

The Globalization of Human Well-Being

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Executive Summary

Controversy over globalization has focused mainly on whether it exacerbates income inequality between the rich and the poor. But, as opponents of globalization frequently note, human well-being is not synonymous with wealth. The central issue, therefore, is not whether income gaps are growing but whether globalization advances well-being and, if inequalities in well-being have expanded, whether that is because the rich have advanced at the expense of the poor.

More direct measures of human well-being than per capita income include freedom from hunger, mortality rates, child labor, education, access to safe water, and life expectancy. Those indicators generally advance with wealth, because wealth helps create and provide the means to improve them. In turn, those improvements can stimulate economic growth by creating conditions conducive to technological change and increasing productivity. Thus, wealth, technological change, and well-being reinforce each other in a virtuous cycle of progress.

During the last half century, as wealth and

technological change advanced worldwide, so did the well-being of the vast majority of the world's population. Today's average person lives longer and is healthier, more educated, less hungry, and less likely to have children in the workforce. Moreover, gaps in these critical measures of well-being between the rich countries and the middle- or low-income groups have generally shrunk dramatically since the mid-1900s irrespective of trends in income inequality. However, where those gaps have shrunk the least or even expanded recently, the problem is not too much globalization but too little.

The rich are not better off because they have taken something away from the poor; rather, the poor are better off because they benefit from the technologies developed by the rich, and their situation would have improved further had they been better able to capture the benefits of globalization. A certain level of global inequality may even benefit the poor as rich countries develop and invest in more expensive medicines and technologies that then become affordable to the poor.

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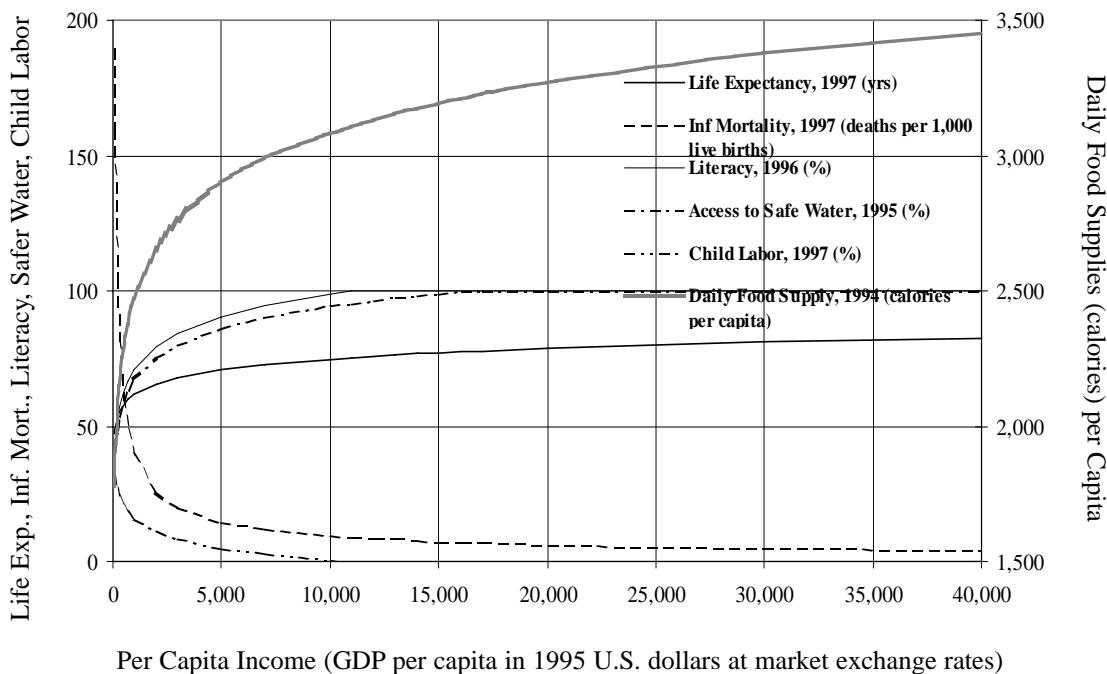
Introduction

Much of the debate over globalization and its merits has revolved around the issues of income inequality and whether in the past few decades globalization has made the rich richer and the poor poorer.¹ For example, Laura D'Andrea Tyson, former national economic adviser in the Clinton administration, and others claimed that "as globalization has intensified, the gap between per capita incomes in rich and poor countries has widened."² David Dollar and Aart Kraay, economists at the World Bank, have challenged such statements, countering that "the best evidence available shows the exact opposite to be true . . . [and that] . . . the current wave of globalization, which started around 1980, has actually promoted economic equality and reduced poverty."³ Regardless of where the truth may lie, these arguments miss the point.

The central issue with respect to globalization is neither income inequality nor whether it is getting larger; rather it is whether globalization advances human well-being and, if inequalities in well-being have indeed expanded, whether that is because the rich have advanced at the expense of the poor.

But as opponents of globalization frequently note, human well-being is not synonymous with wealth,⁴ nor—to echo a catchy anti-globalization slogan—can you eat GDP.⁵ To conflate the two is to confuse ends with means. While wealth or per capita income (as measured by gross domestic product per capita) is probably the best indicator of material well-being, its greater importance stems from the fact that it either helps provide societies (and individuals) the means to improve other, probably more important, measures of human well-being (such as freedom from hunger, health, mortality rates, child labor, educational levels, access to safe water and

Figure 1
Well-Being vs. Wealth in the 1990s



Source: Indur M. Goklany, *Economic Growth and the State of Humanity* (Bozeman, Mont.: Political Economy Research Center, 2001), using data from World Bank, *World Development Indicators 1999* (Washington: World Bank, 1999).

sanitation, and life expectancy)⁶ or is associated with other desirable indicators (such as adherence to the rule of law, government transparency, economic freedom, and, to some extent, political freedom).⁷ In fact, as shown in Figure 1, which will be discussed in greater depth below, analyses of cross-country data show that although these other indicators generally improve as per capita income rises, their relationships are not linear.⁸ The improvements are usually rapid at low levels of economic development but slow down or, in some cases, halt altogether as they reach their practical or theoretical limits.⁹ Therefore, per capita income would not, by itself, be a good measure of human well-being, and any determination of whether globalization has benefited humanity in general, or favors the rich at the expense of the poor, should be based on an examination of how these more relevant measures of human well-being have evolved as globalization has advanced.

Indicators of Human Well-being

This paper examines five indicators that measure distinct, though related, aspects of well-being. Three of these are measures of misery and deprivation and reflect “negative” well-being, one is a “positive” measure of well-being, and the last is the United Nations Development Program’s human development index, which combines per capita income with two of the positive indicators of well-being.¹⁰

The negative indicators that are examined are available food supplies per capita (low levels of which are surrogates for hunger and malnourishment), infant mortality, and the prevalence of child labor. The first two—indicative at the extremes of famine and death, two of the Four Horsemen of the Apocalypse—have through the ages been synonymous with fear and misery. Less than half a century ago, famine, natural or man-made, still seemed to have mankind within its awful reach. This once-chronic condition claimed

more than 30 million Chinese in 1959–61 alone.¹¹ An increase in the quantity of food is, perhaps, the first step to a healthy society. Having an adequate amount of food also enables the average person to focus on matters beyond mere sustenance and to live a more fulfilling and productive life. Hunger and undernourishment, moreover, retard education and the development of human capital, which, in turn, could slow down both technological change in every human endeavor and growth in every economic sector.¹² Thus, inadequate food supplies could not only add to misery but also slow progress in the positive indicators of well-being.

The second negative measure, infant mortality, also broadly tracks child and maternal mortality. Perhaps nothing has caused more sorrow and grief for womankind through the ages than the untimely death of children. For most of mankind’s tenure on earth, infant mortality has been one of nature’s cruel mechanisms for keeping human populations in check.

The third negative measure is the prevalence of child labor. The ability to provide one’s children a childhood free from labor was a luxury that for centuries only the upper classes and the wealthy could afford. In most households in most cultures, children were traditionally viewed as additional hands. They contributed to the family’s economic security by working on the farm, in handicrafts, menial tasks, and, in the initial phases of industrialization, in factories. Increases in productivity due to new technologies, however, have made it possible to dispense with their labor in developed countries. This trend accelerated as families became wealthier, real prices of food dropped, the children’s economic contribution became less critical to the family’s survival and security in old age, and the intrinsic and economic value of education to children’s and, possibly, the family’s future economic and social security began to be recognized.

The positive measure that this paper analyzes is life expectancy at birth, probably the single most important indicator of human well-being. Longer life expectancy is also gen-

For any specific level of real income, human well-being ought to be more advanced today than it was a few decades ago.

The average inhabitant of the developing world has never been better fed and less likely to be hungry and undernourished.

erally accompanied by an increase in disability-free years of life. According to the World Health Organization, the disability-adjusted life expectancies for the United States, China, and India, for instance, were 70.0, 62.3, and 53.2 years, respectively, in 1997–99.¹³ Contrast that with the total (unadjusted) life expectancies of those three countries in 1950–55: 69.0, 40.8, and 38.7 years, respectively.¹⁴ Moreover, studies from various developed nations indicate that disability in their older populations has been declining.¹⁵ In the United States, for instance, the disability rate dropped 1.3 percent per year between 1982 and 1994 for persons aged 65 and over, which resulted in 1.2 million fewer disabled persons in that age group in 1994.¹⁶ So we are living longer—and healthier—lives. Thus the quantity and the quality of life go hand in hand. It might be argued that, because higher levels of hunger and mortality reduce life expectancy, these measures overlap. However, life expectancy does not fully capture the fear and dread associated with famine and death.

The last indicator that this paper examines is the United Nations Development Program's aggregate human development index (HDI). This indicator was developed in recognition of the fact that there is more to development than a higher income. The HDI is based on the average of three measures: life expectancy at birth, educational attainment, and the logarithm of per capita income—the logarithm, because each additional dollar of income adds less to the quality of life than the previous dollar. The composition of the HDI can be justified on the grounds that life expectancy, as noted, is perhaps the most significant indicator of human well-being, per capita income reflects material well-being, and educational attainment—in addition to being an end in itself—is essential for conserving and creating new human capital. With the appropriate set of institutions, education can accelerate the creation and diffusion of technology.¹⁷ Moreover, education (particularly of women) seems to be a key factor in spreading knowledge about safe drinking water, sanitation, proper hygiene, nutri-

tion, and other public health practices that help societies improve health, reduce mortality, and increase life expectancy.¹⁸

Trends in Measures of Human Well-being

Are the trends in the various measures of human well-being improving as globalization marches on? Have gaps in these measures between the rich and the poor countries widened and, if they have, is globalization responsible?

Trends with Respect to Economic Development

Figure 1, based on cross-country data, shows that various indicators of human well-being improve as countries become wealthier, with improvements coming most rapidly at the lowest levels of wealth. There are several possible explanations for this association. First, economic development indeed improves these indicators. Greater wealth translates into greater resources for researching and developing new technologies that directly or indirectly advance human well-being.¹⁹ It also means increased resources for advancing literacy and education, which, too, are generally conducive to greater technological innovation and diffusion.²⁰ Equally important, wealthier societies are better able to afford new as well as existing, but underused, technologies.²¹ For instance, with respect to health—captured in Figure 1 by both infant mortality and life expectancy—these include “old” technologies such as water treatment to produce safe water, sanitation, basic hygiene, vaccinations, antibiotics, insect and vector control, and pasteurization,²² as well as newer science-based technologies such as AIDS and oral rehydration therapies, organ transplants, mammograms, and other diagnostic tests. They also include agricultural technologies that increase crop yields, thereby increasing available food supplies and reducing hunger and malnourishment, which then reduces the toll of infectious and parasitic diseases.²³

Historically, reducing hunger and undernourishment has been among the first practical steps nations have taken to improve public health. That step has reduced infant mortality and increased life expectancy.²⁴ And if despite increased food production a country is still short of food, greater wealth makes it possible, through trade, to purchase food security.²⁵ Greater wealth also makes it more likely that a society will establish and sustain food programs for those on the lower rungs of the economic ladder.²⁶ Therefore, while “you can’t eat GDP,”²⁷ the larger GDP is, the less likely you are to go hungry or be undernourished. As Figure 1 illustrates, greater wealth, through a multiplicity of mechanisms—higher literacy, greater food supplies, and greater access to safe water—leads to better health.²⁸

It is possible that the causation may work in the reverse direction. Perhaps it is advances in human well-being that stimulate economic development, rather than vice versa. Healthier people are more energetic, less prone to absenteeism, and, therefore, more productive in whatever economic activity they undertake.²⁹ When malaria was eradicated in Mymensingh (in Bangladesh), crop yields increased 15 percent because farmers had more time and energy for cultivation.³⁰ In other areas, elimination of seasonal malaria enabled farmers to plant a second crop. A study done jointly by the Harvard University Center for International Development and the London School of Hygiene and Tropical Medicine estimates that had malaria been eradicated in 1965, Africa’s GDP would have been 32 percent higher in 2000.³¹

Moreover, healthier people can devote more time and energy to education and intellectual development.³² Good health is particularly important during children’s formative years. Also, the incentives for investing in developing human capital increase if individual beneficiaries expect to live to 60 rather than, say, a mere 40. Not surprisingly, educational levels increase with life expectancy.³³ Today it is not unusual to encounter aspiring doctors and researchers in their mid-30s, in

effect, devoting what once was literally a lifetime to learning their trade. And having acquired expertise, those doctors and researchers are poised to contribute to technological innovation and diffusion in their chosen fields and to guide others along the same path. Thus better health helps raise human capital, which aids the creation and diffusion of technology and thereby further advances health and accelerates economic growth.

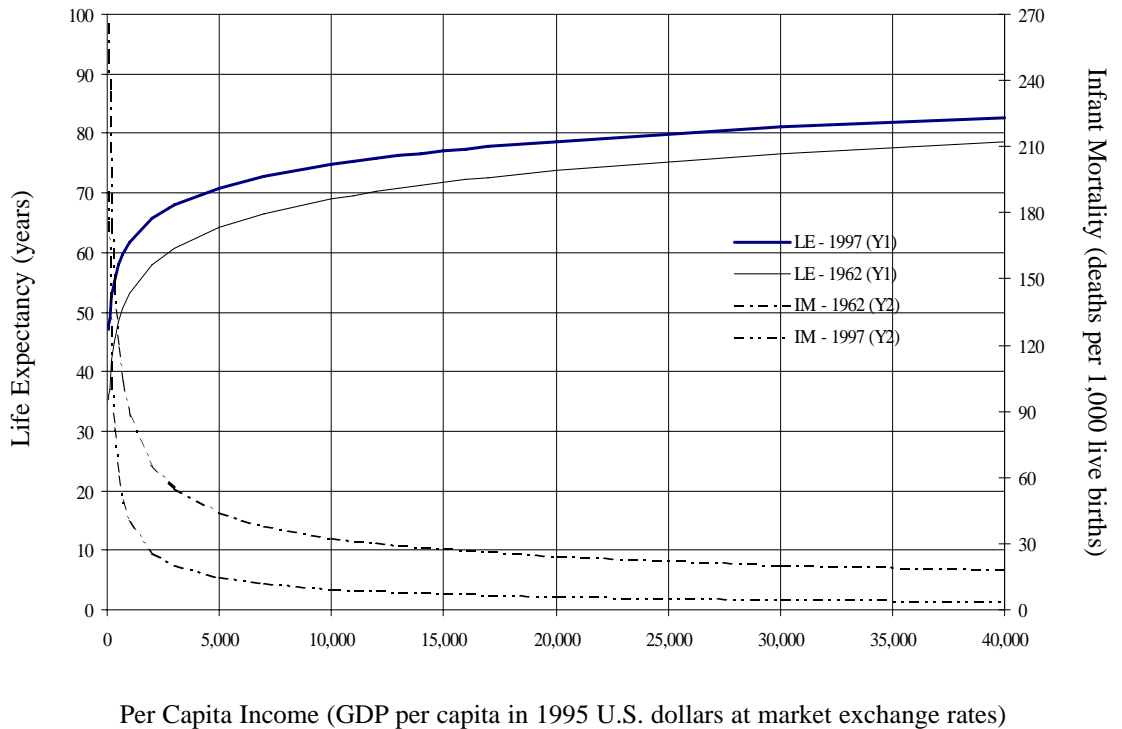
Both wealth’s and health’s causes and effects probably reinforce each other in a set of interlinked cycles. One such cycle is the health-wealth cycle in which—as we have seen—wealth begets health and health, wealth. Another cycle consists of food production, food access, education, and human capital, which also helps turn the health-wealth cycle. These cycles are embedded in a larger “cycle of progress” in which economic growth and technological change reinforce each other.³⁴

Yet another explanation for the association between human well-being and wealth is that the factors that improve one also improve the other. Those include legal and economic systems—free markets; secure property rights; honest, predictable, and fiscally responsible governments and bureaucracies; and adherence to the rule of law—that encourage competition not only in the commercial sphere but also in the scientific and intellectual spheres and allow those who venture their labor, intellectual capital, and financial resources to profit from the risks they incur.³⁵ These institutions are also the foundations of civil societies and democratic systems.

Trade is an integral part of the cycle of progress. Freer trade directly stimulates economic growth,³⁶ helps disseminate new technologies, and creates pressures to invent and innovate.³⁷ For instance, competition from foreign car makers accelerated the introduction of several automobile safety and emission control systems to the United States, improving both environmental and human well-being.³⁸ Trade also helps contain the costs of basic infrastructure, including water

Gaps between developing and developed countries in hunger and malnourishment have, in the aggregate, declined in absolute and relative terms.

Figure 2
Life Expectancy and Infant Mortality vs. Wealth, 1962 and 1997



Source: Indur M. Goklany, *Economic Growth and the State of Humanity* (Bozeman, Mont.: Political Economy Research Center, 2001), using data from World Bank, *World Development Indicators 1999* (Washington: World Bank, 1999).

Globalization, through trade, has enhanced food security.

supply, sanitation, and power generation (although the full benefits are often squandered because of corrupt, inefficient, and opaque bureaucracies and governments).³⁹ Finally, as will be discussed below, trade has globalized food security.⁴⁰

Trends with Respect to Time or Technological Change

Figure 2 shows not only that life expectancy has increased with the level of economic development but that the entire life expectancy-wealth curve has risen over time.⁴¹ This curve's upward displacement is consistent with the creation and diffusion over time of new as well as existing, but underused, technologies. In effect, in Figure 2 the change in time (depicted by going from the 1962 life expectancy curve to the 1997 life expectancy curve) serves as a surrogate for

technological improvement.⁴²

This figure also shows that infant mortality improves with economic development and technological change (the entire curve drops with time).⁴³ I have shown elsewhere that these features—improvements in wealth and technology (for which time serves as a surrogate)—are common to other indicators of well-being including those shown in Figure 1.⁴⁴ Cumulatively, they indicate that, for any specific level of real income, human well-being ought to be more advanced today than it was a few decades ago.

Trends in Inequalities in Well-Being

Hunger and Undernourishment

Concerns about the world's ability to feed

its burgeoning population have been around at least since Malthus's *Essay on Population*, published 200 years ago. Initially the concern was global. But by the 1950s and 1960s, despite the privations of the Great Depression and World War II, it seemed that the problem, if any, would be restricted to developing countries. Several neo-Malthusians, such as Paul Ehrlich, author of *Population Bomb*,⁴⁵ and the Paddock brothers,⁴⁶ confidently predicted apocalyptic famines in the latter part of the 20th century in the developing world. But remarkably, despite an unprecedented increase in the demand for food fueled by equally unprecedented population and economic growth, the average inhabitant has never been better fed and less likely to be hungry and undernourished.

Between 1950 and 2000, world population increased by 140 percent and per capita income by more than 170 percent. Yet, because of the enormous increase in agricultural productivity and trade, the real price of food has never been lower. Low food prices ensure that the benefits of increased production are distributed broadly and food surpluses flow voluntarily to deficit areas. As a result, worldwide food supplies per capita have improved steadily during the past half century. Between 1961 and 1999, the average daily food supplies per person increased 24 percent globally, from 2,257 calories to 2,808 calories.⁴⁷ The increase was even more rapid in developing countries where it increased 39 percent, from 1,932 to 2,684 calories.

The improvements for Indians and Chinese—40 percent of humanity—are especially remarkable. By 1999, China's average daily food supplies had gone up 82 percent to 3,044 calories from a barely subsistence level of 1,636 calories in 1961 (a famine year). India's went up 48 percent to 2,417 calories from 1,635 calories in 1950–51.⁴⁸

However, consistent with Figure 1, which shows per capita daily food supplies rising with wealth, improvements in per capita food supplies have been slower where for whatever reason—war, political instability, or failed policies and institutions—economic

development has lagged. For instance, between 1961 and 1999 average daily food supplies per capita in Sub-Saharan Africa increased a paltry 6 percent from 2,059 to 2,195 calories.⁴⁹ The decline in food supplies in Eastern Europe and the former Soviet Union (EEFSU) after the collapse of communist regimes there only underscores the importance of economic development.

To put the improvements in per capita food supplies into context, the United Nations' Food and Agricultural Organization estimates that an adult in developing countries needs a minimum of 1,300 to 1,700 calories per day merely to keep basic metabolic activities functioning when at rest in a supine position. Food intake below those levels results in poor health, declining body weight, and physical and mental impairment. If one allows for moderate activity, then the national daily average requirement increases to between 2,000 and 2,310 calories per person.⁵⁰

Therefore, since 1961, developing countries' available food supply has, on average, gone from inadequate to above adequate. But these averages mask the fact that hunger still persists today since many people unfortunately have below-average food intake. Nevertheless, between 1969–71 and 1997–99 the number of people suffering from chronic undernourishment in developing countries declined from 920 million to 790 million, or from 35 percent to 17 percent of their population, despite a 76 percent growth in their population.⁵¹ Thus gaps between developing and developed countries in hunger and malnourishment have, in the aggregate, declined in absolute and relative terms. But the trends for Sub-Saharan Africa tell a somewhat more nuanced tale. Between 1979–81 and 1997–99, the share of population that was undernourished declined from 38 to 34 percent, but the absolute numbers increased from 168 million to 194 million.⁵²

Why does economic development reduce the level of undernourishment? Cross-country data show that both crop yield and per capita food supply follow the pattern indicated in Figure 2, that is, both increase with income.⁵³ Crop yields increase because richer countries (or farmers)

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are better able to afford yield- and productivity-enhancing technologies, such as fertilizers, pesticides, better seeds, and tractors.⁵⁴ But even if a country has poor yields or insufficient production, if it is rich it can import its food needs.⁵⁵ Hence, as Figure 1 shows, the richer the country, the greater its available food supplies.

Because it is always possible to have local food shortages in the midst of a worldwide glut, the importance of trade should not be underestimated. Currently, grain imports amount to 10 percent of production in developing countries and 20 percent in Sub-Saharan Africa.⁵⁶ Without such imports, food prices in those countries would no doubt be higher and more people would be priced out of the market. In essence, globalization, through trade, has enhanced food security. And in doing so it has reduced the severe health burdens that accompany hunger and undernourishment.⁵⁷

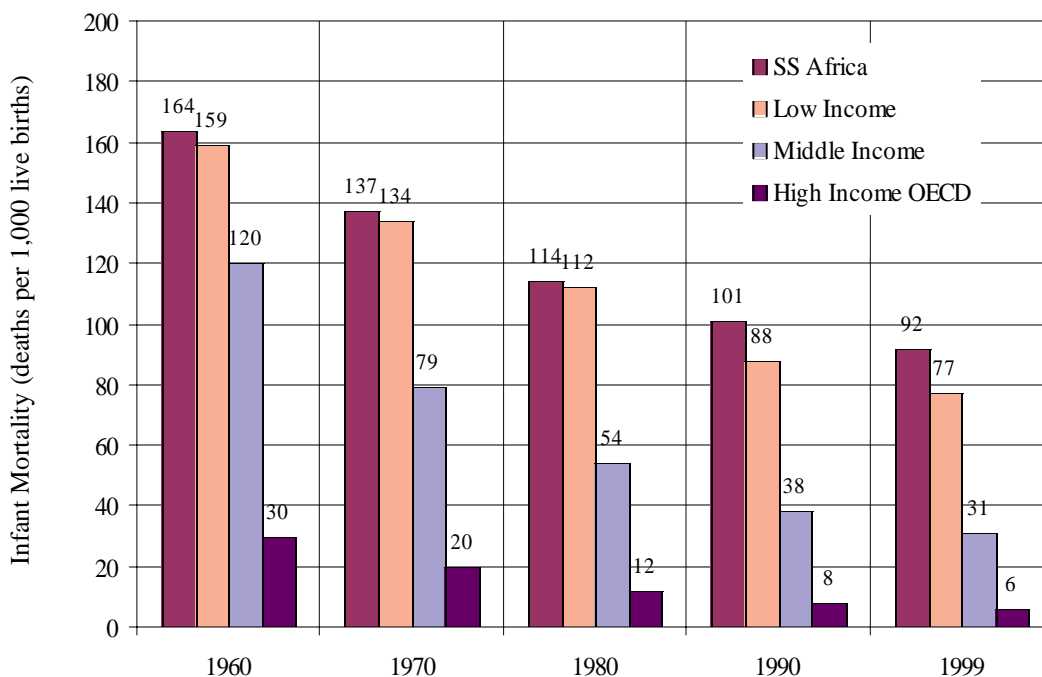
To summarize, the developing countries where hunger and undernourishment were

reduced the most are those that also experienced the most economic development. Certainly, for this indicator, globalization leading to faster economic development and greater trade would seem to be the solution rather than the problem.

Infant Mortality

Before industrialization, infant mortality, measured as the number of children dying before reaching their first birthday, typically exceeded 200 per 1,000 live births.⁵⁸ Starting in the 19th century, infant mortality began to drop in several of the currently developed countries because of advances in agriculture, nutrition, medicine, and public health. By the early 1950s, a gap had opened up between developed and developing countries as infant mortality dropped to 59 in the former and 178 in the latter.⁵⁹ By 1998 further medical advances reduced infant mortality in developed countries to 9, but because existing health care technology

Figure 3
Infant Mortality, 1960–99



Source: World Bank, *World Development Indicators 2001* (Washington: World Bank, 2001).

(including knowledge) diffused even faster from developed to developing countries, it had declined to 64 in the latter.⁶⁰ Thus, during the past half century the gap between developed and developing countries has been halved.⁶¹

The drop in infant mortality has been broad and deep. Since at least 1960 infant mortality has dropped more or less continuously for each of the country groups shown in Figure 3.⁶² It also illustrates that in any given year, consistent with Figure 1, higher per capita income is generally associated with lower infant mortality. Between 1960 and 1999, the gaps in this indicator between high-income members of the Organization for Economic Cooperation and Development and the other income groups shrank rather than increased. These gaps closed the fastest for medium-income countries and the slowest for Sub-Saharan Africa. This is counterintuitive since the larger the initial gap, the faster it ought to shrink, because the closer infant mortality is to zero, the harder it should be to reduce it further.

Consistent with Figure 2 and the rapid technological diffusion from developed to developing countries in the past few decades, Table 1 indicates that many developing countries are far better off today than the currently developed countries were at equivalent levels of economic development.⁶³ In

1913 when the United States had a per capita income of \$5,301 (in 1990 international dollars), its infant mortality was about 100. By contrast, in 1998 China's and India's, for example, were 31 and 71, respectively, despite per capita incomes that were 41 to 67 percent lower.

Thus, as is the case for hunger and under-nourishment, the areas where infant mortality has improved the least are those with insufficient economic development or that, for whatever reason, have been unable to fully capitalize on existing knowledge and technology. Once again, globalization seems to be part of the solution rather than the problem.

Life Expectancy

Because historically the decline in infant mortality was a major factor in the improvement in life expectancy, there are certain parallels between the progress in these two indicators, especially in the earlier years.

For much of human history average life expectancy was between 20 and 30 years.⁶⁴ Life expectancies in the currently developed countries increased slightly in the early part of the 19th century, followed by (small) declines in the middle half of the 1800s (probably because of urbanization) before commencing, with a few notable exceptions

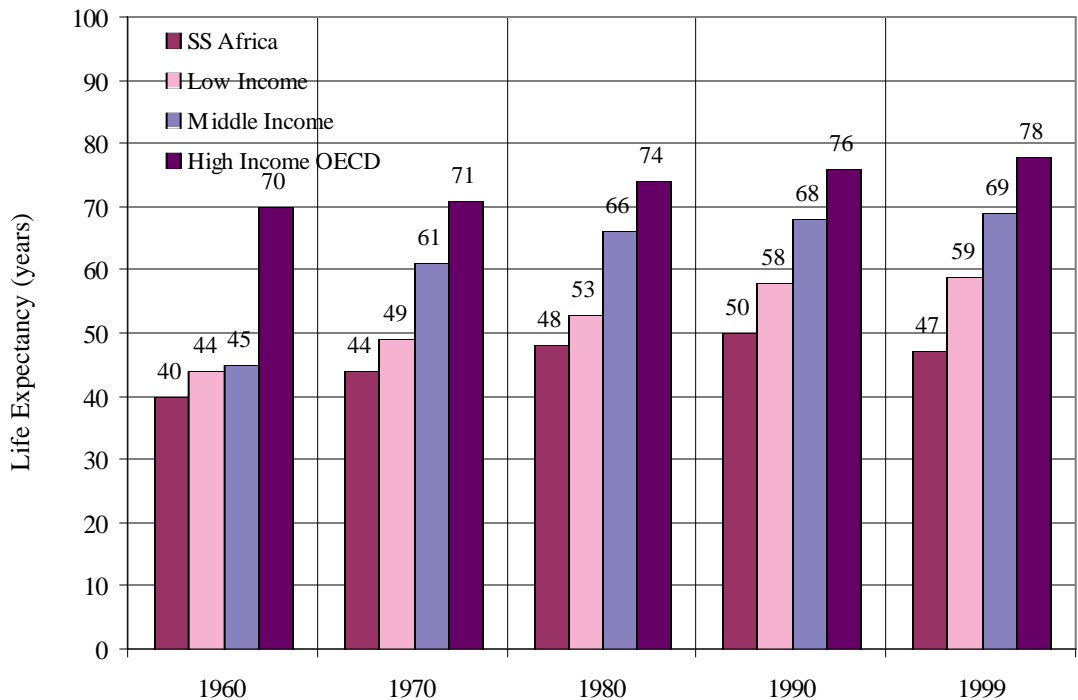
Both economic and human resources are more likely to be augmented with globalization than without it.

Table 1
Technological Progress, Infant Mortality, and Life Expectancy

Country	Year	Per Capita Income (1990 International \$)	Infant Mortality (deaths per 1,000 live births)	Life Expectancy at Birth (years)
United States	1913	5,301	~100	52
Ghana	1998	1,244	57	59
India	1998	1,745	71	63
China	1998	3,117	31	70
Peru	1998	3,666	40	68

Sources: Angus Maddison, *The World Economy: A Millennial Perspective* (Paris: OECD, 2001); U.S. Bureau of the Census, *Historical Statistics of the United States: Colonial Times to 1970* (Washington: Government Printing Office, 1975); and World Bank, *World Development Indicators 2001* (Washington: World Bank, 2001).

Figure 4
Life Expectancy, 1960–99



Source: World Bank, *World Development Indicators 2001* (Washington: World Bank, 2001).

and some minor fluctuations, a sustained improvement that continues to this day.⁶⁵

Contributing to these improvements were increases in food supplies per capita; the ascendancy of the germ theory; and the adoption of such basic public health measures as access to clean water, sanitation, pasteurization, vaccination, antibiotics, and the use of pesticides such as DDT to control malaria and other vector-borne diseases.

Because these public health and medical advances were discovered, developed, and adopted first by the developed countries, a substantial gap opened up in average life expectancy between them and developing countries. By the early 1950s the gap stood at 25.7 years in favor of the former.⁶⁶ But by the late 1990s, with the diffusion and transfer of technology (including knowledge) to developing countries, this gap had closed to 11.6 years.

A closer look at trends for different country groupings, however, reveals a more complex situation. Figure 4 compares life expectancies

of high-income OECD, middle-income, and low-income countries and Sub-Saharan Africa. Consistent with Figures 1 and 2, in any given year, life expectancy increases with per capita income. Between 1960 and 1999, life expectancy improved for high-income OECD and middle-income countries. However, the gap between these two sets of countries, which had shrunk from 24.5 in 1960 to 7.9 by the late 1980s, increased slightly to 8.6 by 1999, mainly because the middle-income countries include many EEFSU nations in which life expectancies declined as their economies contracted during that period.⁶⁷

The gap between high-income OECD and low-income countries also declined for most of the post-World War II period. But it expanded slightly from 1997 to 1999 because, while life expectancy in the former continued to increase because of medical advances, it dropped slightly in the latter.⁶⁸ This drop was particularly severe in Sub-Saharan Africa where, as shown in Figure 4,

Sub-Saharan Africa's experience with AIDS is in stark contrast to that of the richer nations.

life expectancy declined by three years in the 1990s, as a result of the HIV/AIDS epidemic and—in some cases, even more important—the resurgence of malaria⁶⁹ aggravated by civil unrest and cross-border conflicts in several areas. Consequently, the gap between rich and poor countries expanded in the 1990s, reversing the direction of the trend of previous decades. But it didn't expand because the rich increased their life expectancy at the expense of the poor; rather it was because, when faced with new diseases (such as AIDS) or new forms of ancient ones (for example, drug-resistant tuberculosis), the poor countries lacked the economic and human resources not only to develop effective treatments but also to import and adapt treatments invented and developed in the rich countries. Notably, both economic and human resources are more likely to be augmented with globalization than without it.

Sub-Saharan Africa's experience with AIDS is in stark contrast to that of the richer nations. When the disease first appeared, it resulted in almost certain death everywhere—in developed as well as developing countries. The former, particularly the United States, launched a massive assault on the disease, which led to the development of several technologies to reduce its toll. As a consequence, between 1995 and 1999 estimated U.S. deaths due to AIDS dropped by more than two-thirds (from 50,610 to 16,273) although the number of cases increased by almost half (from 216,796 to 320,282). In 1996 it was the eighth leading cause of death in the United States. By 1998 it had dropped out of the worst 15 list.⁷⁰

The United States was able to reduce deaths from AIDS because it both was wealthy and had the human capital to address this disease. But despite the fact that the necessary technology now exists and, in theory, is available worldwide, similar improvements have yet to occur in Sub-Saharan countries because they cannot afford the cost of treatment, unless it is subsidized by the governments, charities, or even industries of the *richer* nations. And indeed such subsidies are

exactly what the worldwide effort to contain HIV/AIDS hopes to mobilize. This is as clear an illustration as any that the greater the economic resources, the greater the likelihood not only of creating new technologies but, equally important, of actually putting those technologies to use. And unless technologies are used, they will sit as curios on a shelf, providing no benefit to humanity.

It might be argued that the rapid spread of AIDS and other diseases was, in fact, one of the unintended consequences of globalization. Without the transportation network that enables goods and people to move great distances, AIDS, for instance, might have been an isolated phenomenon rather than a pandemic. And indeed that much is true. But the same network also helped reduce public health problems in numerous ways. It helped reduce hunger and malnourishment by moving agricultural inputs and outputs between farms and markets. This was critical to increasing global food supplies in the past half century and, as noted, was one of the first steps to improved public health. Second, the transportation network is crucial to the worldwide diffusion of medical and public health technologies because it makes possible, for instance, the distribution of medicines, vaccines, medical equipment, insecticides for pest control, and equipment for water treatment plants. But globalization is more than the movement of goods; it also involves the movement of people and the diffusion of their ideas, knowledge, and expertise. That movement, too, is made possible by the transportation network as doctors, nurses, agronomists, engineers, and scientists move back and forth between the developing and developed worlds.

But there is one area in which globalization of ideas and attitudes has retarded further progress toward improvements in human well-being. One reason for the resurgence of malaria in many developing countries in the 1980s and 1990s was that, starting in the early 1960s, DDT, which had been instrumental in the post-World War II conquest of malaria in Europe and North America, began to be demonized in the rich countries.⁷¹

One reason for the resurgence of malaria in many developing countries was that DDT began to be demonized in the rich countries.

Gaps in child labor between Sub-Saharan Africa, the low- and middle-income countries, and the high-income OECD countries have been shrinking at least since 1960.

Eventually, many of the rich countries banned the use of DDT and curtailed, if not eliminated, its production. Although that had virtually no effect on their public's health—the rich countries had already conquered malaria and could, moreover, afford substitutes in case they were needed to combat any recurrence—the consequences for much of the developing world were tragic. The global translocation of rich countries' attitudes toward DDT, coupled with its unavailability or higher price due to reduced production and the paternalistic insistence of Western aid agencies that DDT's environmental consequences justified suspending its use for public health purposes, reduced the developing world's access to its most cost-effective weapon in its long-standing war against malaria.⁷² That contributed to a rebound in the malaria mortality rate in Sub-Saharan Africa.⁷³ That rate, which had dropped from 216 per 100,000 in 1930 to 107 in 1970, had climbed back to 165 per 100,000 in 1997.⁷⁴ Between 1990 and 1997, according to the World Health Organization's *World Health Report 1999*, the malaria mortality rate in Sub-Saharan Africa increased by 17 deaths per 100,000 (from 148 to 165 per 100,000).⁷⁵ Notably, that rate exceeded

the increase in the region's (total) crude death rate (which increased from 1,541 to 1,552 per 100,000 between 1990 and 1997) of 11 per 100,000 during the same period.⁷⁶ That is, despite the AIDS epidemic, but for the increase in malaria deaths, Sub-Saharan Africa's mortality rate (and life expectancy) might have held their own during that period.

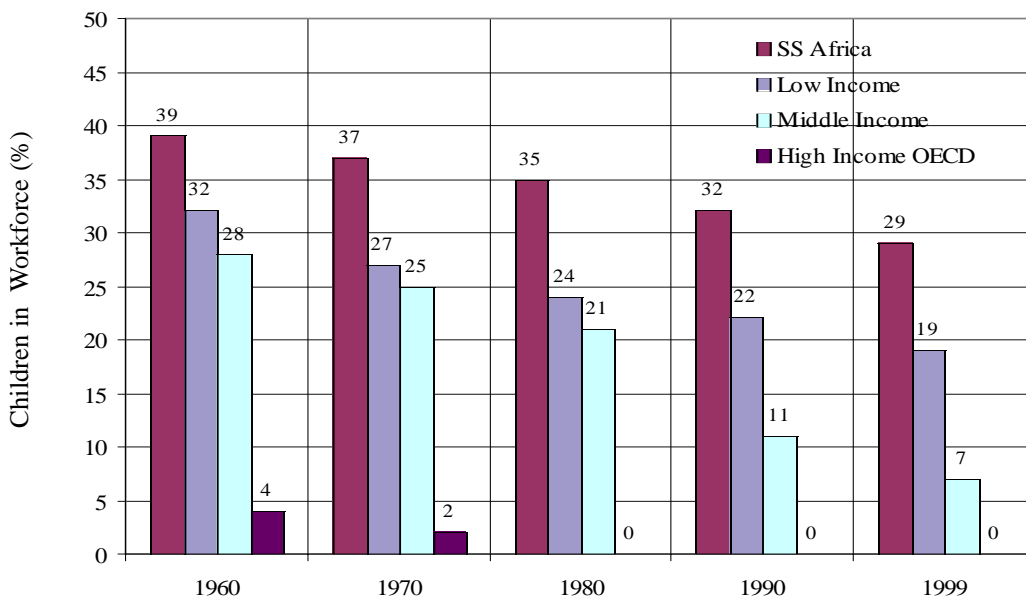
Nevertheless, the fact that life expectancy in the Sub-Saharan countries still exceeds the 20–30 years that was typical prior to globalization indicates that, despite the AIDS epidemic and the resurgence of malaria, the net effect of globalization has been positive as far as life expectancy is concerned.

This conclusion—hinted at in Figure 2 by the upward displacement in the life expectancy curve as we move from 1962 to 1997—is reinforced by Table 1, which shows that life expectancies are much higher in many developing countries than they were in today's developed countries (such as the United States) at equivalent levels of economic development.

Child Labor

Figure 5 shows that the proportion of

Figure 5
Child Labor, 1960–99



Source: World Bank, *World Development Indicators 2001* (Washington: World Bank, 2001).

children in the workforce has also been declining steadily for each of the income groups, and the richer the group, the lower that percentage. Gaps in child labor between Sub-Saharan Africa, the low- and middle-income countries, and the high-income OECD countries have been shrinking at least since 1960. For this indicator also, the gap between high-income OECD and middle-income countries has diminished the most; the gap between the former and Sub-Saharan Africa has diminished the least.⁷⁷

Human Development Index (HDI)

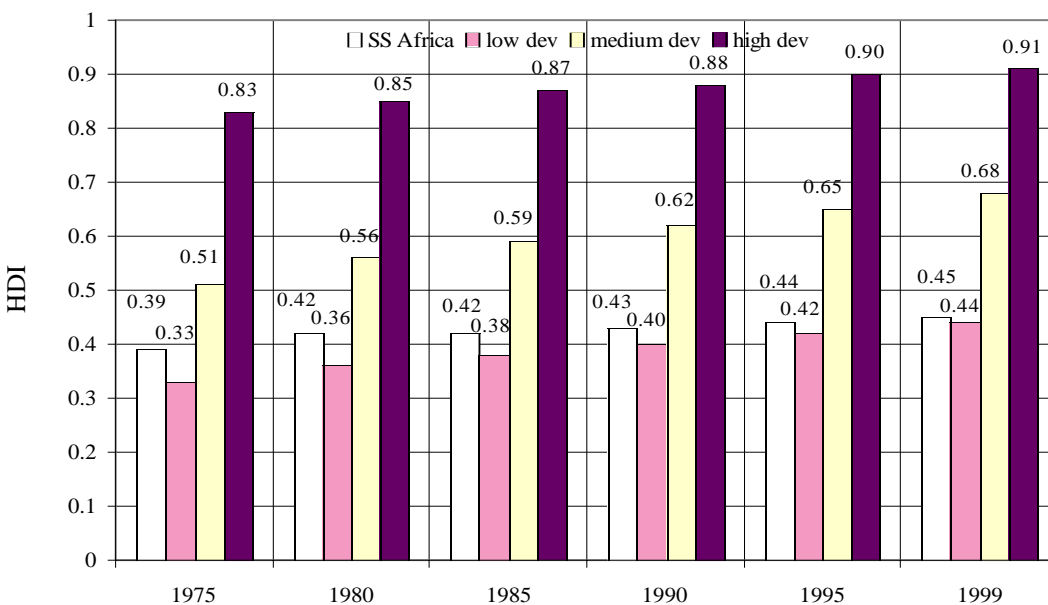
Broad improvements in life expectancy, literacy, and economic growth have combined to increase the HDI for most countries. Figure 6, based on the UN Development Program's *Human Development Report 2001*, shows that since 1975—the first year for which that report provides data—the population-weighted HDI has improved for the so-called high-, middle-, and low-development tiers of countries, as well as for Sub-Saharan countries (two-thirds of which are also

included in the low-development tier). Note that in this figure the HDI scale tops out at one unit.

Nevertheless, despite the broad improvement for the various groups of countries, some countries' HDIs have deteriorated in the past decade or so. According to the UNDP's *Human Development Report 2001*, of the 97 countries for which data are available for 1975 and 1999, Zambia has the dubious, but unique, distinction of having a lower HDI in 1999 than in 1975 because both GDP per capita and life expectancy declined over this period. The presence of refugees from conflicts in neighboring countries may have contributed to these declines. Curiously, in terms of aid as a fraction of GDP, at 22.8 percent, Zambia is also among the world's largest recipients of foreign aid.⁷⁸ Thus, its downward spiral can hardly be attributed to globalization or to rich countries having enriched or improved themselves at the expense of the poor. Moreover, of the 128 countries for which data were available, 18 countries, or 15 percent—10 Sub-Saharan

Gaps in human well-being between the rich countries and other income groups have for the most part shrunk over the past four decades.

Figure 6
Human Development Index, 1975–99



Sources: United Nations Development Program, *Human Development Report 2001* (New York: UNDP, 2001); and World Bank, *World Development Indicators 2001* (Washington: World Bank, 2001).

There may be situations where some inequality would benefit humanity.

and 8 EEFSU countries—had lower HDIs in 1999 than in 1990. Life expectancy in each of the 10 Sub-Saharan countries declined during this period mainly because of HIV/AIDS or malaria, or both; in all but two cases, per capita GDP also declined. During this period, most of those countries also were directly or indirectly affected by civil unrest or spillovers from conflicts in neighboring countries, which further strained their resources. Per capita income declined in all eight EEFSU countries while life expectancies dropped in six of the eight.

All else being equal, one would have expected that HDI improvements would generally be largest for the lowest tier and least for the highest tier of countries because the latter are closer to the top of the HDI scale and because with each improvement in HDI it becomes harder to improve it further (just as each additional dollar adds less to the quality of life than the previous dollar). But in fact, as Figure 6 shows, between 1975 and 1999, the middle-tier countries saw the most progress, followed, in order, by the low-tier, high-tier, and Sub-Saharan countries. As a result, the HDI gap between the high- and medium-tier countries diminished the most. The gap between high- and low-tier countries also declined slightly, but, for the reasons discussed above, the gap between the high-tier and Sub-Saharan countries expanded.

Summarizing the Trends

The well-being of the vast majority of the world's population has improved and continues to improve. Because of a combination of economic growth and technological change, compared to a half century ago the average person today lives longer and is less hungry, healthier, more educated, and more likely to have children in a schoolroom than in the workplace. During that period, indicators of well-being have improved for every country group, although life expectancies have declined in many Sub-Saharan and EEFSU countries since the late 1980s

because of HIV/AIDS, malaria, or problems related to economic deterioration.

For every indicator examined, regardless of whether the rich are richer and the poor poorer, gaps in human well-being between the rich countries and other income groups have for the most part shrunk over the past four decades. However, comparing rich countries and Sub-Saharan Africa, although the gap in infant mortality between the two has continued to close, the gap in life expectancy has expanded in the past decade or so (but not enough to erase the large improvement made previously). Despite this, in aggregate, the corresponding gap in HDI has decreased.

Globalization and Inequality

Conventional wisdom decries income inequality, but there may be situations where some inequality would benefit humanity. Consider, for instance, that since most of the easy improvements in public health have been largely captured (except where globalization has lagged), the search for and implementation of cures and treatments for today's unconquered diseases (such as strokes, heart disease, and cancers) could become progressively more expensive. Richer societies are in a better position to invest in the research and development of new or improved technologies in general, and technologies for detecting, treating, or eliminating these diseases in particular. AIDS is a case in point.

Moreover, new technologies are often relatively costly initially. The rich, therefore, are usually the first to obtain new or innovative technology. As the rich purchase this technology, the supplier can increase production and its price drops because of economies of scale and learning by doing, if nothing else. Such declines allow the less wealthy to also afford that technology, which then paves the way for further price drops and induces people of more modest means to enter the market. Thus, arguably, wealth inequality spurs

the invention, innovation, and diffusion of new technologies.

This pattern has been repeated time and again for goods and services (such as telephones, VCRs, personal computers, and even vacations to exotic places) as well as health technologies (such as antibiotics, organ transplants, and, now, AIDS treatments). Innovations were expensive at first but their costs came down. Therefore, some inequality in wealth probably benefits humanity. Presumably, for a given set of supply and demand characteristics for a particular technology, there is an optimum level of income inequality that would maximize the rate of adoption of that technology, as well as the rate at which it improves human well-being. In other words, even if one were to ignore trends in inequalities in other, more significant indicators of human well-being, income inequality is a poor lens for viewing the merits of globalization.

Without restricting himself only to income inequality, Nobel prize-winning economist Amartya Sen claims that inequality is the central issue with respect to globalization and that a “crucial question concerns the sharing of the potential gains from globalization, between rich and poor countries, and between different groups within countries.”⁷⁹

If one accepts Sen’s contention regarding the centrality of inequality, the data presented and discussed in this paper indicate that, whether or not income inequalities have been exacerbated, in terms of the truly critical measures of well-being—hunger, infant mortality, life expectancy, child labor—the countries of the world are much closer to being equal now than they were a few decades ago.

But in the past dozen years the life expectancy gap between the richest and some of the poorest countries has expanded. Therefore, it might be argued that, with respect to this most significant of all indicators at least, globalization might yet fail Sen’s “crucial question.” But it is no more reasonable to expect that globalization would lead to equal gains among countries than, say, that a course in economics would lead to equal gains

in knowledge for all students. Sen, for instance, benefited much more from his education than did his classmates, not because someone else gained less but perhaps because of better preparation, harder work, or even greater natural ability. Just as unequal sharing of benefits or outcomes does not indict education, unequal progress in human well-being does not damn globalization.

In fact, Figures 1 through 6 suggest that where gaps in well-being have expanded, it is not because of too much globalization but because of too little. The rich are not better off because they have taken something away from the poor; rather, the poor are better off because they have benefited from the technologies developed by the rich, and their situation would have been further improved had they been better prepared to capture the benefits of globalization. To the extent the rich can be faulted, it is that, first, their demonization of DDT—and here globalization is culpable—also affected attitudes in the developing countries.⁸⁰ That contributed to the resurgence in malaria during the 1980s and 1990s, because of which mortality rates are higher—and life expectancy lower—in Sub-Saharan Africa than they would otherwise have been. Second, and perhaps more important, by protecting favored economic sectors through subsidies and import barriers—activities that have not necessarily improved their own economic welfare—the rich have retarded the pace of globalization and made it harder for many developing countries to capture its benefits.

Notes

1. See, for example, Kevin Watkins, Aart Kraay, and David Dollar, “Point/Counterpoint: Making Globalization Work for the Poor,” *Finance and Development* 39, no. 1 (March 2002), pp. 24–28; Martin Khor, “Backlash Grows against Globalisation,” 1996, www.globalpolicy.org/globaliz/bcklash1.htm; W. Bowman Cutter, Joan Spero, and Laura D’Andrea Tyson, “New World, New Deal,” *Foreign Affairs* (March–April 2000): 80–98, www.foreignpolicy2000.org/library/issuebriefs/readingnotes/fa_tyson.html; Bernard Wasow, “New World, Bum Deal?” *Foreign Affairs* (July–August 2000), www.tcf.

Wealth inequality spurs the invention, innovation, and diffusion of new technologies.

org/Opinions/In_the_News/Wasow-NewWorld_BumDeal.html; Jay Mazur, "Labor's New Internationalism," *Foreign Affairs* (January–February 2000): 79–93; "The FP Interview: Lori's War," Interview originally published in *Foreign Policy* (Spring 2000), www.foreignpolicy.com/best_of_fp/articles/wallach.html; and United Nations Development Program, *Human Development Report 1999* (New York: UNDP, 1998), pp. 3, 11.

2. Cutter, Spero, and Tyson.

3. David Dollar and Aart Kraay, "Spreading the Wealth," *Foreign Affairs* (January–February 2000), www.foreignaffairs.org/articles/Dollar0102.html (visited May 26, 2002). Xavier Sala-i-Martin finds that both world poverty rates and global income inequality have declined substantially in the past 20 years. Xavier Sala-i-Martin, "The World Distribution of Income," National Bureau of Economic Research working paper no. 8933, May 2002, www.papers.nber.org/tmp/32723-w8933.pdf.

4. For instance, Stephen Lewis, a leading Canadian New Democratic Party politician, former Canadian ambassador to the United Nations, and erstwhile deputy executive director of UNICEF, is quoted as having said: "There is something profoundly wrong with globalization. . . . There is more to the world than creating bigger markets. We can't ignore the human dimension." Quoted in Ryan Smith, "Lewis Flays Globalization," *University of Alberta Express News*, January 29, 2001, on file with author. Similarly, Lori Wallach, an anti-globalization organizer who came to prominence during the Seattle protests, notes: "The question is, what is going on in real measures of well-being? So, while the volume, the flow of goods, may be up, and in some countries gross national product may be up, those macroeconomic indicators don't represent what's happening for the day-to-day standard of living for an enormous number of people in the world. That gets to one of the biggest critiques of the WTO in its first five years, which is that while the overall global flow of trade continues to grow, the share of trade flows held by developing countries has declined steadily. Similarly, over that five-year period, while the macroeconomic indicators have often looked good, real wages in many countries have declined, and wage inequality has increased both within and between countries." "The FP Interview."

5. Zach Dubinsky, "Amid the Tears: Protesters, Police, Politics and the People of Quebec," *Cleveland Free Times*, April 25–May 1, 2001. This slogan is reminiscent of the title of a book by Eric A. Davidson, *You Can't Eat GNP: Economics As If Ecology Mattered* (Cambridge, Mass.: Perseus, 2000).

6. Indur M. Goklany, *Economic Growth and the State*

of Humanity (Bozeman, Mont.: Political Economy Research Center, 2001), pp. 6, 10–19; and Indur M. Goklany, "The Future of the Industrial System," Paper presented at International Conference on Industrial Ecology and Sustainability, University of Technology of Troyes, Troyes, France, September 22–25, 1999.

7. James Gwartney and Robert Lawson with Walter Park and Charles Skipton, *Economic Freedom of the World: Annual Report 2001* (Vancouver, B.C.: Fraser Institute, 2001); David Dollar and Aart Kraay, "Growth Is Good for the Poor," World Bank, Development Research Group, 2000, www.worldbank.org/research/growth/absdollakray.htm; James Gwartney, Randall Holcombe, and Robert Lawson, "The Scope of Government and the Wealth of Nations," *Cato Journal* 18, no. 2 (1998): 163–90; Seth W. Norton, "Poverty, Property Rights, and Human Well-Being: A Cross-National Study," *Cato Journal* 18, no. 2 (1998): 233–45; and Robert J. Barro, *The Determinants of Economic Growth: A Cross-Country Empirical Study* (Cambridge, Mass.: MIT Press, 1997). With respect to democracy and economic growth, Barro, pp. 52–61, suggests that increased economic growth tends to increase democracy (the so-called Lipset hypothesis), but democracy's effect on economic growth is mixed; apparently growth increases with democracy at low levels of democracy but declines at high levels, perhaps because redistribution impulses are harder to contain in democracies. This is echoed in William Easterly, *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics* (Cambridge, Mass.: MIT Press, 2001), pp. 265–67. See also Dani Rodrik, "Democracy and Economic Performance," Harvard University, Kennedy School of Government, December 14, 1997, www.ksghome.harvard.edu/~drodrik.academic.ksgh/demoecon.PDF; and Francisco L. Rivera-Batiz, "Democracy, Governance and Economic Growth: Theory and Evidence," undated, www.columbia.edu/cu/economics/discapr/DP0102-57.pdf.

8. Figure 1 is based on cross-country analyses reported in Goklany, *Economic Growth and the State of Humanity*, and Indur M. Goklany, *The Precautionary Principle: A Critical Appraisal of Environmental Risk Assessment* (Washington: Cato Institute, 2001), pp. 23, 76–78. The data used to generate this figure are from World Bank, *World Development Indicators 1999* (Washington: World Bank, 1999) except for daily food supplies per capita, which are from World Resources Institute, *World Resources 1998–1999* (Washington: World Resources Institute, 1998). Each of the curves in Figure 1 is based on a best-fit equation generated using log-linear regression of the indicator on the (log of) per capita income (estimated as gross domestic product per capita), with the exception of the infant mortality curve, which was generat-

ed using a log-log regression. The curves representing access to safe water and literacy were truncated at 100 percent, while the child labor curve was truncated at 0 percent. The slopes of each of the regression lines were significant at the 0.1 percent, or better, level. The number of data points (N) and R^2 for the indicators were as follows: 148 and 0.645 for life expectancy, 147 and 0.745 for infant mortality, 150 and 0.629 for daily food supplies per capita, 96 and 0.520 for literacy, 51 and 0.549 for access to safe water, and 140 and 0.534 for child labor.

9. For example, 100 percent for literacy and access to safe water and 0 percent for child labor (measured as the percentage of children aged 10–14 years in the labor force).

10. See United Nations Development Program, *Human Development Report 2001* (New York: UNDP, 2001).

11. Jasper Becker, *Hungry Ghosts: Mao's Secret Famine* (New York: Free Press, 1996).

12. Robert W. Fogel, "The Contribution of Improved Nutrition to the Decline of Mortality Rates in Europe and America," in *The State of Humanity*, ed. Julian L. Simon (Cambridge, Mass.: Blackwell, 1995), pp. 61–71; Robert W. Fogel, *The Fourth Great Awakening and the Future of Egalitarianism* (Chicago: University of Chicago Press, 2000), pp. 74–79; World Health Organization, *World Health Report 1999* (Geneva: WHO, 1999); Richard A. Easterlin, *Growth Triumphant: The Twenty-First Century in Historical Perspective* (Ann Arbor: University of Michigan Press, 1996), pp. 46, 89–91; and Indur M. Goklany, "Saving Habitat and Conserving Biodiversity on a Crowded Planet," *BioScience* 48 (November 1998): 941–53.

13. World Health Organization, *World Health Report 2000* (Geneva: WHO, 2000), pp. 176–83.

14. World Resources Institute, *World Resources 1998–1999*.

15. U.S. Department of Health and Human Services, Office of Disability, Aging and Long Term Care, *Active Aging: A Shift in the Paradigm* (Washington: HHS, 1997), www.aspe.hhs.gov/daltcp/reports/actaging.htm; see also Eileen M. Crimmins, Yasuhiko Saito, and Dominique Ingegneri, "Trends in Disability-free Life Expectancy in the United States, 1970–90," *Population and Development Review* 23, no. 3 (1997): 555–72, 689–90.

16. *Ibid.*

17. Joel Mokyr, *The Lever of Riches: Technological*

Creativity and Economic Progress (New York: Oxford University Press, 1990), pp. 174–76; Gwartney, Holcomb, and Lawson; Barro, *The Determinants of Economic Growth*, pp. 19–23; Robert J. Barro, *Education and Economic Growth*, www.hrdc-drhc.gc.ca/stratpol/arb/conferences/oecd/education.pdf; and Easterly, pp. 71–84.

18. Easterlin, pp. 9, 79. Barro, *Education and Economic Growth*, pp. 20–21, suggests that education of women at the primary level might increase economic growth by reducing the total fertility rate, but his analysis does not show any significant effect on economic growth due to secondary education for women, which, he opines, might be due to gender discrimination. Dean Filmer and Lant Pritchett show that infant and child mortality rates—indicators of public health—decline with women's education. This might be a mechanism through which women's education helps spur economic growth. Dean Filmer and Lant Pritchett, *Child Mortality and Public Spending on Health: How Much Does Money Matter?* October 17, 1997, www.worldbank.org/html/dec/Publications/Workpapers/WPS1800series/wps1864/wps1864.pdf.

19. Not surprisingly, expenditures on research and development increase with per capita GDP. Linear-regression analysis of cross-country data for 1994 from World Bank, *World Development Indicators 1999*, shows that the slope is significant at the 5 percent level ($N = 53$, $R^2 = 0.506$). This analysis used GDP per capita for 1994 adjusted for purchasing power parity. See also Indur M. Goklany, "Strategies to Enhance Adaptability: Technological Change, Economic Growth and Free Trade," *Climatic Change* 30 (1995): 427–49.

20. Easterlin, p. 46. However, as Mokyr, pp. 174–75, has pointed out, this may not always be the case. See also Easterly, pp. 71–84.

21. Goklany, "Strategies to Enhance Adaptability"; and Goklany, "Saving Habitat and Conserving Biodiversity."

22. Easterlin, p. 161.

23. Fogel, "The Contribution of Improved Nutrition," pp. 61–71; Fogel, *The Fourth Great Awakening*, p. 78; World Health Organization, *World Health Report 1999*; Easterlin; and Goklany, "Saving Habitat and Conserving Biodiversity."

24. Fogel, *The Fourth Great Awakening*; and Easterlin.

25. Goklany, "Saving Habitat and Conserving Biodiversity"; Goklany, "Strategies to Enhance Adaptability"; and Indur M. Goklany, "Potential Consequences of Increasing Atmospheric CO_2 Concentration Compared to Other Environmental

- Problems," *Technology 7S* (2000): 189–213.
26. Goklany, "Saving Habitat and Conserving Biodiversity"; and Goklany, "Strategies to Enhance Adaptability."
27. Dubinsky; and Davidson.
28. Goklany, "Saving Habitat and Conserving Biodiversity"; see also Lant Pritchett and Lawrence H. Summers, "Wealthier Is Healthier," *Journal of Human Resources* 31 (1996): 841–68.
29. World Bank, *World Development Report: Investing in Health* (New York: Oxford University Press, 1993), pp. 17–21; Fogel, "The Contribution of Increased Nutrition"; Easterlin, pp. 89–91; World Health Organization, *World Health Report 1999*; and Barry Bloom, "The Future of Public Health," *Nature* 402 (Supplement 1999): C63–64.
30. Easterlin, p. 90.
31. Harvard University Center for International Development and the London School of Hygiene and Tropical Medicine, *Economics of Malaria, Executive Summary*, 2000, www.malaria.org/jdsachseconomic.html.
32. World Health Organization, *World Health Report 1999*; and Fogel, "The Contribution of Increased Nutrition."
33. Goklany, *Economic Growth and the State of Humanity*, Figures 3 and 7, pp. 11, 18.
34. The cycle of progress is briefly described in *ibid.*, pp. 26–31. See also Goklany, "The Future of the Industrial System."
35. See, for example, Barro, *The Determinants of Economic Growth*; Dollar and Kraay, "Growth Is Good for the Poor"; Gwartney and Lawson; and Gwartney, Holcomb, and Lawson.
36. Jeffrey A. Frankel and David Romer, "Does Trade Cause Growth?" *American Economic Review* (June 1999): 379–99; Barro, *The Determinants of Economic Growth*; and Dollar and Kraay, "Growth Is Good for the Poor."
37. Goklany, "Strategies to Enhance Adaptability."
38. *Ibid.*
39. A vivid example of the importance of trade in improving human well-being comes from Iraq whose inability, because of trade sanctions, to fully operate and maintain its water, sanitation, and electrical systems or to obtain sufficient food for its population has contributed to a deterioration of public health and lowered life expectancies since the Gulf War. The need to alleviate these problems was the basis for various UN Security Council resolutions to extend its "Oil-for-Food" program. United Nations, "Security Council Extends Iraq 'Oil-for-Food' Programme for Further 186 Days," Press release SC/6872, June 8, 2000, www.un.org/News/Press/docs/2000/20000608.sc6872.doc.html.
40. Goklany, "Strategies to Enhance Adaptability."
41. Figure 2 is based on cross-country analyses reported in Goklany, *Economic Growth and the State of Humanity*, pp. 11, 15, using data from World Bank, *World Development Indicators 1999*. In this figure GDP per capita is based on constant (1995) dollars at market exchange rates. As in Figure 1, the life expectancy curves are based on best-fit equations generated using log-linear regressions. The slopes of both of these regression lines are significant, that is, economic development leads to a statistically significant improvement in life expectancy. Equally important, the change in the intercepts going from 1962 to 1997 is positive and statistically significant at the 0.1 percent level. That is, the upward displacement in the life expectancy curve between 1962 and 1997 (which can be attributed to technological change over that period) is statistically significant.
42. Goklany, *Economic Growth and the State of Humanity*, pp. 7, 9.
43. As in Figure 1, the two infant mortality curves are based on log-log regressions using data from World Bank, *World Development Indicators 2001* (Washington: World Bank, 2001). The slopes of each of these regression lines are statistically significant at the 0.1 percent level. More important, the change in the intercepts on the log (infant mortality) axis going from 1962 to 1997 is statistically significant for this pair as well. See Goklany, *Economic Growth and the State of Humanity*, pp. 13–34.
44. *Ibid.*
45. Paul Ehrlich, *The Population Bomb* (New York: Ballantine Books, 1968).
46. W. Paddock and P. Paddock, *Famine 1975! America's Decision: Who Will Survive?* (Boston: Little, Brown, 1967).
47. Based on *FAOSTAT Database*, www.apps.fao.org from Indur M. Goklany, "Agricultural Technology and the Precautionary Principle," in *Environmental Policy and Agriculture: Conflicts, Prospects, and Implications*, ed. Roger Meiners and Bruce Yandle (Lanham, Md.: Rowman and Littlefield, forthcoming 2002).
48. *Ibid.*
49. *Ibid.*

50. UN Food and Agricultural Organization, "Assessment of Feasible Progress," in *Food Security. Technical Background Documents* 12–15 (Rome: FAO, 1996), vol. 3.
51. UN Food and Agricultural Organization, *The State of Agriculture 1996* (Rome: FAO, 1996); and UN Food and Agricultural Organization, *The State of Food Insecurity in the World 2001*, www.fao.org/docrep/003/y1500e/y1500e00.htm.
52. Ibid.
53. Goklany, "Saving Habitat and Conserving Biodiversity"; Goklany, "The Future of the Industrial System"; and Goklany, "Potential Consequences of Increasing Atmospheric CO₂ Concentration."
54. Ibid.
55. Ibid.
56. *FAOSTAT Database 2001*, www.apps.fao.org.
57. Goklany, "Strategies to Enhance Adaptability."
58. K. Hill, "The Decline in Childhood Mortality," in *The State of Humanity*, pp. 37–50.
59. World Resources Institute, *World Resources 1998–1999*.
60. Goklany, *Economic Growth and the State of Humanity*, p. 14.
61. Goklany, "The Future of the Industrial System."
62. The country groupings in this and the following two figures are taken from the classifications used in World Bank, *World Development Indicators 2001*.
63. Economic data are from Angus Maddison, *The World Economy: A Millennial Perspective* (Paris: OECD, 2001); data on life expectancy (LE) and infant mortality (IM) for the United States in 1913 are from U.S. Bureau of the Census, *Historical Statistics of the United States: Colonial Times to 1970* (Washington: Government Printing Office, 1975); the LE and IM data for 1998 are from World Bank, *World Development Indicators 2001*.
64. Samuel H. Preston, "Human Mortality throughout History and Prehistory," in *The State of Humanity*, pp. 30–36.
65. Goklany, *Economic Growth and the State of Humanity*, pp. 7–15.
66. World Resources Institute, *World Resources 2000–2001* (Washington: World Resources Institute, 2000).
67. World Bank, *World Development Indicators 2001*.
68. Ibid.
69. For example, in 1998 Zambia lost more than twice as many disability-adjusted life years to malaria as it did to HIV/AIDS. Personal communication from Richard Tren, May 14, 2002, based on statistics from Zambia's Central Board of Health. The malaria mortality rate in Sub-Saharan Africa, which stood at 184 per 100,000 in 1950, had declined to 107 in 1970. That decline continued until the 1980s, but by 1997 it had rebounded to 165; by contrast, in the rest of the world it declined from 39 per 100,000 in 1950 to 1 per 100,000 in 1997. World Health Organization, *World Health Report 1999*, p. 50.
70. Goklany, *The Precautionary Principle*, pp. 9–10 and references therein.
71. Rachel Carson, *Silent Spring* (Cambridge, Mass.: Houghton Mifflin, 1962).
72. Roger N. Bate, "How Precaution Kills: The Demise of DDT and the Resurgence of Malaria," in *Perilous Precaution: The Folly of Disregarding Science*, ed. Roger N. Bate (Cambridge: European Science and Environment Forum, 2002), pp. 70–82; Wallace Chuma, "A Renewed Role Sought for DDT in Malaria War," *Pittsburgh Post Gazette*, July 21, 2002, www.post-gazette.com/healthscience/20020721malaria3.asp; and Goklany, *The Precautionary Principle*, pp. 13–18.
73. Bate; Chuma; and Goklany, *The Precautionary Principle*, pp. 13–18.
74. World Health Organization, *World Health Report 1999*, p. 50. It's unclear whether the mortality rate was age adjusted for a standard population distribution. However, the change in this distribution between 1990 and 1997 is unlikely to have modified the increase in mortality rate by much.
75. Ibid. This increase in the mortality rate alone translates into an increase of more than 100,000 additional malaria deaths in 1997.
76. World Bank, *World Development Indicators 2002*.
77. World Bank, *World Development Indicators 2001*.
78. "Emerging-Market Indicators: Net Official Aid," *The Economist*, March 23–30, 2002, p. 102.
79. Amartya Sen, "A World of Extremes: Ten Theses on Globalization," *Los Angeles Times*, July 17, 2001, www.globalpolicy.org/globaliz/define/0717amrt.htm.
80. Deepak Lal has warned against rich countries

imposing their values on poor countries. "If the West ties its moral crusade too closely to the emerging process of globalization," he writes, "there is a danger that there will also be a backlash against the process of

globalization." Deepak Lal, "The Challenge of Globalization: There Is No Third Way," in *Global Fortune: The Stumble and Rise of World Capitalism*, ed. Ian Vásquez (Washington: Cato Institute, 2000), p. 40.

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