indicators projected for the period 1974–1983, were already shown in Table 1. In addition, estimates were made of the alternative combinations of improvements beyond these trends which would result from the adoption of alternative broad social approaches each of which was estimated to have specific costs and effects on the various domains of the quality of life.[15]

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[14] This does not necessarily mean that there are no systematic relationships between the *state of the economy* and either of these indicators. For example, there may be a correlation between the unemployment rate and the entry, especially by the young, into crime, which may produce long run effects over later decades independent of subsequent economic growth. But, while some short run relationships have been investigated, such long term effects have not yet been examined.

[15] *Op. cit.*, pp. 55–70. In that study, no complete analysis was attempted of the possible two-way dependence between economic growth and changes in the quality of life. However, tentative estimates were made of the possible effects of certain improvements in the quality of life on economic growth, both negative (as in the case of increased leisure time), and positive (as in the case of increased levels of education), indicating that considerable effects on the rate of economic growth might result from some combinations of activities aimed primarily at improving the quality of life.

These estimates indicate that considerable improvements beyond the levels indicated by the trend projections apparently could be achieved within the limits of available resources not committed to on-going activities (as projected separately for the public and the private sectors) if these resources were used effectively and efficiently.

It appears that most of the questions one might ask about the relationship between economic growth and the quality of life over a future period would really have to be answered in terms of rather detailed specifics. As mentioned, given increment of economic growth would have rather different impact on the different domains of the quality of life depending on whether it originates in productivity improvement, in the extension of man-hours worked by the existing labor force, or in the expansion of the labor force, again depending on whether this expansion is accomplished through immigration or by increased participation in the labor force, and in the latter case, by which population groups. Conversely, the various positive and negative effects of changes in the quality of life on economic growth would also depend on the specifics of the institutional or organizational implementation and their demographic locus. For example, progress in health conditions that are reflected in increases in the average longevity of the population may represent reductions of mortality of very different age groups with different labor force participation and hence might have different implications for economic growth. Even an improvement in the health and longevity of the aged population alone, need not have any unique effect on the economy or on any other dimension of the quality of life independent of the institutional arrangements for social security support, opportunities for earnings and savings of older persons, etc.

A fully developed model capable of focusing on the necessary demographic and economic detail cannot be developed in this paper. The various multiple relationships, including relationships embodying complex time lags, which such a model requires have not been estimated as yet.

The simple projection model summarized in Table 6, is provided here to indicate the type of effects that economic or demographic trends may exert on the future course of the indicators of quality of life. The estimated statistical relationships between the rate of economic growth and contemporaneous changes in the social indicators using the data for the successive ten year periods (and the period 1970–75) are listed in the table. They are used to estimate the future baseline projections of social trends. Such baseline projections provide the basis from which to estimate the implications of alternate assumptions about the future economic or demographic changes or the effects of specific prospective policies or independent events.

Two different rates of economic growth for the period 1975 to 1985 are derived from two alternate assumptions about the rate of change in productivity, i.e., in output per man-hour. The high assumption is based on growth in output per man-hour from 1947 to 1970, the low assumption on growth from 1967 to 1975.

The growth in GNP shown in Table 6 is simply derived from its historic relationship with productivity growth where the growth in GNP is shown to vary in proportion to productivity growth and also

includes a constant 1.3 percent per year which reflects mostly growth in man-hours worked.

TABLE 6.—CHANGES IN SELECTED ECONOMIC AND SOCIAL VARIABLES

[Actual, 1960–70 and 1970–75, and Projected, 1975–85]

Variable and basis for projection	Actual 1960–70	Actual 1970–75	Baseline trend projection 1975–85
Economic growth:			
Output per man-hour, $\dot{P}$; compound annual growth rate, actual (percent)	2.9	1.0	
High: 1947–70 average			3.1
Low: 1967–75 average			1.8
GNP, $\dot{Y}$; compound annual growth rate, actual (percent)	4.0	1.8	
$\dot{Y}=1.3+0.81\ \dot{P}$; high $\dot{P}$			3.8
$Y=1.3+0.81\ \dot{P}$; low $\dot{P}$			2.2
Quality of life variables dependent on economic growth:			
Consumption per capita $\dot{C}$; compound annual growth rate, actual (percent)	2.9	2.0	
$\dot{C}=0.45+0.47\ \dot{Y}$; high $\dot{Y}$			2.2
$C=0.45+0.47\ \dot{Y}$; low $\dot{Y}$			1.5
Average work week, $\dot{H}$, change in hours per decade, actual (hours)	−1.5	−6.0	
$\dot{H}=-6.0+1.1\ \dot{Y}$; high $\dot{Y}$			−1.8
$H=-6.0+1.1\ Y$; low $\dot{Y}$			−3.6
Family income ratio, $\dot{R}$, change in percentage points per decade (points)	9	−5	
$\dot{R}=-16.7+6.1\ \dot{Y}$; high $\dot{Y}$			6
$R=-16.7+6.1\ Y$; low $\dot{Y}$			−3
Quality of life variables not dependent on economic growth:			
Life Expectancy, change in years per decade, actual (years)	1.2	3.0	
Average of actual change in last 2 periods (years)			2.1
Violent crime rate, compound annual growth rate, actual (percent)	8.5	5.9	
Age-specific crime rates, held at 1975 levels			−0.7
Age-specific crime rates, grow at 1967–75 rates			3.5

Productivity growth is subject to much greater variation than the number of man-hours worked, which except in unusual circumstances (e.g., in wartime) has changed slowly relative to population. Hence only the productivity assumption is varied here, underlining the importance of productivity growth for economic growth and through economic growth indirectly also for some of the important indicators of social conditions, i.e., consumption per capita, average work week and the family income ratio. These effects are shown in the respective lines for high and low projections in these indicators. The average work week is positively related to growth in GNP; the large negative constant in this relationship indicates that in the absence of economic growth there were large declines in the workweek in the past, calculated at 6 hours per decade. The ratio of incomes of non-white families to that of white families is also shown to be highly sensitive to the rate of economic growth, as given by the average relation of the changes in the two indicators since 1950.

The remaining two variables are not related to economic growth. In the absence of a specific analysis which would permit more focused assumptions, the projection for life expectancy simply assumes growth at a rate averaging the 1960–1970 and the 1970–1975 rates. The rate of violent crime on the other hand is projected in two alternative ways, both derived from analysis of demographic data.

The rates of violent crime as manifested by the arrest rates for these crimes vary very much with age. The highest rates of violent crime occur between the ages of 15 and 25. One projection assumes

that from 1975 to 1985, given the already known prospective trends in the age composition of the population, the violent crime rates for each age group will remain unchanged at their 1975 levels until 1985. However, the age specific crime rates have been rising in the past years. To allow for the possibility that this growth will continue, an alternate trend was projected, based on the assumption that the age specific rates of violent crime will grow in the period 1975–85, at the same rates at which they grew from 1967 to 1975. Neither projection incorporates any effects of future policy or a spontaneous reversal (or acceleration) of the present growth rates. However, such estimates can be derived given specific information about such effects, which can be used to modify the results of the trend projection.

The main point is, that analysis of prospective changes in the different dimensions of the quality of life can be usefully separated into projections of the baseline trends determined by the ongoing economic and demographic changes on the one hand which sometimes can be estimated with a great degree of reliability and the often more uncertain changes contingent on particular events, developments or policies.

References

Japan, Economic Council of, *Measuring Net National Welfare of Japan* (Report of the NNW Measurement Committee), March 1973.

Jaszi, George, "A Critique of the United States Income and Product Accounts," Studies in Income and Wealth, Volume 22, National Bureau of Economic Research (Princeton: Princeton University Press, 1958).

Juster, F. Thomas, "A Framework for the Measurement of Economic and Social Performance," pp. 25–83, *The Measurement of Economic and Social Performance*, in Milton Moss, Ed. *Studies in Income & Wealth, No. 38*, National Bureau of Economic Research (New York: Columbia University Press, 1973).

Nordhaus, William D., and James Tobin, "Is Growth Obsolete?", p. 509–532, *The Measurement of Economic and Social Performance*, in Milton Moss, Ed. *Studies in Income & Wealth, No. 38* National Planning Association and National Bureau of Economic Research (New York: Columbia University Press, 1973).

Kuznets, Simon, "Government Product and National Income," *Income and Wealth, Series I*, International Association for Income and Wealth (Cambridge: Bowes and Bowes, Ltd., 1951).

Meadows, Donella H., Dennis L. Meadows, Jorgen Randers, William W. Behrens, III, *The Limits to Growth* (A Report for The Club of Rome's Project on the Predicament of Mankind), (New York: Universe Books, 1972).

Mishan, E. J., *The Costs of Economic Growth* (London: Staples Press, 1967).

Sheldon, Eleanor Bernert and Parke, Robert, "Social Indicators" *Science*, 16 May 1975, Vol. 188, pp. 693–694.

Terleckyj, Nestor E., *Improvements in the Quality of Life: Estimates of Possibilities in the United States*, 1974–1983 (Washington, D.C.: National Planning Association, 1975).

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