Chapter 5: The Reality of Economic Growth: History and Prospect

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Questions

1. What is modern economic growth?

2. What was the post-1973 productivity slowdown? What were its causes? Is the productivity slowdown now over?

3. Why are some nations so (relatively) rich and other nations so (relatively) poor?

4. What policies can make economic growth faster?

5. What are the prospects for successful and rapid economic development in tomorrow's world?

5.1 Before Modern Economic Growth

Before the Industrial Revolution

Looking Back into Deep Time

If we take the scattered and imperfect information we have about the global economy that we have from the distant past up to today we see a pattern like that of table 5.1.

Table 5.1: Economic Growth Through Deep Time

Longest-Run Economic Growth

Year	Population*	GDP per Capita**
-5000	5	$130
-1000	50	$160
1	170	$135
1000	265	$165
1500	425	$175
1800	900	$250
1900	1625	$850
1950	2515	$2030
1975	4080	$4640
2000	6120	$8175

*Millions

**In year-2000 international dollars.

Up until 1800 the growth rates of human populations were glacial. Population growth between 5000 B.C. and 1800 averaged less than one-tenth of a percent per year. (Nevertheless, the cumulative magnitude of population growth was impressive, carrying the number of human beings alive on the planet from perhaps 5 million in 5000 B.C. to 900 million in 1800; 7,000 years is a long time.)

Up until 1500, as best we can tell, there had been next to *no* growth in output per worker for the average human for millennia. Even in 1800 the average human alive had a material standard of living (and an economic productivity level) at best twice that of the average human alive in the year 1. The problem was not that there was no technological progress. There was. Humans have long been ingenious. Warrior, priestly, and bureaucratic elites in 1800 lived much better than their predecessors in previous millennia had lived. But just because the elite that ruled you lived better does not mean that you--if you were average--lived any better.

Only after 1800 do we see large sustained increases in worldwide standards of living. After 1800 human numbers grew as the population explosion took hold. It carried our total population to 6 billion in October 1999. Population growth on a world scale accelerated from a rate of 0.2% per year between 1500 and 1800 to 0.6% per year between 1800 and 1900, 0.9% per year between 1900 and 1950, 1.9% per year between 1950 and 1975, and—in the first slowing of the global rate of population growth--1.6% per year from 1975 to 2000.

Average rates of material output per capita, which grew at perhaps 0.15% per year between 1500 and 1800, grew at perhaps 1.0% per year worldwide between 1800 and 1900, and have grown at an average pace of perhaps 2.0% per year worldwide between 1900 and 2000, as Figure 5.1 shows.

Figure 5.1: Population Growth Since 1000

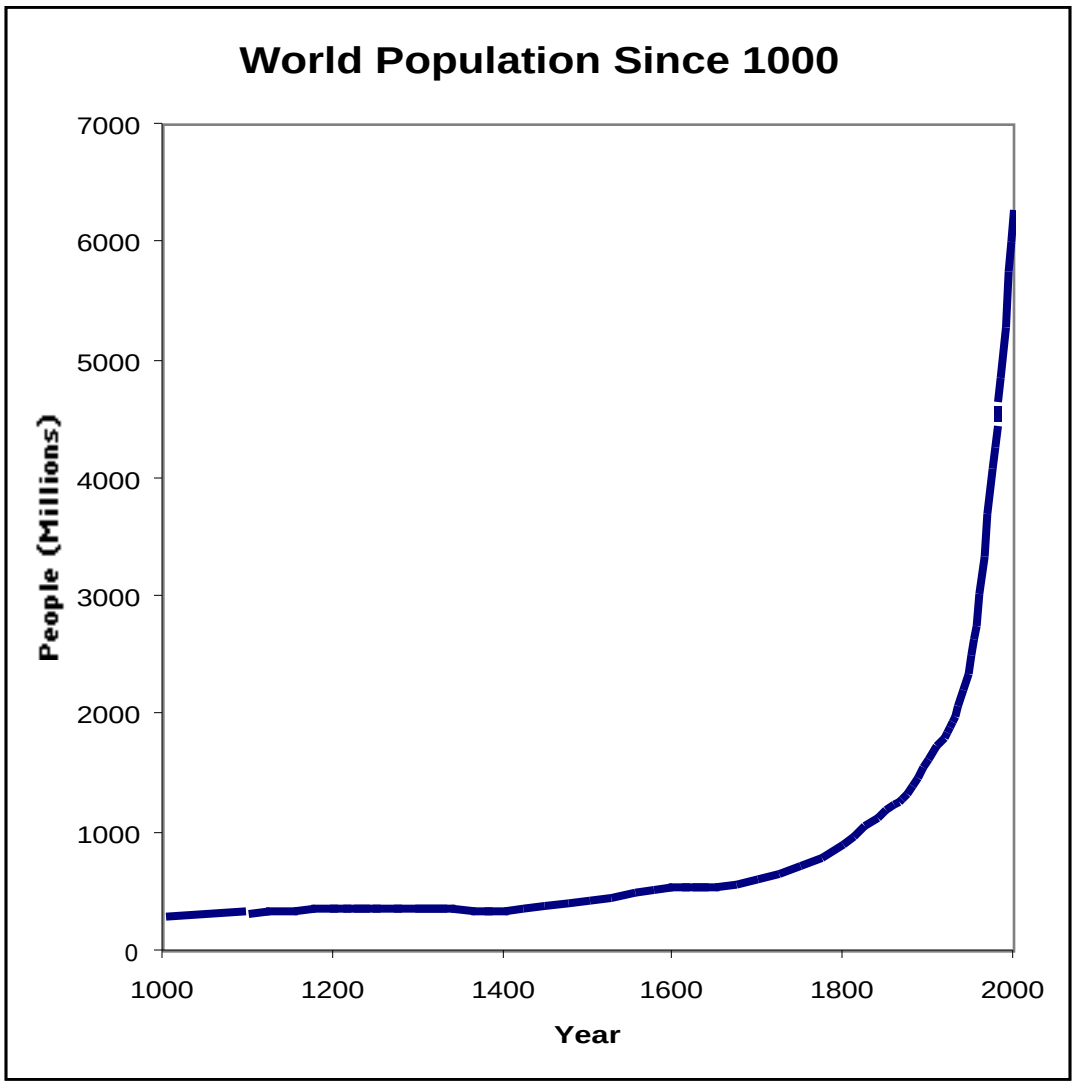


Figure Legend: The explosion of human populations since 1800 is called—not surprisingly—the *population explosion.*

Source: United Nations and Michael Kremer of MIT.

Pre-Modern Economic “Growth”

Why were there no sustained increases in the material productivity of human labor back before 1500? Because improved technology quickly ran aground on resource scarcity. As human populations grew the stocks of natural resources known had to be divided up among more and more people: miners had to exploit lower-quality metal ores, farmers had to farm lesser-quality agricultural land, and forests vanished. Who alive today has ever seen one of the cedars of Lebanon? In spite of technological progress resource scarcity meant that the efficiency of labor was little if any greater in 1500 A.D. than in 1500 B.C.

One of the oldest ideas in economics is that increases in technology inevitably run into natural resource scarcity, and so lead to increases in the numbers of people but not in their standard of living of productivity. This idea was introduced into economics late by Thomas R. Malthus, who was to become the first academic professor of economics (Adam Smith had been a professor of moral philosophy) at the East India Company's Haileybury College.

Malthus saw a world in which inventions and higher living standards led to increases in the rate of population growth. With higher living standards women ovulated more frequently. More pregnancies were successfully carried to term. Better-nourished children (and adults) had a better chance of resisting diseases. Moreover, when incomes were high new farmsteads are relatively plentiful, and getting the permission of one's father or elder brother to marry was easier. For these reasons both social and biological, a higher standard of living back before 1800 led to a faster rate of population increase. And

faster rates of population growth increased natural resource scarcity and lowered productivity until once again people were so poor and malnourished that population growth was roughly zero.

The End of the Malthusian Age

Technology

We clearly no longer live in a Malthusian age. For at least two hundred years improvements in the efficiency of labor made possible by new technologies and better organizations have *not* been neutralized by natural resource scarcity. (But a Malthusian age may return: project twentieth century population growth rates forward and calculate that the year-2200 population of the earth would be 93 billion; it requires skill and ingenuity to argue today that resource scarcity would not be a dominant feature of such a world).

So what caused the end of the Malthusian age? How did humanity escape from the trap in which invention and ingenuity increased the numbers but not the material well-being of humanity?

The key is that even in the Malthusian age the pace at which inventions were made increased steadily. First of all, the population grew. Inventions made communication easier: especially after the invention of printing knowledge could diffuse widely and quickly. More people meant more inventions: two heads are greater than one. The rate of technological progress slowly rose over millennia. And about 1500 it passed the point at

which natural resource scarcity could not fully offset it. Sustained increases not just in population but in the productivity of labor followed.

The Demographic Transition

At first the rise in material standards of living brought sharp increases in the rate of population growth: the population explosion. But as material standards of living rose far above subsistence, countries began to undergo the *demographic transition*, sketched out in Figure 5.2.

Figure 5.2: Stylized Picture of the Demographic Transition

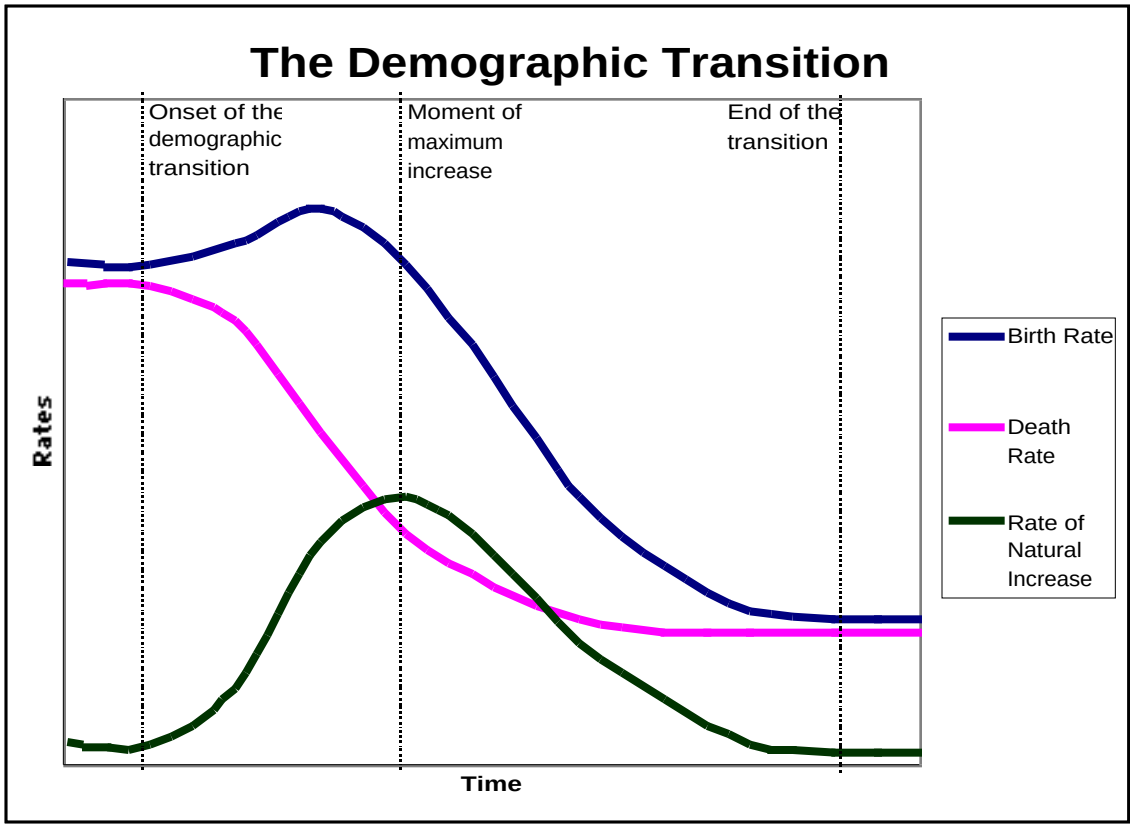


Figure Legend: The demographic transition sees, first, a rise in birth and a sharp fall in death rates as material standards of living increase above "subsistence" levels. But after a while birth rates start to decline rapidly too. The end of the demographic transition sees both birth and death rates at a relatively low level, and the population nearly stable.

Birth control meant that those who did not wish to have more children could exercise their choice. Parents began to find more satisfaction out of having a few children and paying a great deal of attention to each. The resources of the average household continued to increase, but the number of children born fell. The long-run relationship between levels of productivity and population growth rates was not--as Malthus thought--a spiral of ever-faster population growth rates as material standards of living increased. Instead population growth rates peaked and began to decline.

In the world today not all countries have gone through their demographic transitions. Many countries today are not rich enough to have begun the population growth declines seen in the second half of the demographic transition. Countries like Nigeria, Iraq, Pakistan, and the Congo are currently projected to have population growth rates in excess of two percent per year over the next generation, as Figure 5.3 shows. But there is also a large group of developing countries like Thailand, China, Korea, and South Africa in which population growth over the next generation is projected to be less than one percent per year. And in the industrialized countries—like Japan, Italy, and Germany—populations are projected to stay nearly the same over the next generation.

Figure 5.3: Expected Population Growth Rates Over the Next Generation

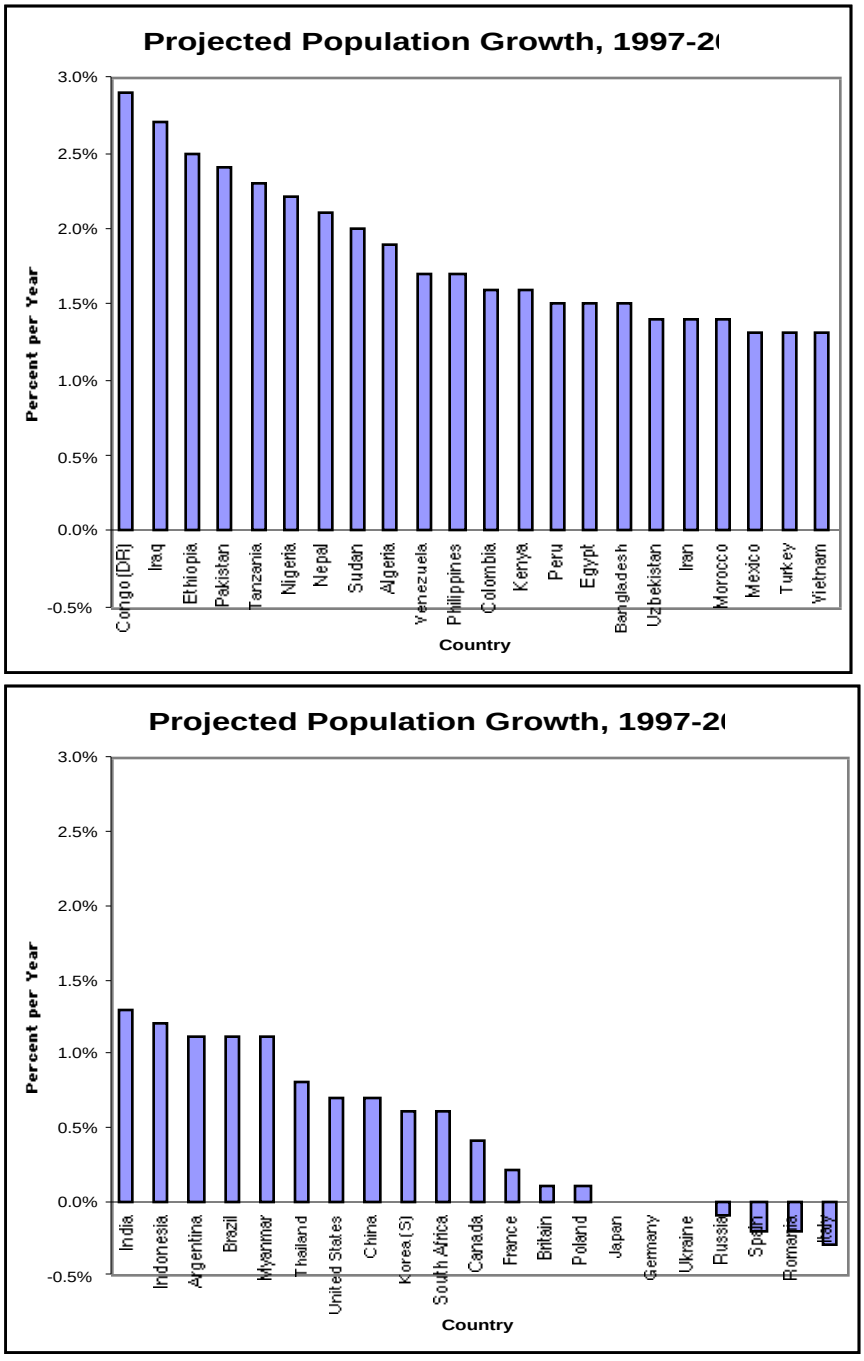


Figure Legend: The population of India is projected to grow at 1.3% and the population of China is projected to grow at 0.7% per year over the next generation.

Demographers today believe that the world population has at most one more doubling to undergo before the demographic transition will have taken hold throughout the world.

Source: United Nations.

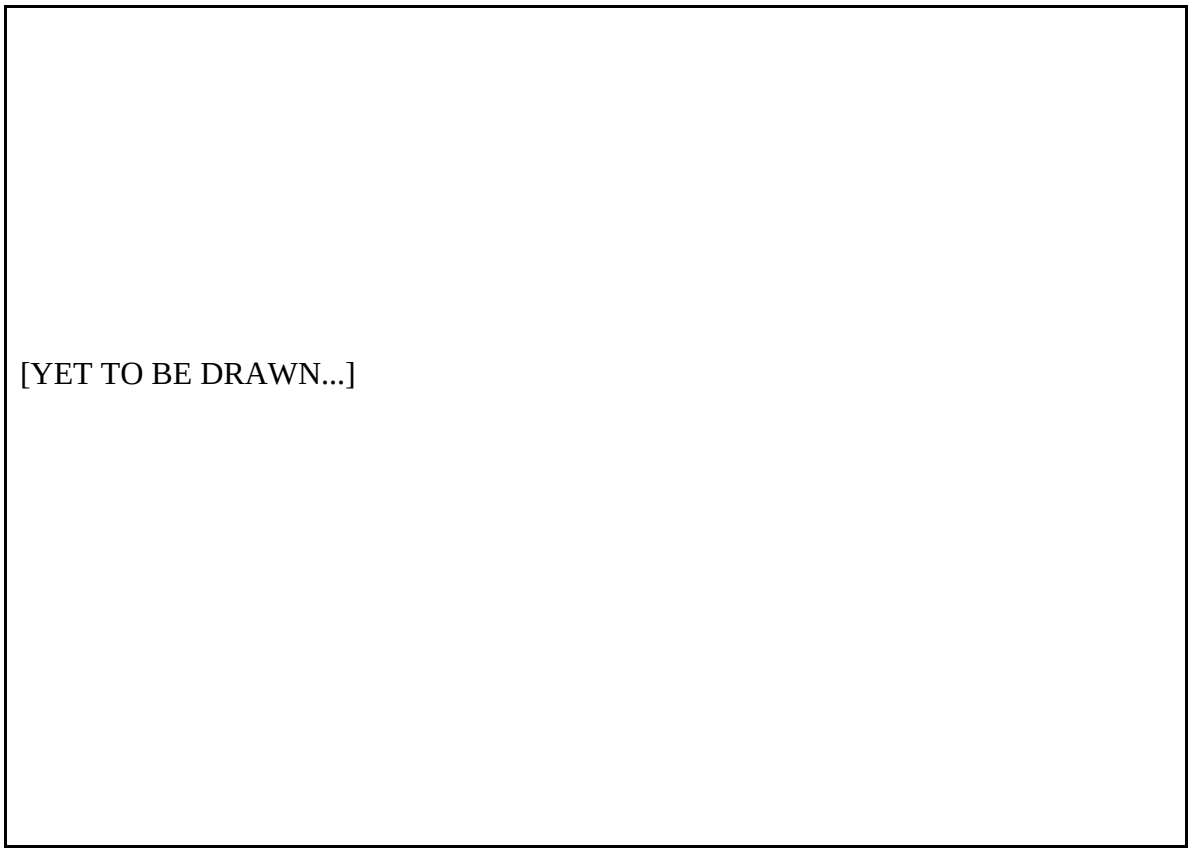
The Industrial Revolution

The century after 1750 saw the industrial revolution proper: the invention of the steam engine, the spinning jenny, the power loom, the hydraulic press, the railroad locomotive, the water turbine, and the electric motor--as well as the hot-air balloon, gas lighting, photography, and the sewing machine.

But the industrial revolution was not just a burst of inventions. It was an economic transformation that revolutionized the process of invention as well. Since 1850 the pace of invention and innovation has further accelerated: steelmaking, the internal combustion engine, pasteurization, the typewriter, the cash register, the telephone, the automobile, the radio, the airplane, the tank, the limited-access highway, the photocopier, the computer, the pacemaker, nuclear weapons, superconductivity, genetic fingerprinting, and the human genome map. The coming of the industrial revolution marks the beginning of the era of modern economic growth: the era in which it is expected that new technological leaps will routinely revolutionize industries and generate major improvements in living standards.

The fact that Britain was the center of the industrial revolution meant that for a century--from 1800 to 1900--British levels of industrial productivity were the highest in the world, and British standards of living were the highest in the world as well. It also meant that English (rather than Hindi, Mandarin, French, or Spanish) became the world's de facto second language. But the technologies of the industrial revolution did not remain narrowly-confined to Britain. Their spread was rapid to western Europe and the United States. Their spread was less rapid--but still relatively thorough and complete--to southern and eastern Europe and--most interesting perhaps--Japan, as shown in Figure 5.4.

Figure 5.4: Industrialized Areas of the World in 1870



Perhaps the most important lesson to draw from this short look back at economic history is that the standard growth models of economists apply to a relatively narrow slice of time. Back before 1800 the growth model set out in chapter 4 does not illuminate very much. Yet the model of chapter 4 is very useful in analyzing what is going on today with respect to the growth of different national economies, and very useful in analyzing what has happened over the past two centuries.

5.2 Modern American Economic Growth

Before 1500 human material standards of living and productivity levels rose at--perhaps--0.01 percent per year. Between 1500 and 1800 they rose faster in the areas--first northwestern Europe, and then northwestern Europe's settler colonies in North America--that were to become the industrial core of the modern world economy: a rate of perhaps 0.2 percent per year. The first half of the nineteenth century saw leading-edge economies' levels of productivity rise at about 0.5 percent per year. And the second half of the nineteenth century saw productivity accelerate still further.

American Long Run Growth, 1800-1973

The Pace of Economic Growth

Focus on the pace of long-run growth in what has been the world's leading-edge economy for the past hundred years: the United States. Growth in the years around the Civil War was faster than it had been in the first half of the nineteenth century. And then growth

accelerated still further, as a second wave of industrialization took hold fueled by new inventions and innovations, like steelmaking, organic chemicals manufacture, oil, the internal combustion engine, pasteurization, the typewriter, the cash register, and the telephone. The accelerated pace of invention and economic growth has been maintained.

Figure 5.5: U.S. *Measured* Economic Growth

Legend: With the exception of the Great Depression of the 1930s, and the productivity slowdown period of the 1970s and 1980s, measured real GDP per

worker in the United States has grown steadily with only minor interruptions.

Source: Various.

Throughout the nineteenth and the first three quarters of the twentieth century the *measured* pace of economic growth continued to accelerate. The measured growth rate of output per worker rose from perhaps 0.5 percent per year from 1800 to 1870 to perhaps 1.6 percent per year from 1870 to 1929, on the eve of the Great Depression, as is shown in Figure 5.5. Growth slowed slightly over the Great Depression and World War II decades--a measured growth rate of 1.4 percent per year from 1929 to 1950. But then it accelerated: the growth rate of output per worker between 1950 and 1973 in the United States was 2.1 percent per year.

Moreover, it is likely that *true* output per worker growth since 1890 has been even faster. Many economists believe that official estimates overstate inflation and understate real economic growth by 1.0 percent per year, in large part because national income accountants have a very hard time valuing the boost to productivity and standards of living generated by the invention of new goods and services, and new types of goods and services. So instead of 1.5 percent per year, perhaps we should be thinking of 2.0 to 2.5 percent per year for the rate of output per worker growth since 1870.

If so, then those of us living in the United States today have a level of productivity--a material standard of living-- somewhere between 14 and 25 times that of our counterparts back in the late nineteenth century. For middle-class and richer consumers today such an estimate does not seem at all unreasonable. It takes only 1/8 as much time to earn the money to buy a hairbrush, 1/12 as much time to earn the money to buy a chair, 1/35 as

much time to earn the money to buy a book today as in 1895. And in 1895, no matter how long you worked, you couldn't earn enough money to buy a plane ticket, or a TV, or a portable CD player, or a laptop computer, or an automatic washing machine, or an electric blender, or a microwave oven.

For the relatively poor of the world, or even of the United States, it is not reasonable to say that their incomes and material standards of living have multiplied to so great an extent. The fact of an invention or innovation has no effect on your material standard of living if you cannot afford it.

Table 5.2: Labor-Time Costs of Commodities

Multiplication of Labor Productivity 1895-1997

Time Needed for an Average Worker to Earn the Purchase Price of Various Commodities

Commodity	Time-to-Earn in 1895 (Hours)	Time-to-Earn in 1997 (Hours)	Productivity Multiple
Horatio Alger books (6 vols.)	21	0.6	35.0
One-speed bicycle	260	7.2	36.1
Cushioned office chair	24	2.0	12.0
100-piece dinner set	44	3.6	12.2
Hair brush	16	2.0	8.0
Cane rocking chair	8	1.6	5.0
Solid gold locket	28	6.0	4.7
Encyclopedia Britannica	140	4	35.0
Steinway piano	2400	1107.6	2.2
Sterling silver teaspoon	26	34.0	0.8
Oranges (dozen)	2	0.1	20
Ground beef (1 lb.)	0.8	0.2	4
Milk (gallon0	2	0.25	8
Television	∞	15	∞

Plane ticket: SFO-BOS	∞	20	∞
Antibiotic strep throat cure	∞	1	∞
Dental x-ray	∞	2	∞
Laptop computer	∞	70	∞

Source: 1895 Montgomery Ward *Catalogue.*

Structural Change

Modern economic growth is also a shift in the kinds of things we do at work and play and in the way we live. Back in the immediate aftermath of the Civil War perhaps half of all Americans were farmers. Today less than two percent of American workers are farmers and farm laborers: there are more gardeners, groundskeepers, and growers and maintainers of ornamental plants in America today than there are food-growing farmers and farm laborers. Americans in the second half of the nineteenth century traveled by foot, by horse, by wagon, by train, and by riverboat. American at the end of the twentieth century traveled by foot (rarely), bicycle (rarely), automobile, bus, train, boat, and plane. Most Americans in the second half of the nineteenth century were literate. But very few had finished anything like what we would call high school. Modern economic growth is the large-scale shift of employment from agriculture to manufacturing and now to services. And modern economic growth is the creation of large business organizations. Back at the start of the nineteenth century, a business with one hundred people was a very large business organization for its time indeed.

Between approximately 1890 and 1930—or perhaps 1890 and 1950—a host of innovative technologies and business practices were adopted in the United States. Europeans speak of “Fordism”: taking the part--Henry Ford’s assembly lines in Detroit, and his mass production of the Model-T Ford--for the whole. The fact that other industrial economies were unable to fully adopt American technologies of mass production and mass distribution in the first half of the twentieth century gave the United States a unique level of industrial dominance and technological leadership in the years after 1950.

Three factors have taken pride of place in explanations of America's place at the world economy's leading edge in its level of technology throughout the twentieth century:

- First, the U.S. had an exceptional commitment to education: to schooling everyone (everyone who was white, that is; and boys more than girls) even in the largely-rural economy of the nineteenth century, and to making the achievement of a high-school diploma the rule rather than the exception in the cities of early twentieth.

- Second, the U.S. was of extraordinarily large size--the largest market in the world. Thus the U.S. could take advantage of potential economies of scale in ways that other, smaller economies could not match.

- Third, the U.S. was extraordinarily rich in natural resources, particularly energy. To the extent that energy and natural-resource intensive industries

were at the heart of early twentieth century industrial growth, the U.S. was again well-positioned.

American Economic Growth Since 1973

The Productivity Growth Slowdown

But in 1973 the steady trend of climbing rates of productivity growth stopped cold. Between 1973 and 1995 *measured* growth in output per worker in the U.S. economy grew at only 0.6 percent per year. The slowdown did not affect the U.S. economy alone: the slowdown hit--to different degrees and with different effects--the other major economies of the world's industrial core in western Europe, Japan, and Canada as well.

Table 5.3: The Magnitude of the Post-1973 Productivity Slowdown

The Productivity Slowdown in the G-7 Economies

Country	1950-1973 Output per Worker Annual Growth	1973-1995 Output per Worker Annual Growth
United States	2.1%	0.6%
Canada	2.7%	1.6%
Japan	7.4%	2.6%
Britain	2.4%	1.8%
Germany (West)	5.7%	2.0%
France	4.4%	1.5%
Italy	4.9%	2.3%

What caused the productivity slowdown? Observers have pointed to four factors--oil prices, the baby boom, increased problems of economic measurement, and environmental protection expenditures--and there are no doubt others.

The argument that the productivity slowdown can be explained by expenditures on environmental protection is a branch of the "problems of measurement" argument. When the price of electricity goes up because power companies switch to burning higher-priced low-sulfur coal or install sulfur-removing scrubbers in their chimneys, they are producing not just electric power but electric power plus cleaner air. But the NIPA do not count pollution reduction as a valued economic output. America has spent a fortune on environmental protection in the past generation, and has in gross received big benefits from this investment. But it isn't captured in measured GDP.

The argument that the productivity slowdown can be explained by problems of economic measurement is a bit subtle. Few doubt that problems of economic measurement lead to understatements of the rate of economic growth. But for problems of measurement to account for a *slowdown* in economic growth, the problems of measurement must have gotten *worse*. They must be worse now than they were three decades ago.

In the 1970s the baby-boom generation of Americans began to enter the labor force. The baby-boom generation was very large. I should know: I was born in 1960, the year in which more Americans were born than in any year either before or since. The relatively young labor force had many more workers with little experience than the labor force of the 1960s and 1950s. Some economists argue that this fall in the average level of experience of the labor force generated the productivity slowdown. Others point out that

the baby-boom generation had little experience but a lot of education, and that in the past education has been a powerful *booster* of productivity. The average level of education in the labor force increased quite rapidly as the baby-boom generation entered the economy.

The last explanation of the productivity slowdown is the tripling of world oil prices by the OPEC cartel in 1973, in the wake of the third Arab-Israeli war. Productivity growth slowed at almost exactly the same time that oil prices skyrocketed. Economists hypothesized that in response to the tripling of world oil prices firms had begun redirecting their capital expenditures from capital that produced more output to capital that used less energy; firms had retired a large share of their most energy-intensive capital; and firms had begun to substitute workers for energy use wherever possible.

The problem with this explanation are twofold. First, real oil prices today are and have since 1986 been *lower* than they were before 1973, hence the productivity slowdown should havge ended a decade ago. Second, energy costs are not *that* large a share of the representative business's costs. By now the productivity slowdown has mounted to more than a quarter of total output. How can even the tripling of the price of a commodity that accounts for less than four percent of costs lead to a more than twenty-five percent reduction in output? It makes no sense.

The causes of the productivity slowdown remain uncertain. The productivity slowdown remains a mystery.

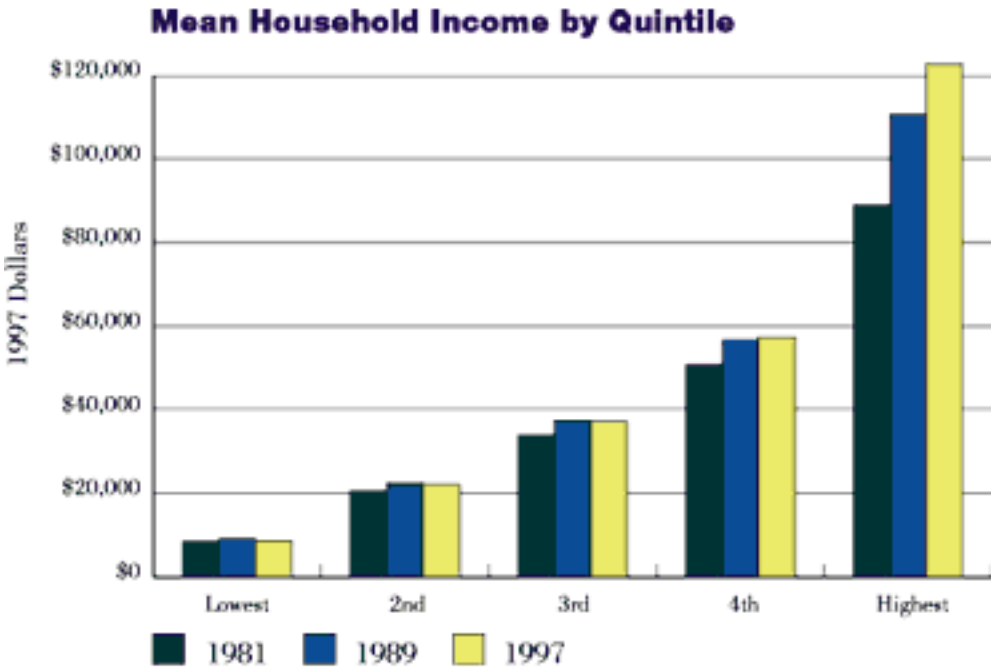
Effects of the Productivity Slowdown

At a growth rate of 2.1% per year, output per worker doubles every 34 years. At a growth rate of 0.6% per year, output per worker takes 120 years to double--three and a half times as long. Social psychologists tell us that 40-year-olds feel happiest not when their incomes are high, but when their incomes are high relative to their households when they were growing up. Before 1973, when economic growth was more rapid, most American voters felt much richer than their parents--and hence more willing to invest in social welfare programs and other liberal political initiatives. Since 1973, slower growth has made Americans feel much less well-off than they had expected that they would be. The consequences of this are uncertain: the somewhat-hapless President Jimmy Carter saw it as the origin of a national "malaise." Liberals have blamed it for a rightward shift in politics. Conservatives have blamed it for a rush to security and an unwillingness to undertake bold libertarian experiments. All have seen it as a cause of more (not necessarily unjustified) skepticism toward the government and its programs.

Box 5.1--Details: Have Real Standards of Living Been Declining?

For some categories of workers (such as males in their 20s with just a high school education), the post-1973 productivity slowdown has been accompanied by stagnant or declining real wages. Yet offsetting this are many improvements in the quality of life--from cleaner air to the convenience of automated teller machines--that the NIPA system cannot measure. If we accept the Boskin Commission estimates of unmeasured growth in material well-being that centered around 1.0% per year, then true total product per worker growth in the U.S. has slowed not to the 0.6% per year recorded in official statistics for 1973-1995, but to 1.6% per year.

Measured Real Household Income



Legend: The era of the productivity slowdown saw not just slow growth but a widening of the American distribution of income.

This is still a substantial drop from the estimated 3.1% per year that the same adjustment produces for growth before 1973. And increased income inequality has produced declines in real income or near-stagnation for some groups. But it is not true that America's output per worker has stagnated over the past generation. Whether we as a society have distributed the gains in productivity to persons and households and to private and public uses wisely and appropriately--that is another question.

The End of the Productivity Slowdown

As computers improved and spread theoughout the U.S. economy in the 1970s and 1980s, economists kept waiting to see the wonders of computing show through in national productivity. But it didn't happen. The productivity growth slowdown continued throughout the 1970s and 1980s. This surprising phenomenon came to be called “the computer paradox” after Robert Solow's famous 1987 observation that: “We see the computer age everywhere except in the productivity statistics.

Since 1995, however, productivity growth in the American economy has accelerated once again to a pace of 2.1 percent per year. Half a decade is a very short time on which to pin any long-run trend, but there is certainly reason to hope that the productivity slowdown has come to an end.

The U.S. economy has benefited from a stunning investment boom since 1992. Between 1992 and 1998 real GDP rose by an average of 3.6% per year, and business fixed investment soared at a 10.1% average rate--almost three times as fast. As a consequence, the share of business fixed investment in GDP jumped from 9.2% to 13.2%, with much of the additional investment going into computers and related equipment. At least one major economic forecasting business attributes the recent acceleration in productivity growth to this investment boom, a huge share of which is driven by the rapidly-falling price of computers.

There is every reason to expect technological progress in the computer and communications sectors to continue. And there is every reason to expect these useful technologies to continue to diffuse throughout the economy. Thus the best bet in forecasting future productivity growth is to project what has happened in the past half-

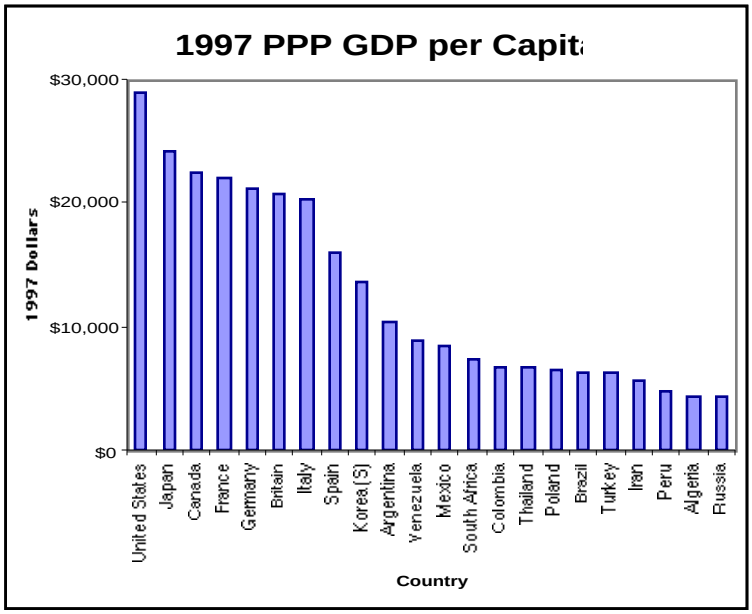
decade forward. If these projections are accurate, then the productivity slowdown has been brought to an end, and it is the technological revolution in computers and communications that has done it. But that is a subject for the end of this book.

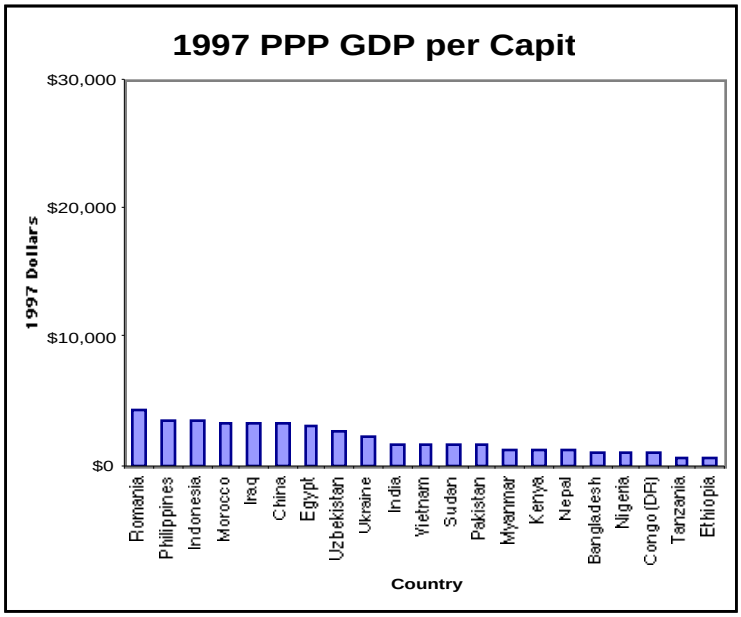
5.3 Modern Economic Growth Around the World

Divergence, Bigtime

The industrial core of the world economy saw its level of material productivity and standards of living explode in the nineteenth and twentieth centuries. Elsewhere the growth of productivity levels and standards of living and the spread of industrial technologies was slower. As the industrialized economies grew while industrial technologies spread slowly elsewhere, the world became a more and more unequal place. As development economist Lant Pritchett puts it, the dominant feature of world economic history is "divergence, bigtime." In terms of relative incomes and productivity levels, the world today is more unequal and more *divergent* than ever before, as Figure 5.6 shows.

Figure 5.6: World Distribution of Income Today: Selected Countries





Legend: In some places modern economic growth has taken hold and propelled levels of productivity and living standards upward. In other places people on average live little if any better than their ancestors did. The world is a more unequal place, in relative income terms, than it has been since there were some human tribes that had fire and others that did not.

Source: Author's calculations.

Those who live in relatively poor regions of the world today have higher material living standards than their predecessors who lived in those regions a century ago. But the relative gap vis-à-vis the industrial core has grown extraordinarily and extravagantly. In the first half of the nineteenth century the average inhabitant of an average country had perhaps one-half the material standard of living of a citizen of the world's leading industrial edge economy. Today the average inhabitant of an average country has only one-sixth the material standard of living and productivity level of the leading edge.

Box 5.2--Tools: Purchasing-Power-Parity and Real Exchange Rate Comparisons

When our focus is on comparing standards of living, either across time or across countries, we get much more meaningful figures by correcting current (and even average trend) exchange rates for differences in purchasing power parity. The differences between estimates of relative income levels based on current exchange rates and estimates based on purchasing-power-parity calculations can be very large. On a purchasing-power-parity basis GDP per worker in the United States today is some 13 times GDP per worker in India; by contrast, on an average-exchange-rate basis GDP per worker in the United States today is more than 70 times the level in India.

Purchasing-power-parity-based calculations attempt (as the name applies) to translate one currency into another at a rate that preserves average purchasing power. But current exchange rates do not preserve purchasing power. It is the case that if you exchange your dollars in the U.S. for rupees in India you will find that your rupees in India will buy

about the same amount of internationally-traded manufactured goods as your dollars would have bought in the U.S. (Unless, of course, you try to buy something that the Indian government has decided to put up a trade barrier against.) But your rupees in India will buy you vastly more in the way of personal services, the products of skilled craftworkers, and any other labor-intensive goods and services.

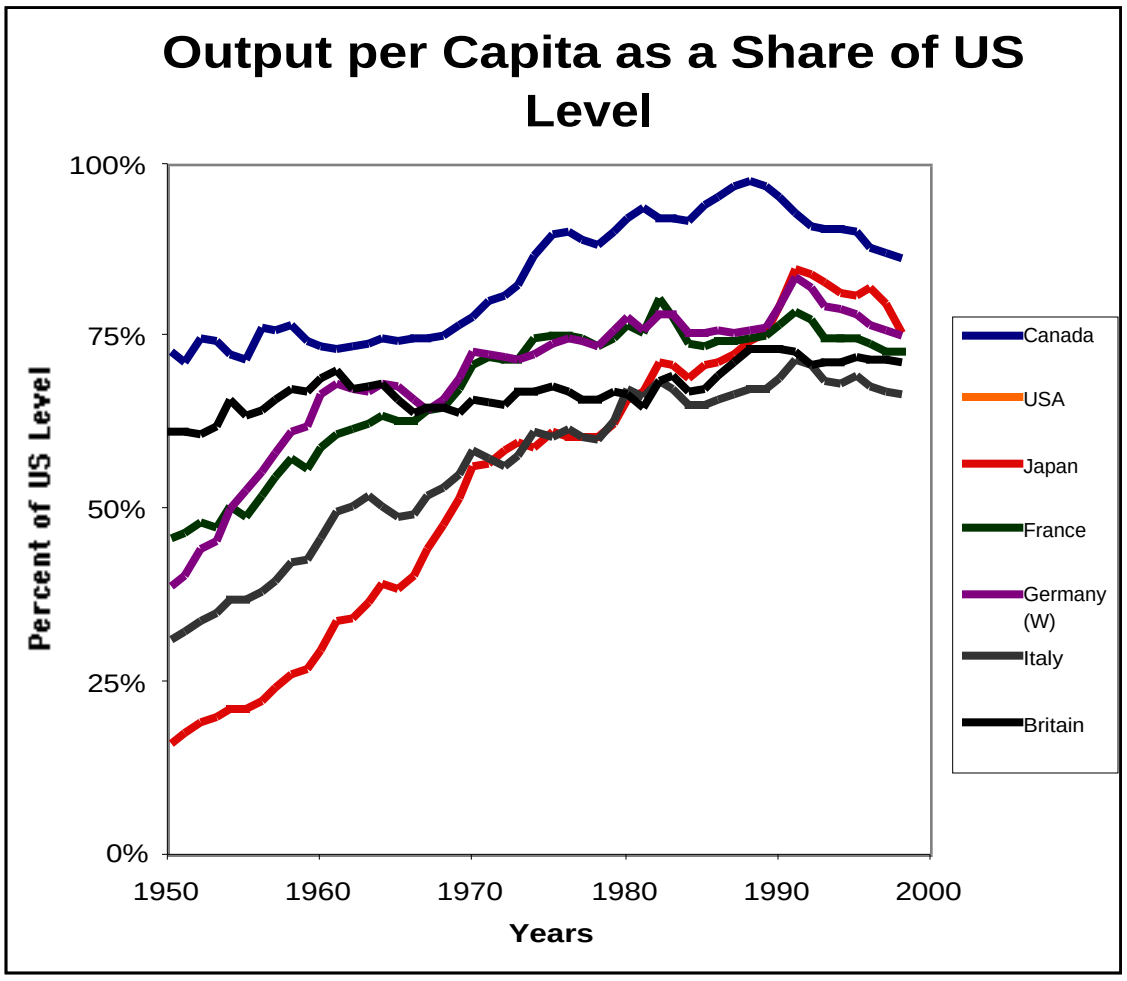
Why? International arbitrage keeps the exchange rate at the level that makes easily-traded manufactured goods roughly equally expensive. If they weren't roughly equally expensive, someone could make an easy fortune by shipping them from where they were cheap to where they were dear. But how--in this world of stringent immigration restrictions--can a cook in Bangalore take advantage of the fact that there is ferocious demand in Marin County north of San Francisco for caterers who can prepare a good curry is fierce? Because relative productivity levels in labor services are much more equal than relative productivity levels in manufacturing, living standards across the world are more equal than looking at exchange rate-based calculations suggests.

The Exception: OECD Economies

It is not inevitable that there be such divergence. The United States--with its 14 to 25-fold increase in output per worker over the years since 1870--has not been the fastest-growing economy in the world. A number of other economies at different levels of industrialization, development, and material productivity a century ago have now *converged*, and their levels of productivity, economic structures, and standards of living are now very close to those of the United States. The six largest of these converging economies are today, with the United States, the so called Group-of-Seven, the G-7

economies whose leaders gather for annual summit meetings. Their steady process of convergence to the U.S. level from 1950 until 1990 is shown in Figure 5.7.

Figure 5.7: Convergence Among the G-7 Economies



Legend: In 1950 GDP per capita levels in the nations that now are America's partners in the G-7 varied from 20% of the U.S. level (Japan) to 70% of the US level (Canada). Today estimates of GDP per capita place levels in all 6 others at more than 65 percent of the U.S. level—and they would be even closer to the U.S. if these measurements took account of the shorter average work year abroad.

Sources: Author's calculations.

Most of these economies were significantly poorer than the U.S. back in 1870 and even in 1950. The Japanese economy, for example, went from a level of output per capita equal to sixteen percent of the U.S. level in 1950 to 84 percent of the U.S. level in 1992--before falling steeply backwards during Japan's recent recession. Italian levels of GDP per capita have gone from 30 percent of the U.S. to 65 percent of the U.S. level; German levels have gone from 40 percent to 75 percent; Canadian levels have gone from 70 percent to 85 percent; and British levels of GDP per capita have gone from 60 to 70 percent of U.S. levels in the past half century.

Box 5.3--Policy: Why Have These Economies Converged?

By and large the economies that have converged are those that belong to the OECD: the Organization for Economic Cooperation and Development, which was started back in the first post-WWII years in the days of the Marshall Plan as a club of countries that received (or gave) Marshall Plan aid to help rebuild and reconstruct after World War II. Countries that received Marshall Plan aid adopted a common set of economic policies: large private sectors freed of government regulation of prices, investment with its direction determined by profit-seeking businesses, large social insurance systems to redistribute income, and governments committed to avoiding mass unemployment.

The original OECD members all wound up with mixed economies. In these, markets direct the flow of resources, while governments stabilize the economy, provide social-insurance safety nets, and encourage entrepreneurship and enterprise. They arrived at this

institutional setup largely due to good luck, partly due to the Cold War, and partly as a result of post-World War II institutional reforms.

This post-World War II institutional configuration was essentially the price countries had to pay for receiving Marshall Plan aid. The U.S. executive was unwilling to send much aid to countries which it thought were likely to engage in destructive economic policies, largely because it did not believe that it could win funding from the Republican-dominated congress for a Marshall Plan that did not impose such strict *conditionality* upon recipients. By contrast, countries that were relatively rich after World War II but that did not adopt OECD-style institutional arrangements--like Argentina and Venezuela--have lost relative ground.

As the OECD economies became richer, they completed their demographic transitions: population growth rates fell. The policy emphasis on entrepreneurship and enterprise boosted national investment rates, so the OECD economies all had healthy investment rates as well. These factors boosted their steady-state capital-output ratios. And the diffusion of technology from the U.S. did the rest of the job in bringing OECD standards of economic productivity close to the U.S. level.

Box 5.4--Policy: The East Asian Miracle

But the set of extraordinarily successful economies is not limited to the set of original OECD economies. The economies of the East Asian miracle have over the past two generations exhibited stronger growth than has ever before been seen anywhere in world

history. They have not yet converged to the standards of living and levels of economic productivity found in the world economy's industrial core. But they are convergin.

Immediately before World War II the regions that are now South Korea, Hong Kong and Singapore, and Taiwan had output per worker levels less than one-tenth of the United States. Today Singapore's GDP per capita is 90%, Hong Kong's is 70%, Taiwan's is 50%, and South Korea's is 45% of the U.S. level. A second wave of East Asian economies--Malaysia, Thailand--now average more than one quarter of the United States's level of GDP per capita.

The successful East Asian economies have a number of similarities in economic policy and structure to the OECD economies. Resource allocation decisions are by and large left to the market. Governments regard the encouragement of entrepreneurship and enterprise as a major goal. And high savings and investment rates are encouraged by a number of different government policies.

Yet there are also a number of differences vis-à-vis the OECD as well.

Governments in East Asia have been more aggressive in pursuing *industrial policy*, and somewhat less aggressive in establishing social insurance systems than the OECD economies. However, they have also had more egalitarian income distributions, hence less need for redistribution and social insurance. They have subsidized corporations that they believe are strategic for economic development, thus thinking that their bureaucrats know better than the market--heresy to economists. (However, it is worth noting that they have focused subsidies on those companies that have proved successful at exporting

goods to other countries--so their bureaucrats have in a sense been rewarding the judgment of *foreign* markets.) The examples of successful catching-up suggest that things could have been otherwise for the world economy. Economies--even very poor economies--*can* rapidly adopt modern machine technologies and move their productivity levels close to first-world leading-edge standards.

The Rule: Divergence Behind the Iron Curtain

But "convergence" is the exception. "Divergence" is the rule. And perhaps the most important diving force behind divergence is Communism: being unlucky enough to have been ruled by communists in the twentieth century is a virtual guarantee of relative poverty.

There used to be a snaky geographic line across Eurasia that Winston Churchill had once called the “Iron Curtain.” On one side were regimes that owed their allegiance to Karl Marx and to Marx’s viceroys on earth. On the other side were regimes claiming in the 1946-1989 Cold War to be of the “free world”--that were, if not good, at least less-worse guys.

Figure 5.8: World Map: the Iron Curtain

[NOT YET DRAWN]

Walk this geographical line, shown in Figure 5.8, from Poland to Korea, and then hop over to the only western hemisphere Communist satellite--Cuba--looking first left at the level of material welfare in the Communist country, and then right at the level of material welfare in the non-Communist country. The location of the Iron Curtain is a historical accident: it is where Stalin's Russian armies stopped after World War II, where Mao's Chinese armies stopped in the early 1950s, and where Giap's Vietnamese armies stopped in the mid 1970s.

Table 5.4: The Iron Curtain: GDP per Capita Levels of Matched Pairs of Countries

East-Block Country	GDP per Capita	Matched West-Block Country	GDP per Capita	Relative Gap
North Korea	$700	South Korea	$13,590	94%
China	$3,130	Taiwan	$14,170	78%
Vietnam	$1,630	Philippines	$3,520	54%
Cambodia	$1,290	Thailand	$6,690	81%
FSR Georgia	$1,960	Turkey	$6,350	69%
Russia	$4,370	Finland	$20,150	78%
Bulgaria	$4,010	Greece	$12,769	69%
Slovenia	$11,800	Italy	$20,290	42%
Hungary	$7,200	Austria	$22,070	67%
Czech R.	$10,510	Germany	$21,260	51%

Poland	$6,520	Sweden	$19,790	67%
Cuba	$3,100	Mexico	$8,370	63%

Notice as you walk that to your right, outside the Iron Curtain, the countries are far better off in terms of GDP per capita. They are not necessarily better off in education, or health care, or in the degree of income inequality. If you were in the poorer half of the population, you probably received a better education and had access to better medical care in Cuba than in Mexico. But the countries fortunate enough to lie outside what was the Iron Curtain were and are vastly more prosperous. Depending on how you count and how unlucky you are, forty and ninety-four percent of the potential material prosperity of a country was annihilated if it happened to fall under Communist rule in the twentieth century. The fact that a large part of the globe fell under Communist rule in the twentieth century is one major factor responsible for the world's *divergence*.

Box 5.5--Policy: Post-Communism

The demolition of the Berlin Wall and the take-down of the Iron Curtain has not significantly improved the situation in what are euphemistically and optimistically called "economies in transition" [from socialism to capitalism, that is]. Figuring out how to move from a stagnant, ex-Communist economy to a dynamic, growing one is very difficult, and no one has ever done it before.

A few of the "economies in transition" appear on the path to rapid convergence to western Europe: Slovenia, Hungary, the Czech Republic, and Poland have already clearly and successfully maneuvered through enough of "transition" to have advanced their economies beyond the point reached before 1989. It seems clear that their economic

destiny is likely to become effectively part of western Europe. Slovakia, Lithuania, Latvia, and Estonia appear to have good prospects of following their example.

Elsewhere, however, the news is bad. Whether reforms have been step-by-step or all-at-once, whether ex-communists have been excluded from or have dominated the government, whether governments have been nationalist or internationalist, the results have been similar. Output has fallen, corruption has been rife, and growth has not resumed. Material standards of living in the Ukraine today are less than half of what they were when General Secretary Gorbachev ruled from Moscow.

Economists debate ferociously the appropriate economic strategy for unwinding the inefficient centrally-planned Soviet-style economy. The fact that such "transition" has never been undertaken before should make advice-givers cautious. And there is one other observation that should make advice-givers depressed: the best predictor of whether an eastern European country's transition will be rapid and successful or not appears to be its distance from western European political and financial capitals like Vienna, Frankfurt, and Stockholm.

The Rule: Divergence in General

But even if attention is confined to non-communist-ruled economies, there still has been enormous divergence in relative output per worker levels over the past hundred years. Since 1870, the ratio of richest to poorest economies has increased sixfold. Back in 1870 two-thirds of all countries had GDP per capita levels between 60 and 160 percent of the average. Today the range that holds two-thirds of all countries extends from 35 to 280 percent of the average.

Sources of Divergence

The principal cause of the extraordinary variation in output per worker between countries today are differences in their respective steady-state capital-output ratios. Two secondary causes are, first, openness to creating and adapting the technologies that enhance the efficiency of labor as measured by levels of development two generations ago, and, second, the level of education today.

Productivity two generations ago is a good indicator the level of technological knowledge that had been acquired as of half a century ago. The level of education today captures the country's ability to invent and acquire further technological expertise today. Without education, inventing new and adopting foreign-born technological knowledge is simply not possible.

Global Patterns

Together these factors--the determinants of capital-output ratios, and the two determinants of access to technology--together account for the bulk of the differences between countries in their relative productivity levels.

The determinants of the steady-state balanced-growth capital-output ratio play a very powerful role. A higher share of investment in national product is powerfully correlated with relative levels of output per worker. No country with an investment rate of less than

ten percent has an output per worker level even twenty percent of the United States. No country with an investment share of less than twenty percent has an output per worker level greater than seventy-five percent of the United States level.

A high level of labor force growth is correlated--albeit less powerfully--with a low level of output per worker. The average country with a labor force growth rate of more than 3 percent per year has an output per worker level less than 20 percent of the U.S. The average variable with a lab or force growth rate of less than one percent has an output per worker level greater than 60 percent of the U.S. level.

Together these determinants of the steady-state capital-output ratio can, statistically, account for up to half of the variation in national economies' levels of productivity per worker in the world today. The power of these factors central to the theoretical model of economic growth presented in chapter 4 should not be underestimated. Indeed, their power is the reason that we spent so much space on the standard growth model in chapter 4.

But the factors stressed in chapter 4 are not the only major determinants of relative wealth and poverty in the world today. Differences in the efficiency of labor are as important as differences in steady-state capital-output ratios. Differences in the efficiency of labor arise from the differential ability of workers to handle and utilitize modern technologies.

The efficiency of labor is high where educational levels are high—so that workers can use the modern technologies they are exposed to—and where economic contact with the

industrial core is high—so that workers and managers are exposed to the modern technologies invented in the world's R&D laboratories.

Schooling is the variable that has the strongest correlation with output per worker. Countries that have an average of 4-6 years of schooling have output per worker levels that average 20 percent of the U.S. Countries with an average level of schooling of greater than 10 years have output per worker levels of 65 percent of the U.S. level, as Figure 5.9 shows.

Figure 5.9: GDP per Worker and Average Years of Schooling

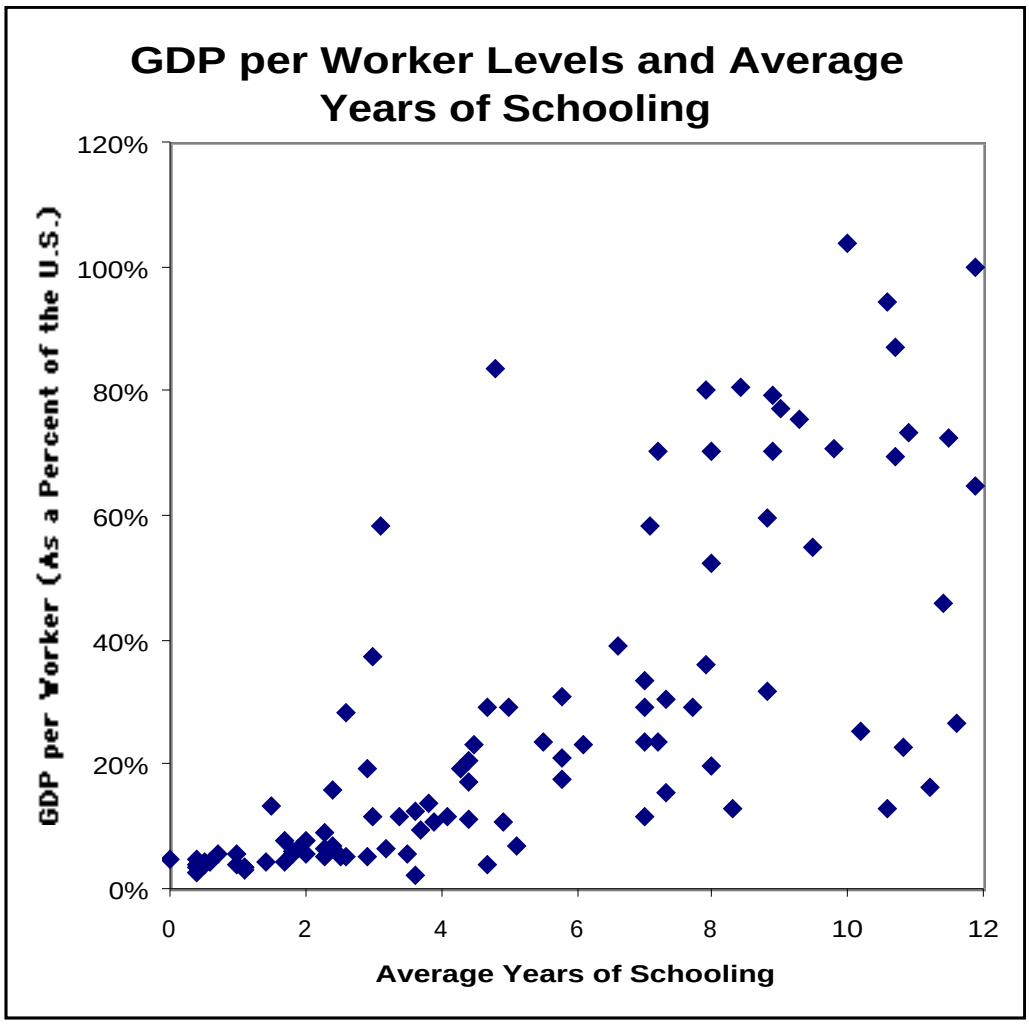


Figure Legend: Countries with a high number of average years of schooling have a better chance of being relatively well-off. Education opens the door to acquiring the technologies of the industrial revolution.

Source: Author's calculations from Penn World Table data constructed by Alan Heston and Robert Summers, online at http://www.nber.org/

There is no single best indicator of a country's exposure to—and thus ability to adopt and adapt—the technologies invented in the industrial core that amplify the efficiency of labor. Some economists like Jeffrey Sachs and Andrew Warner of Harvard focus on trade and foreign investment as the main sources of increased efficiency and technological capability. Others like Charles Jones and Robert Hall of Stanford focus on geographical and climatic factors which have influenced migration and which still influence trade and intellectual exchange. Still others like Ken Sokoloff and Stan Engerman or Andrei Shleifer, Rafael La Porta, Florencio Lopez-di-Silanes, and Robert Vishny focus on institutions of governance and their effect on entrepreneurship as the key variable. But as much as economist dispute the variables most important as determinants of technology transfer and the efficiency of labor, all agree that they are very important indeed to understanding why our world today is the way it is.

Cause and Effect, Effect and Cause

Moreover, all these factors are both cause and effect and effect and cause. High population growth and low levels of output per worker go together both because rapid population growth reduces the steady-state capital-output ratio, and because poor countries have not yet undergone their demographic transitions. This interaction by which a high rate of population growth reduces the steady-state capital-output ratio and a low steady-state capital-output ratio means that the demographic transition is not far advanced creates a vicious spiral to reinforce relative poverty.

Moreover, demography is not the only such vicious spiral potentially present. A poor country will have a high relative price of the capital equipment it needs to acquire in order to turn its savings into productive additions to its capital stock. This should come as no surprise. The world's most industrialized and prosperous economies are the most industrialized and prosperous because they have attained very high levels of manufacturing productivity: their productivity advantage in unskilled service industries is much lower than in capital- and technology-intensive manufactured goods. The higher relative price of machinery in developing countries makes means that poor countries get less investment--a smaller share of total investment in real GDP--out of any given effort at saving some fixed share of their incomes.

Moreover, to the extent that education is an important kind of investment, a good education is much harder to provide in a poorer country. Even primary education requires at its base a teacher, some books, and a classroom--things that are relatively cheap and easy for a rich country to provide, but expensive for a poor country. In western Kenya today the average primary school classroom has 0.4 books per pupil.

But there is also the possibility for virtuous circles. Anything that increases productivity and sets the demographic transition in motion will both reduce the rate of growth of the labor force. It will increase the amount of investment bought by any given amount of savings. It will make education easier.

How important are these vicious and virtuous circles? It is hard to look at the cross-country pattern of growth over the past century without thinking that such vicious and

virtuous circles *must* have been very important. Otherwise the massive divergence in relative productivity levels seems inexplicable.

5.4 Policies and Long-Run Growth

Hopes for Convergence

Relative and Absolute Stagnation

Always keep in mind that in the context of economic growth "stagnation" and "failure" are relative terms. Consider Argentina once again, for it has been one of the world's most disappointing performers in terms of economic growth in the twentieth century. Argentina has experienced substantial economic growth. *Officially measured* labor productivity or national product per capita in Argentina today is perhaps three times what it was in 1900. True productivity, taking adequate account of the value of new commodities, is higher. But the much more smoothly-running engine of capitalist development in Norway—no more, and probably less, rich and productive than Argentina in 1900—has multiplied *measured* national product per capita there by a factor of nine.

A pattern of productivity growth like Argentina's is heartbreakingly slow when compared to what, reasonably, might have been and was achieved by the world's industrial leaders. What is bad about falling behind, or falling further behind, is not that second place is a bad place to be--it is false to think that the only thing that matters is to be top nation, and that it is better to be poor but first than rich but second. What is bad about falling behind

is that the world's industrial leaders provide an easily viewable benchmark of how things might have been different, and of how much better things might have been. There was no destiny keeping Buenos Aires today from looking like and having its people as rich as those of Paris, Toronto, or Sidney.

Half Empty and Half Full

In many respects, it is decidedly odd that the world distribution of output per worker is as unequal as it is. World trade, migration, and flows of capital should all work to take resources and consumption goods from where they are cheap to where they are dear. As they travel with increasing speed and increasing volume as transportation and communication costs fall, these commodity and factor-of-production flows should erode differences in productivity and living standards between national economies. Moreover, most of the edge in standards of living and productivity levels held by the industrial core is no one's private property, but instead the common intellectual and scientific heritage of humankind. Hence every poor economy has an excellent opportunity to catch up with the rich by adopting and adapting from this open storehouse of modern machine technology.

We can view this particular glass either as half empty or as half full. Half full is that much of the world has already made the transition to sustained economic growth. Most people today live in economies that, while far poorer than the leading-edge post-industrial nations of the world's economic core, have successfully climbed onto the escalator of economic growth and thus the escalator to modernity. The economic transformation of most of the world is less than a century behind the economic transformation of the leading-edge economies--only an eyeblink behind from the

perspective of the six millennia since the spread of agriculture out of the Middle East's Fertile Crescent.

Moreover, perhaps we can look forward to a future in which convergence of relative income levels will finally begin to take place. The bulk of humanity is now achieving material standards of living at which the demographic transition takes hold. As population growth rates in developing countries fall, their capital-output ratios will begin to rise quickly. And--with tolerable government, reasonable security of property, and better ways of achieving an education--their output per worker levels and material standards of living will converge to the world's leading edge.

Half empty is that we live today in the most unequal--in terms of the divergence in the life prospects of children born into different economies--age that the world has ever seen. One and a half billion people today live in economies that have *not* made the transition to intensive economic growth, and have *not* climbed onto the escalator to modernity. It is very hard to argue that the median inhabitant of Africa is *any* better off in material terms than his or her counterpart of a generation ago.

Policies for Saving, Investment, and Education

It is certainly possible for a government to adopt policies that boost national savings, improve the ability to translate saving into productive investment, and accelerate the demographic transition.

Savings and Investment

Policies to ensure that savers get reasonable rates of return on their savings have the potential to boost the savings rate. By contrast, systems of economic governance in which profits are diverted into the hands of the political powerful through restrictions on entrepreneurship will tend over time to diminish savings, as will economic policies that divert the real returns to savings into the hands of financiers or the government through inflation. Government deficits also have the potential to reduce the savings rate: unless consumers and investors are far-sighted enough to recognize that a government deficit now means a tax increase later, a government that spends more than it raises in revenue must borrow--and this amount borrowed is not a contribution to total national savings because it is not available to fund investment.

A number of potential policies work to boost investment for a given amount of savings. Policies that welcome foreign investors' money have the potential to cut a decade or a generation off of the time to industrialize--if the foreign funded capital is used wisely. Free-trade policies that allow businesses to freely earn and spend the foreign exchange they need to purchase new generations of machinery and equipment are an effective way of boosting investment. Policies that impose heavy tariffs or require scarce import licenses in order to purchase foreign-made capital equipment are a sure sign that a country will not get its money's worth out of a given nominal savings share, but will instead find that real investment remains low. Indeed, many of the most successful *developmental states* have done the opposite. They have provided large subsidies to fund investment and expansion by businesses that have demonstrated their competence and productivity by successfully exporting and thus competing on the world market.

Education

Universal education--especially universal education of girls--pays a two-fold benefit. Investments are more likely to be productive with a better-educated workforce to draw on; hence investments are more likely to be made. Educated women are likely to want at least as much education for their children, and to have relatively attractive opportunities outside the home--and so the birthrate is likely to fall.

It is certainly the case that the developing countries of the world appear, for the most part, to be going through the demographic transition faster than the economies of today's industrial core did in the past three centuries. Thus current estimates of the world's population in 2050 are markedly lower than the estimates of a decade ago. A decade ago the projected global population in 2050 was sixteen billion or more; today it is twelve billion or less. This is in part at least due to rapid expansions in educational attainment in today's developing economies.

A high level of educational attainment also raises the efficiency of labor both by teaching skills directly and by making it easier to advance the general level of technological expertise. A leading-edge economy with a higher level of educational attainment is likely to make more inventions. A follower economy with a higher level of educational attainment is likely to have a more successful time at adapting to local conditions inventions and innovations from the industrial core of the world economy. How large these effects are at the macroeconomic level is uncertain. That they are there nobody doubts.

The East Asian economies, especially, provide examples of how uncorrupt and well-managed developmental states can follow macroeconomic policies that accelerate economic growth and convergence. These economies that have provided incentives to accelerate the demographic transition and boost savings and investment have managed to close the gap vis-à-vis the world economy's industrial core faster than anyone would *ex ante* have believed possible.

Policies for Technological Advance

Without better technology, increases in capital stock produced by investment rapidly run into diminishing returns. And without improvements in the "technologies" of organization, government, and education, productivity stagnates.

Somewhat surprisingly, economists have relatively little to say about what governs technological progress. Why did better technology raise living standards by 2% annually a generation ago, but by less than 1% today? Why did technology progress by only 0.25% per year in the early 1800s? Improving literacy, communications, and research and development may help explain faster progress since than before the industrial revolution, and faster progress in the twentieth than in the nineteenth century. Yet, as noted above, as important a feature of recent economic history as the post-1973 productivity slowdown remains largely a mystery.

Invention and Innovation

Economists note that technological progress has two components--science on the one hand (solid-state physics and the invention of the transistor, mapping the human genome,

discovering that potassium nitrate, sulfur, and charcoal when mixed together and exposed to heat have… interesting properties), and research and development that leads to successful innovation on the other.

About pure science economists have almost nothing to say.

About research and development, and the innovations it generates, economists have rather more to say.

Economists note that perhaps 75% of all U.S. scientists and engineers work on research and development for private firms. Research and development spending amounts to perhaps 3 percent of GDP in the United States and other advanced industrial economies. One-fifth of total gross investment is research and development. More than half of net investment is research and development--investments in knowledge, as opposed to investments in machinery, equipment, structures, and infrastructure.

Businesses conduct investments in research and development to increase their profits. Firms spend money on research and development for reasons analogous to those that lead them to expand their capacity or improve their factories. If the expected present value of profits from a research and development project at the prevailing rate are greater than the costs of the project, then the business will spend money on the research and development project. If not, then not.

Rivalry and Excludibility

But there are features of technology that make thinking about the research and development process more complicated than thinking about other types of investment. First and most important, research and development is a public good. A firm that has discovered something--a new and more profitable process, a new and better way of organizing the factory, a new type of commodity that can be produced--will not reap the entire social benefit from this discovery. Other businesses can examine the innovation--the product, the process, the method of organization--and copy it. They can probably do so for a much lower cost than it took to research and develop the innovation in the first place.

By contrast, a firm that has just spent a large sum to buy and move into a new building does not have to worry that any firm will use that building as well. As a commodity, a building--a machine--even the skills and experience inside a worker's head--is both *rival* and *excludible.* To say that a commodity is *rival* means that if one firm is using it, another firm cannot be: I cannot use this hammer to pound that nail if you are now using it to pound that other nail. To say that a commodity is *excludible* means that the "owner" of the commodity can easily monitor who is using it, and easily keep those whom he or she does not authorize from using it.

Most physical commodities are (or with the assistance of the legal system can easily be made) both rival and excludible. But by their nature ideas are not. Ideas are definitely not *rival*--there is nothing in the physical universe that makes it impossible for me to use the same idea you are using. And ideas are hard to make *excludible* as well: how can you keep me from thinking what I want to think?

Patents and Copyrights

That is why countries have patent laws, and copyrights. That is why one of the few enumerated powers that the U.S. Constitution gives the Congress is the power to set up limited-term patent and copyright laws. Patents give a firm that has discovered something new the right to exclude anyone else from using that discovery for a period of years. But even the strictest patent and copyright laws are incomplete. Often the most valuable part of the research and development process is not figuring out how to do something, but whether or not it (or something very close to it) can be done at all. Once one patent has been granted, other firms can and do search for alternative ways of making it, or of making something close to it, not covered by the patent.

Governments seeking to establish patent laws face a difficult dilemma. If their patent laws are strong, then much of the modern technology in the economy will be restricted in use: either restricted to being used only by the inventor, or restricted because the inventor is charging other firms high licensing fees to use the technology (or not letting them use it at all). There is no social cost involved in letting everyone use the idea or the process or the innovation, once it is discovered. Information, after all, wants to be free. Thus a government that enacts strict patent laws is pushing the average level of technology used in its factories and businesses at some particular moment far below the level that could be achieved at that particular moment.

On the other hand, if the patent laws are weak--so that they provide little protection to inventors and innovators--then the profits that inventors and innovators earn will be low. Why then should businesses devote money and resources to research and development?

They will not. And the pace of innovation, and thus of technological improvement, will slow to a crawl.

This dilemma cannot be evaded. The profits from innovation come because the innovator has a monopoly right to the innovation--and hence the rest of the economy is excluded from using that item of technology. Reduce the degree of exclusion so as to lower the deadweight loss from using less-than-best-practice technology, and find that you have reduced the rewards to research and development (and thus presumably the pace of research and development as well). Increase the strength of the patent system to raise the rewards to research and development, and find that you have increased the gap between the average technology used in the economy and the feasible best-practice.

Moreover, technological progress depends on more than the *appropriability* of research--the extent to which the increased productivity made possible by innovation boosts the profits of the innovating firm. It also depends on the productivity of research: how much in the way of new productivity-enhancing inventions is produced by a given investment in research and development? Economists don't know much about the interactions among product development, applied research, and basic research. So they have little to say about how to improve the productivity of research, and the pace of productivity growth.

Will Governments Follow Good Policies?

That governments *can* assist in growth and development does not mean that governments *will.* The broad experience of growth in developing economies--outside of the East Asian

Pacific rim, outside of the OECD--has been that governments often *won't*. Over the past two decades many have argued that typical systems of regulation in developing countries have retarded development by:

- Embarking on "prestige" industrialization programs that keep resources from shifting to activities in which the country had a long-run comparative advantage.
- Inducing firms and entrepreneurs to devote their energies to seeking rents by lobbying governments, instead of seeking profits by lowering costs.
- Creating systems of regulation and project approval that have degenerated into extortion machines for manufacturing bribes for the bureaucrats.

Many governments--particularly unelected governments--are not *that* interested in economic development. Giving valuable industrial franchises to the nephews of the dictator; making sure that members of your ethnic group are in key places to extort bribes; or taking the foreign exchange that would have been spent importing productive machinery and equipment and using it instead to buy more modern weapons for the army--these can seem more attractive options. In the absence of political democracy, the checks on a government that does not seek economic development are few.

Moreover, checks on government that do exist may not be helpful. In a non-democracy--or a shaky semi-democracy--there are two possible sources of pressure on the government: riots in the capital, and coups by the soldiers. Even a government that seeks only the best for its people in terms of economic growth will have to deal with these sources of pressure, and will have to avoid riots in the capital, and avoid coups by the soldiers.

Coups by the soldiers are best avoided by spending money on the military. Riots in the capital are best avoided by making sure that the price of food is low, and that influential opinion leaders in the capital are relatively happy with their material standards of living. Thus governments find themselves driven to policies that redistribute income from the farms to the cities, from exporting businesses to urban consumers of imported goods, from those who have the power to invest and make the economy grow to those who have the power to overthrow the government.

If the rulers have the worst of motives, government degenerates into *kleptocracy:* rule by the thieves. If government has the best of motives, it is still hard to avoid policies that diminish saving and retard the ability to translate saving into productive investment. W.W. Rostow recounts a visit by President Kennedy to Indonesia in the early 1960s; Kennedy talked about economic development, and a South Asian Development Bank to provide capital for Indonesia's economic growth. Indonesia's then-dictator Sukarno's response? "Mr. President, development takes too long. Give me West Irian [province, the western half of the island of New Guinea, to annex] instead."

Taken as a group, the poor countries of the world have *not* closed any of the gap relative to the world's industrial leaders since World War II.

Neoliberalism

Thus much thinking about the proper role of government in economic growth over the past two decades has led to conclusions that are today called *neo-liberal.* The government has a sphere of core competencies--administration of justice, maintenance of

macroeconomic stability, avoidance of deep recessions, some infrastructure development, provision of social insurance--at which it is effective. But there is a large area of potential activities in which governments--or, at least, governments that do not have the bureaucratic honesty and efficiency needed for a successful *developmental state*--are more likely to be destructive than constructive. Hence the neo-liberal recommendation that governments attempt to shrink their role back to their core competencies, and thus to deregulate industries and privatize public enterprises. Whether such policies will in fact lead to convergence rather than continued divergence is still an open question.

5.5 Chapter Summary

Main Points

1. Back before the commercial revolution--before 1500 or so--economic growth was very slow. Populations grew at a glacial pace. And as best we can tell there were no significant increases in standards of living for millennia before 1500: humanity was caught in a Malthusian trap.

2. They way out of the Malthusian trap opened about 1500. Thereafter populations grew, and standards of living and levels of material productivity grew as well.

3. The industrial revolution was the start of the current epoch: the epoch of modern economic growth. Starting in the mid-eighteenth century the pace of invention and

innovation ratcheted up. Key inventions replaced muscle with machine power. And material productivity levels boomed.

4. Modern economic growth is well-described by the growth model of chapter 4--that is why we spent so much time on it, after all. Output per worker and capital per worker increase at a pace measured in percent per year, a pace that is extraordinarily rapid in long-term historical perspective.

5. Looking across nations, the world today is an astonishing unequal place in relative terms--the relative gap between rich and poor nations in material productivity is much greater than it has ever been before.

6. Combine the determinants of the steady-state capital-output ratio with the proximate determinants--the level of technological knowledge in a country after World War II and its average level of educational attainment--and you have accounted for the overwhelming bulk of variation in the relative wealth and poverty of nations today.

7. Macro policies to increase economic growth are policies to accelerate the demographic transition (through education), to boost savings rates, to boost the amount of real investment that a country gets for a given savings effort, and (again through education) to boost the rate of invention or of technology transfer.

8. What are the prospects for successful rapid development in tomorrow's world? Do you see the glass as half empty or half full?

Important Concepts

Malthusian Equilibrium

Natural Resource Scarcity

Commercial Revolution

Industrial Revolution

Demographic Transition

Divergence

Productivity Growth

Productivity Slowdown

Intellectual Property

Patents and Copyrights

Analytical Exercises

1. Why do many economists think that the consumer price index overstates the true rate of inflation?

2. Would an increase in the saving and investment share of U.S. total output raise growth in productivity and living standards?

3.Many project that by the end of the twenty-first century the population of the United States will be stable. Using the Solow growth model, what would such a downward shift

in the growth rate of the labor force do to the growth of output per worker and to the growth of total output (consider both the effect on the steady-state growth path, and the transition from the "old" positive population growth to the "new" zero population growth steady-state growth path)?

4. What are the arguments for having a strong patent system to boost economic growth? What are the arguments for having a weak system of protections of "intellectual property"? Under what systems do you think that the first will outweigh the second? Under what circumstances do you think that the second will outweigh the first?

5. What steps do you think that international organizations--the UN, the World Bank, or the IMF--could take to improve political leaders' incentives to follow growth-promoting policies?

6. Suppose somebody who hasn't taken any economics courses were to ask you why humanity escaped from the Malthusian trap--of very low standards of living and slow population growth rates that nevertheless put pressure on available natural resources and kept output per worker from rising--in which humanity found itself between the year 8000 B.C.E. and 1800. What answer would you give?

7. Suppose somebody who hasn't taken any economics courses were to ask you why it is that some countries are so very, very much poorer than others in the world today. What answer would you give?

8. The *endogenous growth theorists*, led by Stanford's Paul Romer, argue that it is a mistake to separate the determinants of the efficiency of labor from investment—that investments both raise the capital-worker ratio and increase the efficiency of labor as workers learn about the new technology installed with the purchase of new, modern capital goods. If the endogenous growth theorists are correct, is the case for government policies to boost national savings and investment rates strengthened or weakened? Why?

9. Suppose that population growth depends on the level of output per worker, so that:

(1) $n = (.0001) \times [(Y/L) - \$200]$

the population growth rate n is zero if output per worker equals $200, and that each $100 increase in output per worker raises the population growth rate by 1% per year.

Suppose also that the economy is in its *Malthusian* regime, so that the rate of increase of the efficiency of labor E is zero and output per worker is given by:

(2) $$\frac{Y_t}{L_t} = \left(\frac{s}{n+\delta}\right)^{\left(\frac{\alpha}{1-\alpha}\right)} E_0$$

with the diminishing-returns-to-investment parameter $\alpha = .5$, with the depreciation rate $\delta = .04$, and with the efficiency of labor $E_0 = \$100$.

a. Suppose that the savings rate s is equal to .08, 8% per year. Graph (on the same set of axes) steady-state output-per-worker (Y/L) as a function of the population growth rate n from equation (2) and the population growth rate n as a function of output-per-worker (Y/L) from equation (1).

b. Where do the curves cross? For what levels of output per worker Y/L and population growth n is the economy (i) on its steady-state path, and (ii) at its Malthusian rate of population growth?

c. Suppose that the savings rate were to rise by an infinitesimal amount--say by one-hundredth of one percentage point, from .08 to .0801. Calculate approximately how the equilibrium position of the economy would change. By how much--and in which direction--would steady-state output per worker change? By how much--and in which direction--would the population growth rate change?

10. Suppose we have our standard growth model with s = 20%, n = 1%, g = 1%, and δ = 3%. Suppose that the current level of the efficiency of labor E is $10,000 per year, and that the current level of capital per worker is $50,000.

Suppose further that the parameter α in the production function:

$$\frac{Y_t}{L_t} = \left(\frac{K_t}{L_t}\right)^{\alpha} \times \left(E_t\right)^{1-\alpha}$$

is equal to one: $\alpha = 1$.

a. What can you say about the future growth of output per worker in this economy? Can you write down an equation for what output per worker will be at any date in the future?

b. Suppose that the savings rate s were not 20% but 15%. How would the future growth of output per worker be different?

c. Why aren't the normal tools of analysis and rules of thumb of the growth model much use when $\alpha = 1$? (Consider the shape of the production function, and what that says about diminishing returns to investment.)

Policy-Relevant Exercises

1. Take a look in the back of this book at the rate of growth of real GDP per worker in the United States over the past ten years. Guess what the average magnitude of annual fluctuations in growth about its trend rate are. How large was the "trend" component of growth in the past year? How large was the "cycle" component of growth in the past year?

2. Pick an industrialized country, an "upper middle income" developing country, a "lower middle income" developing country, and a "poor" country from the tables in the back of the book. What have been their relative rates of economic growth over the past five years? Are your countries representative in light of the discussion in this chapter?

3. Take a look at the relative purchasing-power-parity compared levels of GDP per worker for the G-7 economies--Germany, France, Britain, Italy, Canada, Japan, and the U.S. Have they drawn closer together in levels of GDP per worker in the past five years?

4. What pieces of news have you read in the past week that you would classify as shifts in macro policies that encourage growth?

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7. What pieces of news have you read in the past week that you would classify as shifts in micro policies that discourage growth?

8. Do you believe that over the next three decades the lower income countries of the world will catch up to--or at least draw nearer in relative terms to--the high income countries? Why or why not?