

This PDF is a selection from a published volume from the National Bureau of Economic Research

Volume Title: Political Arithmetic: Simon Kuznets and the Empirical Tradition in Economics

Volume Author/Editor: Robert William Fogel, Enid M. Fogel, Mark Guglielmo, and Nathaniel Grotte

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-25661-8, 978-0-226-25661-0 (cloth)

Volume URL: <http://www.nber.org/books/foge12-1>

Conference Date: n/a

Publication Date: March 2013

Chapter Title: Introduction: The Amazing Twentieth Century

Chapter Author(s): Robert William Fogel, Enid M. Fogel, Mark Guglielmo, Nathaniel Grotte

Chapter URL: <http://www.nber.org/chapters/c12912>

Chapter pages in book: (p. 1 - 9)

Introduction: The Amazing Twentieth Century

The human race (*Homo sapiens*) is about 200,000 years old. Measured in generations of 30 years, that translates into about sixty-seven hundred generations. In all but the last four hundred generations, our ancestors were hunters and gatherers with little ability to alter their environments.

During the last four hundred generations, we discovered agriculture and developed it to the point that it became the principal source of our food supply and provided a diet far better than previously experienced by the human race.

In 1800 (seven generations ago), it took five people working on farms in America and Western Europe to support one person working off the farm. Today, one person working on an American farm feeds three hundred people. In the short time span of two hundred years, farmers have declined from over 80 percent of the American labor force to less than 2 percent.

It was not until four generations ago that the majority of the labor force in the United States became nonagricultural. During the last four generations, there was a remarkable improvement in health, labor capacity, and longevity. During the twentieth century, life expectancy at birth increased by about thirty-five years in the rich nations, going from about forty-four to about seventy-nine years. Thus, in three of the last four generations, there has been a larger increase in life expectancy than in the whole previous history of *Homo sapiens*.

Not only has the length of life increased remarkably since 1900, but also the age of onset of disabilities has been pushed back by more than ten years. Moreover, the share of the aged population that becomes severely disabled has dropped from 80 percent to less than 40 percent. Rapid advances in biomedical technology since the late 1930s made it possible to sharply mitigate (sometimes even to reverse) the disabilities at advanced ages and dramatically improve the quality of life.

It is likely that the median age of death (the age by which half of a birth cohort has died) will increase from 78 years for the birth cohort of the 1920s to about 105 years for the current cohort of undergraduate college students, an increase of 27 years in just three generations.

Until recently, we were limited to learning about mankind through the study of bone fragments and other ancient artifacts carried out by archaeologists. With the advent of modern analytic tools and techniques, we have been able to develop and model rich insights into how we, as a people, live our lives amid a range of varied and rich economic choices.

During the 1920s and early 1930s, economists at the NBER developed measures of the national output of goods and services and helped establish a permanent bureau in the Department of Commerce to oversee the work of this measurement. Simon Kuznets was the overarching leader of this enterprise, which resulted in the estimation of the now-familiar statistics GNP and GNP per capita. These statistics, originally estimated by month and year from the late 1920s, were eventually pushed back to 1800 and carried forward to the present. They are derived from a complex set of accounts now regularly created by the federal government called *national income and product accounts*.

In this complex array of accounts, the output of the economy is measured in three ways, with each way revealing something different about the operation of the economy:

1. The *value-added* or *production approach* reveals how much each industry adds to GNP.
2. The *income approach* reveals how much each factor of production (labor, land, and capital) contributes to GNP.

3. The *expenditure approach* reveals how the consumption of GNP was divided among household consumption, business investment, government expenditures, and net exports.

Kuznets did not work out the full array of national income and product accounts, but he initiated the process and gave it a powerful impetus that persuaded economists and government leaders that it was an indispensable tool in the management of the economy.

Although the GNP estimates were a huge advance in the statistical arsenal of economists, they are no longer adequate. They do not take into account *technophysio evolution*, by which we mean the synergism between rapid technological change and the improvement in human physiology. Because of this synergism, human beings have acquired so great a degree of control over their environment that they are set apart not only from all other species but also from all previous generations of *Homo sapiens*. This new degree of control has enabled our species to increase its average body size by over 50 percent, to increase its average longevity by more than 100 percent, and to greatly improve the robustness and capacity of its vital organ systems.

Worldwide, the most important aspect of technophysio evolution is the continuing conquest of chronic malnutrition, which was almost universal three centuries ago. At the beginning of the eighteenth century, such countries as France and Great Britain could not produce enough food to keep more than 80 percent of the potential labor force regularly employed. Moreover, those who were in the labor force had on average only about a quarter of the daily energy that is currently available for work. Today, by contrast, food is so abundant that obesity is a significant problem.

The improvement in nutrition and human physiology accounts for much of the economic growth of rich nations. It has, for example, recently been estimated that about half of British economic growth since 1790 was due to technophysio evolution.¹ Much of this gain came from improvements in human thermodynamic efficiency. The

1. For a more extensive discussion of technophysio evolution, see Floud, Fogel, Harris, and Hong (2011).

rate of converting human energy input into work output appears to have increased by about 50 percent over the past seven generations.

One aspect of technophysio evolution has been a change in the structure of consumption and in the division of discretionary time between work and leisure. Sleep, meals, and essential hygiene, which are biologically determined, required about ten hours of the day a century ago, as they do today. The remaining fourteen hours represent discretionary time. A century ago, most of the discretionary time of the typical head of a household in Western Europe and America was devoted to earning a living. He worked about thirty-one hundred hours a year in the marketplace to provide for the family, and he also had unpaid chores at home, as well as travel to and from work, that occupied another eleven hundred hours. Only a minuscule amount of time was left for leisure each day.

Over the course of the twentieth century, annual hours of work have fallen by nearly half, so much so that the household head in a rich country now usually works only about seventeen hundred hours per year in the marketplace. Indeed, on the average day, he spends more hours at leisure than at work. Because of the mechanization of the household, the typical married woman also spends more time at leisure than at work.

Leisure is not a synonym for indolence but a reference to desirable forms of effort or work. As the Irish playwright George Bernard Shaw put it in *The Intelligent Woman's Guide to Socialism and Capitalism* (1928), "Labor is doing what we must; leisure is doing what we like; and rest is doing nothing whilst our bodies and minds are recovering from their fatigue." In order to avoid confusion, *work* refers to an activity that requires energy over and above the basal metabolic rate. Activity aimed primarily at earning a living is *earnwork*. Purely voluntary activity, even if it incidentally carries some payment with it, is *volwork*.

Why have hours of earnwork declined so much in recent years? The answer to that question is suggested by the fact that it is not just daily and weekly hours of earnwork that have declined. The share of lifetime discretionary hours spent in earnwork has declined even more rapidly, partly because the average age of entering the labor

force is five years later than it used to be, and partly because the average period of retirement is about eleven years longer than it was a century ago.

Today, people are willing to forgo earnwork, even though the extra hours would allow them to buy more things, because they are approaching saturation not only in food and other necessities but also in a whole array of consumer durables. Because of rapid technological change, goods that during the first third of the twentieth century used to be thought of as luxuries or were only dreams or science fiction are now available even to the poor. A century ago, the typical household head had to labor 1,800 hours to acquire the family's annual food supply. But, by the end of the twentieth century, that task required just 260 hours. All in all, commodities that used to account for over 80 percent of household consumption could be obtained in greater abundance than previously, with less than a third of either the market or the household labor once required.

As a result, there have been enormous changes in the pattern of national expenditures, especially when the extra hours of leisure are valued at what workers could have earned if they remained at work. Food, clothing, and shelter, which used to account for three-quarters of consumption, now account for just 12 percent. On the other hand, leisure has risen from 18 percent of consumption to 67 percent. There has also been a vast increase in expenditures for health care and for education.

However, the computations presented so far are inadequate to portray the full extent of economic growth over the past century because they do not take into account improvements in the quality of output, especially in such services as education and health care. Children in high schools are taught more today than postgraduate college students used to be taught a generation ago, let alone two generations ago. Adolescent children today know more about computers than most of their parents do.

Even more dramatic are the improvements in health care. A century and a half ago, people in their forties were more afflicted by chronic disabilities than people in their late fifties and early sixties are today. Not only has the average age of onset of disabilities been delayed by

ten or so years, but, once those disabilities appear, there are also now numerous effective interventions. Hernias, which used to be permanent and exceedingly painful conditions, afflicting one of every four males, can now be repaired by a surgical procedure that in the United States requires hospitalization for only twenty-three hours. Other areas where medical interventions have been highly effective include genitourinary conditions, control of hypertension and reduction in the incidence of stroke, replacement of knee and hip joints, curing of cataracts, and chemotherapies that reduce the incidence of osteoporosis and heart disease.

Yet most of these great advances in health care and education are overlooked in accounts of GNP because of the difficulty in measuring them. The inadequacy of the national income and product accounts in dealing with these issues was recognized by Kuznets, who sketched the probable magnitude of the error. The problem stems from the fact that production of health care and education is measured by inputs instead of by output. An hour of a doctor's time is considered no more effective today than an hour of a doctor's time was three-quarters of a century ago, before the age of antibiotics and modern surgery. It has recently been estimated that, if properly measured, improvements in health care would add significantly to the level of per capita income, but such calculations have not yet made their way into the GNP accounts. In the case of the United States, rough estimates indicate that allowance for such factors as the increase in leisure time, the improvement in the quality of health care, and the improvements in the quality of education would come close to doubling the U.S. annual growth rate over the past century (from 1.8 to more than 3 percent per annum).

What is the implication of these statistics for the understanding of change in standards of living for the typical American? If we use the conventional measure of growth, the real income of the typical American in 2000 was six times greater than it was in 1900. However, if the adjusted measure is used, Americans in 2000 had real incomes that were twenty times greater than they were in 1900. In other words, 70 percent of the goods and services that Americans enjoyed at the end of the twentieth century were outside the measured economy.

We now want to consider briefly another aspect of the changing nature of economic growth. That is the impact of high levels of economic attainment on the distribution of the output of the economy and households. Those who worry about egalitarian issues tend to think about distribution in terms of material goods, such as food, clothing, and shelter, which used to constitute over 80 percent of the consumption of households. To be poor in the decades before World War I was to be deprived of these tangible essentials of life and to be vulnerable to disease and early death. In that era, things that you could see, count, weigh, or otherwise directly measure constituted the overwhelming output of an economy.

During the last six or so decades of the twentieth century, the domination of output by material products began to be eroded at an increasing rate. The rise to dominance of immaterial commodities is symbolized by the growth of such professional occupations as physicians, mathematicians, natural scientists, lawyers, teachers, and engineers from barely 4 percent of the labor force in 1900 to over a third today. Similarly, the main form of capital at the end of the twentieth century was not buildings, machines, or electrical grids but labor skills, what economists call *human capital* or *knowledge capital*. Both for individuals and for businesses, it is the size and quality of these immaterial assets that determine success in competitive markets and in conditions of life for ordinary people.

The agenda for egalitarian policies that has dominated reform movements for most of the past century, the modernist agenda, was based on material redistribution. The critical aspect of a *postmodern* egalitarian agenda is not the distribution of money income, or food, or shelter, or consumer durables. Although there are still glaring inadequacies in the distribution of material commodities, the most intractable maldistributions in rich countries such as the United States are in the realm of spiritual or immaterial assets. These are the critical assets in the struggle for self-realization.

Some proponents of egalitarianism insist on characterizing the *material* level of the poor today as being harsh. They confound current and past conditions of living. Failure to recognize the enormous *material* gains over the last century, even for the poor, impedes rather than

advances the struggle against chronic poverty in rich nations, whose principal characteristic is the *spiritual estrangement* from the mainstream society of those so afflicted. Although material assistance is an important element in the struggle to overcome spiritual estrangement, such assistance will not be properly targeted if one assumes that improvement in material conditions naturally leads to spiritual improvement.

Realization of the potential of an individual is not something that can be legislated by the state, nor can it be provided to the weak by the strong. The government cannot transfer virtue from those who have it in abundance to those who are bereft of it. Nor can the rich write out checks denominated in virtue. Self-realization has to develop within each individual on the basis of a succession of choices. The emphasis on individual choice does not mean that other individuals and institutions play no role. Quite the contrary, the quality of the choices and the range of opportunities depend critically on how well endowed an individual is with critical spiritual resources.

The quest for spiritual equity thus turns not so much on money as on access to immaterial assets, most of which are transferred and developed privately rather than through the market. Moreover, some of the most critical spiritual assets, such as a sense of purpose, self-esteem, a sense of discipline, a vision of opportunity, and a thirst for knowledge, are transferred at very young ages.

Although there are spiritually deprived individuals at all ages, the two main concentrations are among the alienated young and the elderly. Some of the young are children in single-parent families whose mothers are themselves spiritually deprived and hence incapable of transferring vital spiritual assets. The other large group is concentrated among the elderly. In the United States, one-third of those over age sixty-five suffer from depression because they are cut off from normal social networks.

Solving these severe problems of social and economic estrangement requires a variety of new educational programs and systems of mentoring the needy. These programs cannot be achieved by the government alone or even primarily but involve mobilizing a vast reservoir of individuals with spiritual abundance who are prepared to assist.

A third way in which economic growth is changing is in the rapid and radical shift in the locus of global markets for durables and high-tech services. The observation is hardly new. Thousands of articles have been written during the past decade on the emerging markets of Southeast Asia. Nevertheless, the full meaning of this development for the unfolding of global economic growth during the next generation is still poorly understood.