Economic Growth: Concepts and Patterns

Why are some countries rich and others poor? Why do some economies grow quickly with their citizens enjoying rapid increases in their average incomes, while others grow slowly or not at all? How did some East Asian countries advance from poverty to relative prosperity in just 30 years, while many African countries remain mired in deep poverty, with few signs of sustained growth and development? These are some of the most important questions in the study of economics and indeed touch on some of the deepest problems facing human society.

As we saw in the last chapter, rapid economic growth and wide divergences of economic performance across countries are fairly recent phenomena in world history. Up until about 500 years ago—a relatively short period of time in human history—most people lived in conditions that we now would consider abject poverty. Housing was poor, food supplies were highly variable and dependent on the weather, nutrition was inadequate, disease was common, healthcare was rudimentary, and life spans rarely exceeded 40 years. Even as recently as 125 years ago, the vast majority of people living in the world's most modern cities, including New York, London, and Paris, lived in extremely difficult conditions on very meager incomes. One decade into the twenty-first century, however, income levels around the world generally are both much higher and far more diverse. A significant minority of the world's population has recorded relatively rapid and sustained income growth during the last several decades and now enjoys much longer and healthier lives, higher levels of education, and much-improved standards of living. Other countries have achieved important but more modest gains and now are middle-income countries.

TABLE 3-1 Economic Growth across Countries, 1960-2009

COUNTRY	GDP PER CAPITA (2005 PPP) 1960	GDP PER CAPITA (2005 PPP) 2009	RATIO OF 2009 TO 1960 GDP/ CAPITA	AVERAGE ANNUAL GROWTH RATE (%)	INCOME AS A SHARE OF U.S. INCOME* 1960	INCOME AS A SHARE OF U.S. INCOME* 2009
Negative growth						
Madagascar	842	753	0.89	−0.23	0.07	0.02
Zambia	1,803	1,765	0.98	−0.04	0.14	0.04
Slow growth						
Senegal	1,421	1,492	1.05	0.01	0.11	0.04
Kenya	1,020	1,206	1.18	0.34	0.08	0.03
Rwanda	860	1,031	1.2	0.37	0.07	0.03
Nigeria	1,528	2,034	1.33	0.58	0.12	0.05
Venezuela	6,663	9,115	1.37	0.64	0.52	0.22
Chad	819	1,277	1.56	0.91	0.06	0.03
Jamaica	5,609	8,795	1.57	0.92	0.44	0.21
El Salvador	3,397	6,338	1.87	1.28	0.26	0.15
Argentina	6,244	11,961	1.92	1.33	0.49	0.29
Peru	3,759	7,280	1.94	1.36	0.29	0.18
South Africa	3,850	7,589	1.97	1.4	0.3	0.18
Ghana	603	1,239	2.05	1.48	0.05	0.03
Philippines	1,314	2,838	2.16	1.58	0.1	0.07
Moderate growth						
Turkey	3,243	9,909	3.06	2.31	0.25	0.24
Papua New Guinea	887	2,746	3.1	2.34	0.07	0.07
Brazil	2,581	8,160	3.16	2.38	0.2	0.2
Chile	3,780	11,999	3.17	2.39	0.29	0.29
Pakistan	728	2,353	3.23	2.43	0.06	0.06
Lesotho	401	1,311	3.27	2.45	0.03	0.03
Dominican Republic	2,355	9,911	4.21	3.06	0.18	0.24
Mauritius	2,208	9,484	4.29	3.01	0.17	0.23
Rapid growth						
India	711	3,239	4.55	3.14	0.06	0.08
Egypt	1,036	4,956	4.78	3.24	0.08	0.12
Sri Lanka	765	4,035	5.27	3.45	0.06	0.1
Indonesia	693	4,075	5.88	3.69	0.05	0.1
Malaysia	1,470	11,296	7.68	4.25	0.11	0.27
Thailand	961	7,794	8.11	4.36	0.07	0.19
Singapore	4,300	47,373	11.02	5.02	0.33	1.15
South Korea	1,782	25,034	14.05	5.54	0.14	0.61
Botswana	578	8,872	15.35	5.73	0.05	0.22
China	403	7,634	18.94	6.18	0.03	0.19
Industrialized countries						
United Kingdom	12,841	33,383	2.6	1.97	1	0.81
United States	15,438	41,099	2.66	2.02	1.2	1
Canada	12,988	36,209	2.79	2.11	1.01	0.88
France	10,101	30,822	3.05	2.31	0.79	0.75
Japan	5,850	30,008	5.13	3.4	0.46	0.73

*Growth rates are trend-growth calculated by ordinary least squares regressions and do not necessarily match endpoint-to-endpoint growth rates. Growth rates are listed in order of magnitude, but the ordering of magnitudes in the third and fourth columns sometimes differ.

PPP, purchasing power parity; GDP, gross domestic product.

Source: Penn World Tables 7.0, http://pwt.econ.upenn.edu/php_site/pwt_index.php, accessed May 2011.

The majority of the world's population, however, continues to live in poverty, in most cases better off than their ancestors but living at levels of income and welfare far below those of the world's richest countries.

Economic growth and economic development are not synonymous, as we discovered in Chapter 2. Yet economic growth is at the heart of the development process, and sustained development and poverty reduction cannot occur in the absence of economic growth. This chapter and the next explore in some detail the puzzles of economic growth and divergent levels of income across countries. Our objectives are to better understand the processes by which economies grow and develop and the characteristics that distinguish rapidly growing economies from those with slower growth. This chapter explores the basic empirical data on economic growth, the concepts underlying the leading ideas of what causes growth, and some of the patterns of changing economic structure that typically accompany growth. Chapter 4 expands the analysis by introducing some formal models of economic growth. Later chapters explore other dimensions of development introduced earlier, including the distribution of income, poverty, and improvements in health and education.

DIVERGENT PATTERNS OF ECONOMIC GROWTH SINCE 1960

As we begin to explore differences in growth rates, consider Thailand and Zambia. In 1960, the annual income of the average Zambian was almost twice as high as that of the average Thai, around $1,800 in Zambia and $960 in Thailand in constant 2005 purchasing power parity (PPP) dollars. Since that time, Thailand achieved very rapid economic growth of around 4.3 percent per person per year, so that the average income in Thailand is now around $7,800. In 2009, the income of the average Thai was over *eight times* higher in real terms than that of his or her grandparents 50 years ago. As a result, Thais can consume much more (and much higher-quality) food, housing, clothing, healthcare, education, and consumer goods. Thais are better off in other ways as well: life expectancy increased from 54 to 69 years, infant mortality dropped from 103 to 12 per thousand (meaning that an additional 91 children per thousand infants lived beyond their first birthday), and the percentage of adults that were literate grew from 80 (in 1970) to 94 percent. In Zambia, by contrast, average income actually fell slightly to $1,765, about 2 percent lower than in 1960. Life expectancy remained at around 45 years, pulled down to a large extent because of the dramatic spread of the HIV/AIDS pandemic in the 1990s. Infant mortality rates improved (from 126 to 86 per thousand), as did literacy rates (from 48 to 71 percent), but overall Zambians are arguably worse off than their parents and grandparents.

The different growth records of Thailand and Zambia are mirrored by the experiences of many other developing countries, as shown in Table 3–1. Madagascar joins

TABLE 3-1 Economic Growth across Countries, 1960–2009

COUNTRY	GDP PER CAPITA (2005 PPP) 1960	GDP PER CAPITA (2005 PPP) 2009	RATIO OF 2009 TO 1960 GDP/ CAPITA	AVERAGE ANNUAL GROWTH RATE (%)	INCOME AS A SHARE OF U.S. INCOME* 1960	INCOME AS A SHARE OF U.S. INCOME* 2009
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PPP, purchasing power parity; GDP, gross domestic product.

Source: Penn World Tables 7.0, http://pwt.econ.upenn.edu/php_site/pwt_index.php, accessed May 2011.

Zambia in the unfortunate experience of shrinking incomes. Because incomes were very low to begin with in many of these countries, negative growth has been a major tragedy. A second group of countries attained positive growth but at relatively slow rates. Average incomes in these countries increased but not by as much as in many other countries around the world. In Venezuela, for example, per capita growth averaged about 0.6 percent per year since 1960, enough for incomes to increase by around 37 percent, but less than what many Venezuelans may have hoped for.

A third group of countries has been more successful and has achieved moderate growth, shown in the table as per capita growth between 2 and 3 percent per year. By world historical standards (calculated by Angus Maddison and shown in Figure 2–1), these growth rates are relatively high and allow for solid increases in average income. For example, Egypt recorded a growth of 3.2 percent a year, enough for average income to double every 22 years and nearly quintuple between 1960 and 2009, a significant achievement. India, home to over 1 billion people, saw similar growth.

A fourth group of countries has done even better, recording rapid growth of more than 3 percent per capita per year. A few have achieved extraordinary growth exceeding 5 percent, including Singapore, South Korea, Botswana, and China. These are some of the fastest growth rates ever recorded over a 50-year period in the history of the world, and they have led to enormous changes. In South Korea, income expanded by a mind-boggling factor of 14, while in Botswana (Box 3–1), average income is *more than 15 times* what it was 50 years ago. (Unfortunately, Botswana's great success is now threatened by the HIV/AIDS pandemic, as we discuss later in the book.) China, where growth has averaged 6 percent per year (with almost all of it coming after 1980, meaning the growth rate since then has been much faster), has undergone perhaps the most remarkable transformation of all: For one-fifth of the world's population, including a huge number of people living in or near poverty, average incomes have increased by a factor of nearly 19 between 1960 and 2009. China's rapid growth is one of the most important events of the last century, and its continued growth will have profound implications for this century, as well.

There are some clear regional differences in growth rates, as the data in Table 3–1 suggest and as we saw in Table 2–3. Most of the rapidly growing countries are in East Asia, while most of the slowly growing countries are in Africa. But beware of taking these general statements too far because there are important exceptions. In East Asia, Myanmar (Burma) and Laos both recorded slow growth, and the Philippines' performance has been modest at best. In Africa, Botswana and Mauritius are among the fastest-growing countries in the world, and tiny Lesotho and Swaziland have also achieved steady growth.

Remember, apparently small differences in growth rates can make a huge difference over time. The difference between 1 percent growth and 2 percent growth is huge: It is not a 1 percent difference but a 100 percent difference. With growth of 1 percent per year, average income increases by about 65 percent over 50 years, and

BOX 3-1 BOTSWANA'S REMARKABLE ECONOMIC DEVELOPMENT[a]

Whereas most of sub-Saharan Africa has achieved little or no economic growth in per capita income on average over the past 50 years, Botswana stands out as a clear exception. Indeed, during the 20-year period between 1970 and 1990, Botswana was the fastest-growing economy in the world, with growth averaging an astonishing 7.9 percent per year, easily outpacing the more widely noted rapid growth in Singapore (6.3 percent), Korea (6.9 percent), and other countries around the world. Table 3–1 shows that over the longer period from 1960 to 2009, Botswana's growth rate was second only to China's. Over the 50-year period, average real income increased by a factor of more than 15 in just over two generations. A wide array of other development indicators improved dramatically as well. Life expectancy increased from 46 to 61 years in 1987 (before plunging again because of the HIV/AIDS pandemic), infant mortality fell from 118 to 43 per thousand by 2009, and literacy rates jumped from 46 percent (in 1970) to 83 percent by 2008.

Botswana did not seem to have strong prospects when it achieved independence from Great Britain in 1965. At that point, there were only 12 kilometers of paved roads in the entire country. Only 22 Batswana had graduated from university, and only 100 had graduated from secondary school. The country is landlocked, and more than 80 percent of the country is in the Kalahari Desert, leaving only a small amount of arable land. Yet, despite the long odds, Botswana prospered. What was behind this remarkable transformation?

Diamonds are part of the story, because Botswana sits atop some of the world's richest diamond deposits, and mining now accounts for about 40 percent of the country's output. But the answer is not that simple: Many other developing countries have rich natural resources, and in many cases, these have created more problems than benefits (see Chapter 17). More broadly, most observers point to Botswana's strong policies and institutions as key determinants of its development success.

Botswana clearly managed its resources much more prudently than other countries. Most of the receipts were invested productively: Botswana has built an impressive infrastructure, with paved roads connecting much of the country,

[a]This account draws heavily from Daron Acemoglu, Simon Johnson, and James Robinson, "An African Success Story," in Dani Rodrik, ed., *In Search of Prosperity: Analytic Narratives on Economic Growth* (Princeton, NJ: Princeton University Press, 2003); and Clark Leith, "Why Botswana Prospered," paper presented at the 34th Annual Meeting of the Canadian Economics Association, University of British Columbia, Vancouver, Canada, June 2000, available at www.ssc.uwo.ca/economics/faculty/Leith/Botswana.pdf, accessed February 2012.

a reasonably reliable electricity generation and distribution system, a substantial stock of housing, and many schools and clinics. Some of the diamond receipts were saved as reserves to help manage macroeconomic fluctuations. Corruption has been much less of a problem than in other countries. Overall macroeconomic policies were strong; inflation was relatively low, for the most part; and supporting fiscal, monetary, and exchange-rate policies were in place. Trade policies were relatively open, with the external tariff set through Botswana's membership in the Southern Africa Customs Union. The public sector has remained small, with a civil service based on merit rather than patronage and relatively few state-owned companies. Property rights and other legal protections have been generally well respected. Strong economic management, in turn, may have been due partly to the fact that Botswana is a democracy, and one of the few countries in Africa that has been so since independence.

However, not everything in Botswana is positive. Income inequality is high and has not declined over time. Unemployment remains high, particularly for migrants coming from rural to urban areas. Although democratic traditions are solid, with fair elections and a vibrant free press, one party has dominated politics since independence. The biggest concern, however, is HIV/AIDS. According to the World Health Organization, Botswana has the second-highest prevalence of HIV in the world; around 24 percent of the adult population is HIV-positive. The scourge of HIV/AIDS threatens to turn back much of the progress Botswana has realized in recent decades. With all that Botswana has achieved, its greatest challenges may lie ahead in fighting the disease and ensuring continued growth and development.

incomes double in about 70 years. With 2 percent growth, average income increases by 270 percent over 50 years, and it takes only 35 years for income to double. (Box 3–2 demonstrates the methods behind these calculations.)

FACTOR ACCUMULATION, PRODUCTIVITY, AND ECONOMIC GROWTH

Economists have been trying to understand the determinants of economic growth and the characteristics that distinguish fast-growing from slower-growing countries at least since Adam Smith wrote *An Inquiry into the Nature and Causes of the Wealth of Nations,* published in 1776. More than 200 years later, our knowledge about the growth process has expanded but is far from complete. A broad range of factors could

BOX 3-2 CALCULATING FUTURE VALUES, GROWTH RATES, AND DOUBLING TIMES

The illustrative growth calculations presented in the text are based on simple, yet quite useful mathematical techniques. Let us take a look at how to perform the calculations required to answer three basic questions.

QUESTION 1

If a country's current level of income per capita is X_0 and that country's income per capita grows for t years at rate r, what will its income per capita be at the end of that period (X_t)?

To answer this question, we will use the basic formula for compound growth over discrete periods (such as years),

$$X_t = X_0 \times (1 + r)^t$$

For example, we see from Table 3–1 that Senegal's income per capita in 2009 was $1,492, and its historical growth rate was 1.05 percent per year (which we will round down to 1 percent per year to simplify this calculation). Suppose we want to project Senegal's per capita income 10 years into the future (in 2019), assuming that its income continues to grow at 1 percent per year. Plugging in $1,492 for X_0, 0.01 for r, and 10 for t:

$$\$1{,}492 \times 1.01^{10} = \$1{,}648$$

The key here is to recognize that this future value is not simply 1 percent times 10 years (or 10 percent) greater than the initial value. Compound growth calculations take into account that after one year of 1 percent growth (starting at $1,492), Senegal's income is $1,507; the second year's growth of 1 percent thus starts from this new base. That is, for the first year, we'd calculate $\$1{,}492 \times 1.01 = \$1{,}507$; for the second year we'd calculate ($\$1{,}492 \times 1.01) \times 1.01$, or $\$1{,}492 \times 1.01^2 = \$1{,}522$, and so on.

QUESTION 2

If, instead, we know a country's initial level of per capita income (X_0) and its level of per capita income t years hence (X_t), what was its annually compounded average rate of growth?

To solve for the growth rate we begin with the basic compound growth formula from Question 1. With a bit of algebraic manipulation, we can solve that equation for r, resulting in the following formula:

$$\left(\frac{X_t}{X_0}\right)^{\frac{1}{t}} - 1 = r$$

If we knew that Senegal's per capita income in 2009 was $1,492 and that it would be $1,648 10 years later, we could calculate its average compound growth rate as:

$$\left(\frac{\$1{,}648}{\$1{,}492}\right)^{\frac{1}{10}} - 1 = 0.01 \text{ or } 1 \text{ percent}$$

Calculating growth rates using these endpoint data is potentially misleading if either the start or end year observation is unusually high or low relative to the underlying trend (that is, if there was a shock of some sort in either the start or end year, making it unrepresentative of the trend). It is possible to avoid this problem by using regression analysis to estimate the growth rate. This approach uses all of the observations in a given time series, rather than relying entirely on the first and last observations.

To estimate average growth rates by least-squares regression, we begin by transforming the basic formula for discrete periods of compound growth into a linear function by taking the natural logarithm of both sides of the formula:

$$\ln X_t = \ln X_0 + \ln(1+r) \times t$$

We can estimate this equation as the least-squares regression $\ln X_t = a + bt$, where $a = \ln X_0$, $b = \ln(1 + r)$, and t is time. That is, we regress the natural log of the series against a linear time trend. To recover the direct estimate of the compound growth rate t, we calculate $r = e^b - 1$.

QUESTION 3

If income (or, for that matter, population) were to grow at rate r, how long would it take to double?

To calculate doubling times (commonly used for illustrative purposes), we resort to the rule of 70. The rule of 70 is based on a slightly different concept of compounding from the one used for the other questions. In the previous examples, we compounded once each year. The rule of 70 is based on continuous compounding, in which the base is increased at each instant. The basic equation for continuous compounding uses the exponential function (e),

$$X_t = X_0 \times e^{rt}$$

In general, continuous compounding using this formula is more appropriate when calculating growth rates for populations, which growth continuously. (When the available data for a series consist of annual observations, such as is common for countries' gross domestic product [GDP], then it may be more appropriate to apply annual compounding for those discrete periods, as described earlier.) We

can use this formula to calculate the time it takes for income (or population) to double by setting $X_t = 2$ and $X_0 = 1$,

$$2 = 1 \times e^{rt}$$

If we transform this equation by taking natural logarithms of both sides, we have

$$\ln 2 = \ln 1 + (r \times t)$$

Conveniently, $\ln 1 = 0$ so that term drops out. This calculation is called the *Rule of 70* because $\ln 2 \approx 0.70$. So if we know r, we can solve for the doubling time:

$$\text{doubling time } (t) = \frac{0.70}{r}$$

If Senegal's economy grows at 1 percent per year, its level doubles every $(0.70/0.01) = 70$ years. If, instead, Senegal's economy grows at 2 percent per year, it would double in size every $(0.70/0.02) = 35$ years.

plausibly be important to growth, including the amount and type of investment, education and healthcare systems, natural resources and geographical endowments, the quality of government institutions, and the choice of public policy. All these play some role, as we see later in the chapter, but some are more central to the process of growth than others.

At the core of most theories of economic growth is a relationship between the basic factors of production—capital and labor—and total economic production. Some countries also are endowed with specific natural resources assets, such as petroleum deposits, gold, rubber, land, rich agricultural soil, forests, lakes, and oceans. These assets are often included as parts of a broad definition of the capital stock, but sometimes are treated separately. For simplicity, we focus our analysis on capital and labor. Depending on the products being produced, different combinations of these inputs are required. Growing rice requires significant amounts of labor (at least around planting and harvesting time), but not much machinery other than a plow. Garment production also requires lots of unskilled labor, but needs many sewing machines as well as decent infrastructure to get goods to overseas markets. A steel or chemical factory requires substantial amounts of machinery and other capital, including a reliable source of energy, and (relatively) less labor.

A country's total output—and thus its total income—is determined by how much capital and labor it has available and how productively it uses those assets. In turn, *increasing* the amount of production—that is, economic growth—depends on

increasing the amount of capital and labor available and increasing the productivity of those assets. In other words, economic growth depends on two basic processes:

- **Factor accumulation**, defined as increasing the size of the capital stock or the labor force. Producing more goods and services requires more machines, factories, buildings, roads, ports, electricity generators, computers, and tools along with more and better educated workers to put this capital equipment to work.
- **Productivity growth**, defined as increasing the amount of output produced by each machine or worker. Productivity can be increased in two broad ways. The first is to improve the **efficiency** with which current factors are being used. A small furniture maker might initially have each worker make a chair from start to finish. By reorganizing the workers so each specializes in one task (for example, cutting, assembling, finishing), total production might be increased. The second is **technological change**, through which new ideas, new machines, or new ways of organizing production can increase growth. Countries that can either invent new technologies or quickly adopt technologies invented elsewhere (a more relevant path for most developing countries) can achieve more rapid economic growth than other countries. Productivity growth often entails shifting resources from producing one good to another. The process of economic growth in low-income countries almost always corresponds to major structural shifts in the composition of output, generally from agriculture to industry, as we discuss in Chapter 15.

Understanding that factor accumulation and productivity gains are at the heart of the growth process is important but takes us only so far. To gain a deeper understanding of growth, we must understand what drives factor accumulation and productivity growth themselves. We begin with saving and investment.

SAVING, INVESTMENT, AND CAPITAL ACCUMULATION

Perhaps the most influential model of economic growth was developed by MIT economist Robert Solow in 1956.[1] At the heart of the **Solow growth model** (which we explore in depth in Chapter 4) and many other influential growth models is the process of capital accumulation. As mentioned previously, classical and neoclassical growth models typically give much less attention to the process of expanding the

[1]Robert Solow, "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* 70 (February 1956), 65–94, and "Technical Change and the Aggregate Production Function," *Review of Economics and Statistics* 39 (August 1957), 312–20.

labor force (because labor is not seen as a binding constraint on growth), which usually is assumed to grow in line with the population. The key ideas in these kinds of models are relatively straightforward:

- *New investment increases the capital stock.* Investment in new factories or machines directly increases the capital stock, which facilitates greater production. For the capital stock to grow, the value of new investment must be greater than the amount of depreciation of existing capital. Factories and machines deteriorate over time, and a certain amount of new investment is needed simply to keep pace and maintain the current size of the capital stock. Investment greater than the amount of depreciation directly adds to the capital stock. Investment must be greater than depreciation and the growth of the labor force for there to be an increase in capital per worker.
- *Investment is financed by saving.* We know from standard national accounts identities that investment equals saving.[2] Thus the models postulate that the key to increasing investment (and the capital stock) is to increase saving.
- *Saving comes from current income.* Households save whatever income they do not consume. Corporations save in the form of retained earnings after distribution of dividends to stockholders. Governments either add to saving to the extent that they receive tax payments in excess of government current (noninvestment) spending (that is, a budget surplus, excluding investment spending) or detract from saving if they spend more than tax receipts (a budget deficit, excluding investment spending). We discuss these concepts in more depth in Chapters 10 and 11. Gross domestic saving, which combines all three sources of saving, provides the resources to finance investment.[3]

A key decision facing households, corporations, and governments is how much income to consume and how much to save. Individuals do not care about the level of capital or even the level of output, but they do care about the amount of goods and services they consume. However, there is a clear trade-off: The more that is consumed now, the less that is available for saving and therefore for investment, growth, and increased future consumption. On the one hand, people prefer to consume sooner rather than later. Given a choice between better housing now or in five years, everyone would choose now. On the other hand, people also recognize that consuming all income now is shortsighted. At a minimum, enough needs to be saved to compensate for depreciation of existing assets: to fix the roof on the house when it leaks, repair

[2]On the production side of the national accounts (for a closed economy with no trade), everything that is produced (total output, usually designated as Y) must be used for either consumption (C) or investment (I). On the income side, total income (also designated as Y because the value of total output must equal total income) is either used to purchase consumption goods (C) or saved (S). Putting these two identities together (because Y and C appear in both), saving must be equal to investment.

[3]In an open economy with trade and international capital flows, foreign saving (for example, borrowing from an overseas bank) can add to the total pool of available saving.

labor force (because labor is not seen as a binding constraint on growth), which usually is assumed to grow in line with the population. The key ideas in these kinds of models are relatively straightforward:

- *New investment increases the capital stock.* Investment in new factories or machines directly increases the capital stock, which facilitates greater production. For the capital stock to grow, the value of new investment must be greater than the amount of depreciation of existing capital. Factories and machines deteriorate over time, and a certain amount of new investment is needed simply to keep pace and maintain the current size of the capital stock. Investment greater than the amount of depreciation directly adds to the capital stock. Investment must be greater than depreciation and the growth of the labor force for there to be an increase in capital per worker.
- *Investment is financed by saving.* We know from standard national accounts identities that investment equals saving.[2] Thus the models postulate that the key to increasing investment (and the capital stock) is to increase saving.
- *Saving comes from current income.* Households save whatever income they do not consume. Corporations save in the form of retained earnings after distribution of dividends to stockholders. Governments either add to saving to the extent that they receive tax payments in excess of government current (noninvestment) spending (that is, a budget surplus, excluding investment spending) or detract from saving if they spend more than tax receipts (a budget deficit, excluding investment spending). We discuss these concepts in more depth in Chapters 10 and 11. Gross domestic saving, which combines all three sources of saving, provides the resources to finance investment.[3]

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the motorbike, or replace a worn-out hoe. Additional saving can provide the basis for even higher income in the future. Deferring current consumption can lead to greater consumption later. For example, a farmer who wants to buy a water buffalo may have to reduce his or her consumption for several years to save enough to eventually make the purchase. The farmer's reward comes later, when (ideally) the water buffalo increases farm production and income by far more than the amount saved, allowing for even larger consumption in the future.

As the last sentence hints, although generating saving and investment is necessary for growth, it is not sufficient. The investments actually have to pay off with higher income in the future, and not all investments do so. The farmer who buys the water buffalo will not earn the reward if the field is too rocky to plow or the land does not have enough nutrients to support the crop. If the government forces down the price of the crop (for example, to try to keep food prices low for urban consumers), the farmer's income will fall and the investment will be much less profitable. If property rights are not secure, the farmer could lose the water buffalo or the land. Changes in world market prices (well out of the farmer's control) could also affect income. These issues highlight a key point: *Sustaining economic growth requires both generating new investment and ensuring that the investment is productive.* This idea is a recurrent theme in the next two chapters and throughout this book.

SOURCES OF GROWTH ANALYSIS

So far, we have identified factor accumulation and productivity gains as the two core determinants of growth. But how important are each of these in explaining growth? Robert Solow pioneered early efforts to quantify the contribution of each of the proximate causes of increased output—capital accumulation, labor accumulation, and productivity gains—to economic growth. This approach is more of an accounting framework based on actual data than an economic model. It seeks to answer the following question: What proportions of recorded economic growth can we attribute to growth in the capital stock, growth of the labor force, and changes in overall productivity?[4]

One way to explore how factor accumulation and productivity growth affect output and economic growth is by examining a **production function**, which characterizes how inputs (capital and labor) are combined to produce various levels of output. Figure 3–1 shows an example of a common production function. The horizontal axis shows one measure of factor inputs (the amount of capital per worker),

[4]Solow, "Technical Change and the Aggregate Production Function." A year before Solow's paper, Moses Abramovitz found similar estimates of the contribution of productivity gains to U.S. growth between 1870 and 1953 using a less formal methodology. See his "Resource and Output Trends in the United States since 1870," *American Economic Review* 46, no. 2 (May 1956), 5–23.

and the vertical axis shows the amount of output per worker (in this example, pairs of running shoes). Combining capital and labor into the single "capital per worker" term is a convenient way to simplify the analysis, but it also reflects the dominant role that capital has played in thinking on economic growth over the years. In most models, insufficient capital is seen as the binding constraint on growth. Labor is usually assumed to be in plentiful supply, based on the observation of unemployed or underemployed workers. Thus, in this formulation, increasing the amount of capital available for each worker is seen as key to growth.

Factor accumulation is shown in Figure 3–1a as a movement to the right along the *x*-axis. As the economy accumulates more capital for each of its workers, output expands, shown by the upward slope of the production function. Note that this particular production function begins to flatten out as capital per worker expands, a characteristic that we explore more fully later. In this case, as the value of capital

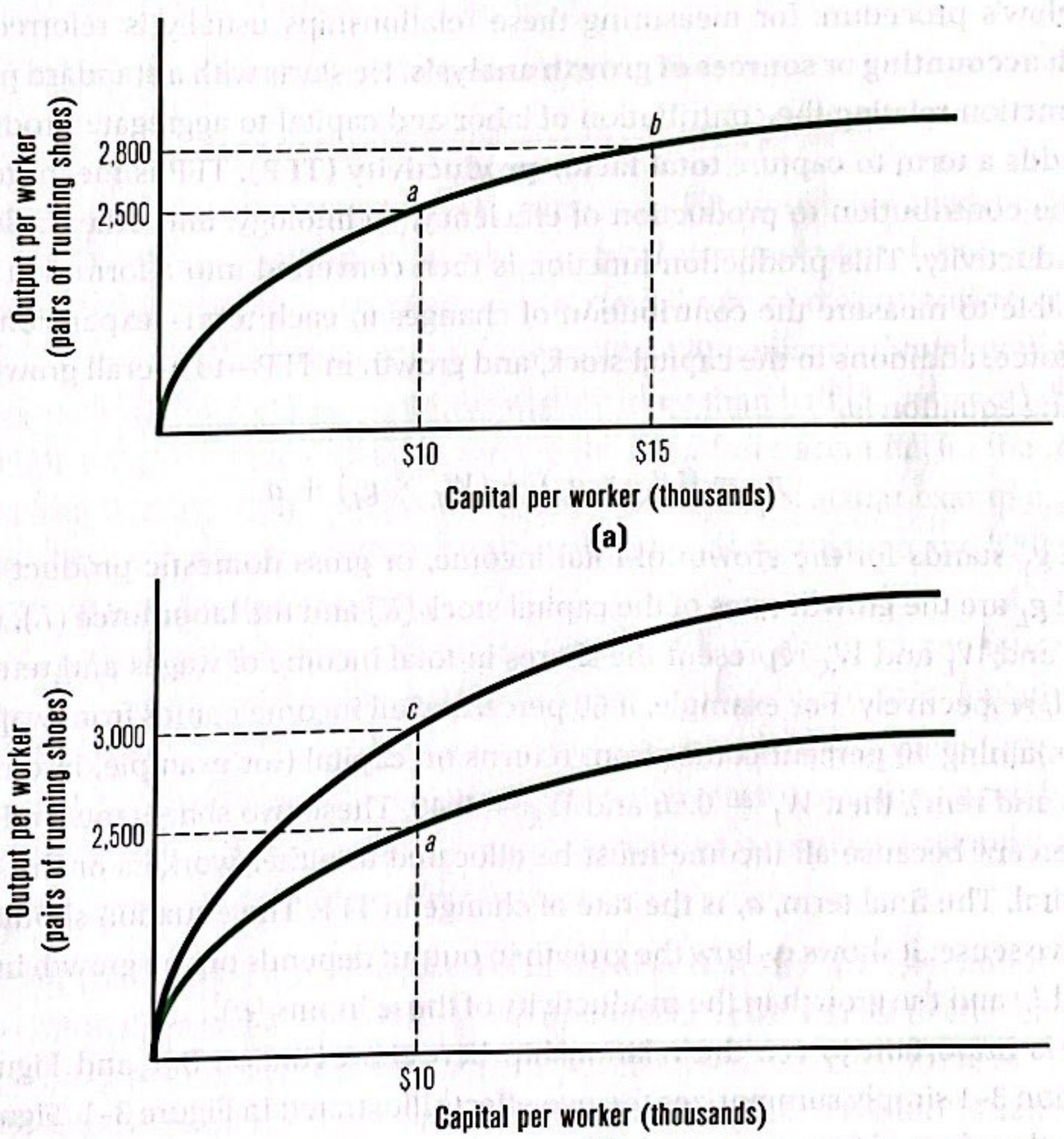

FIGURE 3-1 Basic Sources of Economic Growth

(a) Factor accumulation. As capital per worker expands, output per worker increases. (b) Productivity gains. As the factors of production are used more efficiently or the economy acquires new technology, the same level of capital per worker can produce more output.

per worker increases from $10,000 to $15,000, output per worker grows from 2,500 to 2,800 pairs of shoes. The movement from point *a* to point *b* on the production function is the process of economic growth. Of course, growth of this magnitude (12 percent) does not happen instantaneously. It might take two years or so, in which case the annual rate of growth would be a brisk 5.8 percent.

Figure 3–1b shows the relationship between productivity change and economic growth. As factors of production are used more efficiently or as new technology is adopted, the production function shifts upward. With this productivity gain, any amount of capital per worker produces more output than it did before. The production function shifts upward so that $10,000 worth of capital per worker can now produce 3,000 pairs of running shoes, whereas it originally produced 2,500 pairs. This expansion of output of 20 percent might take four years, in which case the annual rate of growth would be 4.7 percent. In this case, the movement along the path from point *a* to point *c* depicts the process of economic growth through productivity gains.

Solow's procedure for measuring these relationships usually is referred to as **growth accounting** or **sources of growth analysis**. He starts with a standard production function relating the contribution of labor and capital to aggregate production, then adds a term to capture **total factor productivity (TFP)**. TFP is meant to measure the contribution to production of efficiency, technology, and other influences on productivity. This production function is then converted into a form that makes it possible to measure the contribution of changes in each term—expansion of the labor force, additions to the capital stock, and growth in TFP—to overall growth. The resulting equation is

$$g_Y = (W_K \times g_K) + (W_L \times g_L) + a \qquad [3\text{–}1]$$

where g_Y stands for the growth of total income, or gross domestic product (GDP); g_K and g_L are the growth rates of the capital stock (K) and the labor force (L), respectively; and W_L and W_K represent the shares in total income of wages and returns on capital, respectively. For example, if 60 percent of all income comes from wages and the remaining 40 percent comes from returns on capital (for example, interest payments and rent), then $W_L = 0.60$ and $W_K = 0.40$. These two shares must add up to 100 percent because all income must be allocated to either workers or the owners of capital. The final term, a, is the rate of change in TFP. The equation should make intuitive sense: It shows us how the growth in output depends on the growth in inputs (K and L) and the growth in the productivity of those inputs (a).

It is important to see the relationship between equation 3–1 and Figure 3–1. Equation 3–1 simply summarizes the two effects illustrated in Figure 3–1. Figure 3–1a shows the effect of factor accumulation on output, while Figure 3–1b illustrates productivity growth as a vertical shift of the production function (for example, getting more output per unit of input). Equation 3–1 combines these two dimensions of growth in a way that allows us to distinguish between them. The first two terms on the right-hand side of the equation, $(W_K \times g_K) + (W_L \times g_L)$, describe movements

along the production function (that is, using more inputs to increase output). TFP growth (indicated by a in equation 3–1) measures the upward shift in the production function in Figure 3–1b.

The basic procedure is to substitute actual data for all the variables in equation 3-1 except a, which cannot be measured directly, then calculate a as the residual. This is the famous **Solow residual**. In this way, the contribution of each of these variables to growth can be measured and identified. A straightforward numerical example illustrates the way in which this equation is used. From the statistical records of a developing country, we find the following values for the variables in the equation:

$g_Y = 0.05$ (GDP growth rate of 5 percent a year).
$g_K = 0.07$ (capital stock growth of 7 percent a year).
$g_L = 0.02$ (labor force growth of 2 percent a year).
$W_L = 0.6$ (the share of labor in national income is 60 percent).
$W_K = 0.4$ (the share of capital is 40 percent).

By substituting these figures into equation 3–1, we get

$$0.05 = (0.4 \times 0.07) + (0.6 \times 0.02) + a$$

Solving for a, we find that $a = 0.01$, meaning that TFP growth is 1 percent per year. These figures tell us the degree to which capital accumulation, labor accumulation, and TFP growth each contribute to the overall rate of output growth of 5 percent. TFP growth of 1 percent counts for one fifth (20 percent) of total growth. The growth in the capital stock accounts for slightly more than half (56 percent) the total growth: $(0.4 \times 0.07)/0.05$. Finally, growth in the labor force accounts for the remaining 24 percent of total growth: $(0.02 \times 0.6)/0.05$. In this particular example, capital accumulation is the main driver of growth, with labor accumulation and TFP growth each contributing similar amounts.

This type of accounting analysis has been used widely in many countries to examine the sources of growth, with particular attention paid to calculating TFP growth. Before examining some of these results, however, it is important to recognize the limits of this kind of study, arising from the fact that we can estimate productivity growth only as the residual output growth unexplained by having used more inputs. There are at least two kinds of problems:

- First, a represents a combination of influences that this analysis cannot entirely disentangle. Should improvements in a be attributed to efficiency gains stemming from improved trade policies, reduced corruption, or streamlined bureaucratic procedures? Or are they due to the introduction of faster computers, new seed varieties for agricultural crops, or other technologies? The limited growth accounting framework cannot definitively answer these questions without adding many more variables for which data do not exist (although that has not stopped analysts from assigning their own favorite explanation to the results).

- Second, *a* invariably is measured inaccurately because it is the residual in the equation. All economic data are measured with some inevitable errors, including all the data used in equation 3–1. As a result, in addition to TFP, *a* captures the net effect of all the errors and omissions in the other data.

What is labeled TFP actually, in practice, is a combination of errors in the data, omission of other factors that should be included in the growth equation, and efficiency gains and changes in technology. As a result, there is a danger in trying to read too much into these data when analysts interpret them as strictly efficiency gains or the effects of new technology. Rather than truly being TFP growth, *a* simply is the part of measured growth that cannot be explained by data on the traditional factors of production. For this reason, economist Moses Abramovitz famously referred to the residual *a* as a "measure of our ignorance" about the growth process.[5]

Sources of growth analyses have been carried out for many countries. Solow's initial study on the United States attributed a surprisingly large share of growth to the residual and a correspondingly small share to changes in the capital stock: 88 percent to TFP growth and only 12 percent to increases in capital per worker. Subsequent work by Abramovitz, Edward Denison, Zvi Griliches, Dale Jorgenson, and others attempted to measure, in a more precise way, the contribution of various inputs to the growth process. They divided labor into different skill categories, based on the amounts of formal education workers had received. A worker having a high school education and earning $50,000 a year is treated as the equivalent of two people having only primary school education and earning $25,000 a year each. Similar procedures are used to measure the increase in productivity that occurs when workers shift from low-productivity occupations in rural areas to higher-productivity occupations in urban areas. Other methods are used to measure improvements in the quality of capital and increasing economies of scale.

Many of these more detailed analyses of the U.S. economy found results similar to Solow's initial work: The bulk of the growth process could be attributed to the residual, with relatively small amounts apportioned to various categories of labor, capital, and other inputs. Over the years, many more studies have been completed for the industrialized countries. Increases in the capital stock frequently account for less than half the increase in output, particularly in rapidly growing countries. These results came as a bit of a surprise for most economists because most basic models put capital formation at the heart of the growth process.

Similar studies have now been carried out for a wide range of developing countries. Data problems and price distortions tend to be more severe for developing countries than for the industrialized countries, making the results even harder to interpret. Few developing countries, for example, have reliable measures for differences in the quality of alternative capital input and labor skill categories.

[5]Abramovitz, "Resource and Output Trends in the United States since 1870."

Generally speaking, sources of growth analyses in developing countries attribute a larger role to capital formation than in the industrialized country studies. This is consistent with the idea that developing countries have lower levels of capital per worker than the industrialized countries and can catch up (or converge incomes) through the investment process. Much of the capital equipment imported by developing countries (counted as investment) embodies advances in technology. Therefore, the mobilization of capital remains a major concern of policy makers in developing countries.

Economists Barry Bosworth and Susan Collins explored the relative contributions of physical capital, human capital (in the form of education), and TFP to economic growth in a large number of countries around the world between 1970 and 2000. Some of their results are shown in Table 3–2.[6] As with other studies, they found a fairly consistent pattern that capital accumulation was the main contributor to growth for developing countries, whereas for industrialized countries, the main contributions were more evenly split between capital accumulation and TFP growth. In East Asia, capital accumulation accounted for about two-thirds of total growth, with TFP growth accounting for a smaller share. In comparing TFP growth across countries, the rapidly growing East Asian economies generally (but not always) recorded faster TFP growth than did developing countries from other regions of the world. TFP growth in East Asia was generally faster than that of the industrialized countries during the 1970s and 1980s and about the same during the 1990s.

Average TFP growth was negative in all three decades in Africa, during the 1980s in Latin America, during the 1970s in South Asia, and during the 1970s and 1990s in the Middle East! What does this mean? Inputs actually became less productive over time. This might be the result of capital and labor lying idle, as often happens during wars, political unrest, or recessions. During Latin America's deep recession, induced by the debt crisis of the 1980s, growth was negative while new investment was essentially zero, implying less productive use of existing capital. Negative TFP growth also might reflect the accumulation of increasingly unproductive assets, like presidential palaces or so-called white elephant projects. For example, Ethiopia built one of the largest tanneries in the world, but it usually operates at a fraction of its capacity, and Nigeria's Ajaokuta Steel factory cost nearly $5 billion in construction costs over 25 years and has yet to produce any steel.

In a more recent study, Bosworth and Collins provide a detailed comparative analysis of the sources of growth in the world's two most populous countries—India and China.[7] Since 1980, GDP per capita has more than doubled in India and increased more than sevenfold in China. While China's growth has been driven by its

[6]Susan M. Collins and Barry Bosworth, "The Empirics of Growth: An Update," *Brookings Papers on Economic Activity* 2 (2003), 113–79.

[7]Barry Bosworth and Susan M. Collins, "Accounting for Growth: Comparing India and China," *Journal of Economic Perspectives*, 22, no. 1 (Winter 2008), 45–66.

TABLE 3-2 Sources of Growth in East Asia and Other Regions, 1960–2000 (Average Annual Growth Rate, Percent)

		CONTRIBUTION BY COMPONENT		
	GROWTH OF OUTPUT PER WORKER	PHYSICAL CAPITAL PER WORKER	EDUCATION PER WORKER	TOTAL FACTOR PRODUCTIVITY
Brazil				
1970s	4.86	2.02	0.12	2.72
1980s	−1.63	0.16	0.68	−2.47
1990s	0.71	0.07	0.38	0.25
Ecuador				
1970s	5.96	1.05	0.89	4.03
1980s	−1.42	−0.28	0.16	−1.30
1990s	−1.40	−0.46	0.31	−1.24
Egypt				
1970s	4.39	2.33	0.54	1.52
1980s	2.91	1.98	0.89	0.03
1990s	1.46	−0.12	0.64	0.94
Ethiopia				
1970s	0.55	0.22	0.13	0.20
1980s	−1.74	1.11	0.27	−3.12
1990s	1.84	0.81	0.29	0.74
Ghana				
1970s	−2.01	−0.24	0.24	−2.00
1980s	−1.14	−1.23	0.15	−0.07
1990s	1.62	0.80	0.16	0.65
India				
1970s	0.70	0.61	0.36	−0.27
1980s	3.91	1.06	0.36	2.48
1990s	3.13	1.35	0.49	1.29
Singapore				
1970s	4.41	3.53	0.11	0.78
1980s	3.79	2.01	0.39	1.38
1990s	5.08	1.96	0.91	2.22
Taiwan				
1970s	5.93	3.69	1.11	1.14
1980s	5.36	2.19	0.24	2.94
1990s	4.84	2.66	0.41	1.77
United States				
1970s	0.83	0.11	0.71	0.01
1980s	1.82	0.55	0.12	1.15
1990s	1.84	0.74	0.11	0.98
Africa				
1970s	1.03	1.28	0.08	−0.32
1980s	−1.06	−0.07	0.42	−1.41
1990s	−0.16	−0.09	0.40	−0.48
East Asia				
1970s	4.27	2.74	0.67	0.86
1980s	4.36	2.45	0.66	1.25
1990s	3.36	2.35	0.50	0.52

Industrial countries				
1970s	1.75	0.95	0.52	0.28
1980s	1.82	0.69	0.24	0.90
1990s	1.52	0.75	0.22	0.54
Latin America				
1970s	2.69	1.25	0.34	1.10
1980s	−1.77	0.04	0.47	−2.28
1990s	0.91	0.16	0.34	0.41
Middle East				
1970s	1.92	2.08	0.45	−0.61
1980s	1.15	0.55	0.53	0.07
1990s	0.84	0.34	0.52	−0.01
South Asia				
1970s	0.68	0.56	0.34	−0.23
1980s	3.67	1.02	0.40	2.25
1990s	2.78	1.19	0.42	1.17

Source: Susan M. Collins and Barry Bosworth, "The Empirics of Growth: An Update," *Brookings Papers on Economic Activity* 2 (2003), 113–79.

industrial sector, India's less traditional growth pattern has been driven by its service sector. Comparing these two economies in the aggregate for the years 1978–2004, Bosworth and Collins estimate that TFP growth accounted for just under half of the growth in output per worker in both countries. Yet, the absolute rate of TFP growth in China over that period was 3.6 percent per year compared with 1.6 percent per year in India. The contribution of TFP to growth in output per worker in India and China, they find, differs sharply from the broader pattern in East Asia (excluding China), where average TFP growth was slower (0.9 percent per year) and accounted for less than 25 percent of growth in output per worker.

The aggregate figures for the contribution of TFP to output growth in Sub-Saharan Africa presented in Table 3–2 are bleak. Yet, a more recent and more detailed analysis of that region by economist Steven Radelet demonstrates that for the 17 countries of the region that succeeded in stabilizing their economic and political circumstances by the mid-1990s, average TFP growth rates soared from negative and unstable rates to positive TFP growth since 1995 on the order of 1.5 percent per year.[8] In summary, sources of growth analyses suggest that capital accumulation is the main source of growth for developing countries, consistent with the Solow growth model. TFP can play an important part in the growth process in the appropriate

[8]Steven Radelet, *Emerging Africa: How 17 Countries Are Leading the Way*. Washington, DC: Center for Global Development, 2010. Radelet's 17 emerging African countries are Botswana, Burkina Faso, Cape Verde, Ethiopia, Ghana, Lesotho, Mali, Mauritius, Mozambique, Namibia, Rwanda, São Tomé and Príncipe, Seychelles, South Africa, Tanzania, Uganda, and Zambia.

policy and structural context. In rapidly growing economies, both factor accumulation and TFP growth appear to play an important role. TFP growth tends to become more important as income rises and is a major contributor to growth in the high-income industrialized countries.

CHARACTERISTICS OF RAPIDLY GROWING COUNTRIES

We identified the key proximate causes of economic growth: factor accumulation (accumulating additional productive assets) and productivity growth. Productivity growth, in turn, comes either from efficiency gains or new technology. Sustaining economic growth requires both generating new investment and ensuring that the new investment is productive. These basic points, however, raise a new set of questions. What are the more fundamental characteristics that explain a country's ability to attract investment and accumulate capital, increase efficiency, and obtain new technologies? More broadly, what are the deep characteristics that distinguish more rapidly growing economies from slowly growing ones?

A large body of research over the last few decades tried to answer this question by searching for broad characteristics common to rapidly growing economies. Until relatively recently, it was difficult for researchers to systematically examine these issues due to severe data limitations. Many researchers examined trends in individual countries, but it was difficult to draw general conclusions from these case studies. A few pioneering efforts, such as Irma Adelman and Cynthia Taft Morris's *Society, Politics, and Economic Development—A Quantitative Approach*,[9] paved the way for today's cross-country empirical growth research. In recent years, this type of research has grown very rapidly, in line with the emergence of many new and large data sets on income in PPP terms, education levels, health characteristics, quality of governance, and a host of related items.[10]

Most of the recent studies are modeled on research conducted by economist Robert Barro in the early 1990s. These studies try to explain the variance in growth rates across countries. With country growth rates as the dependent variable, this approach examines several variables that might affect growth through one of the channels identified earlier (controlling for the initial level of income in each country). These variables include levels of education and health, policy choices, resource endowments, geographic characteristics (latitude, whether the country is landlocked, etc.), and political systems.

[9]Irma Adelman and Cynthia Taft Morris, *Society, Politics, and Economic Development—A Quantitative Approach* (Baltimore, MD: Johns Hopkins University Press, 1967).

[10]The vast literature on cross-country growth empirics began with Robert Barro, "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics* 106, no. 2 (May 1991), 407–43. For the most comprehensive recent survey of this type of research, see S. Durlauf, P. Johnson, and J. Temple, "Growth Econometrics," in P. Aghion and S. Durlauf eds., *Handbook of Economic Growth* (Amsterdam: North Holland, 2005).

This type of research has been controversial, and there is far from a consensus on the exact group of variables that affects growth.[11] For one thing, although this research starts with the Solow model, for many of the variables tested, there is no well-developed theoretical link between the variable and either economic growth or the proximate causes of growth (factor accumulation or productivity growth). The existing theories on economic growth simply are not explicit enough about exactly what variables determine the shape of the production function, the rate of investment, the profitability of investment, efficiency, and the rate of change in technology. Some characteristics may appear statistically important in one research study that includes a certain group of variables but unimportant in another study with a different group of variables.[12]

A second issue has to do with interpretation of the statistical results. For example, most economists would agree that high saving rates are associated with rapid economic growth. But which causes which? Higher saving can lead to more rapid growth, as suggested by the Solow model, while faster economic growth might provide more disposable income and a higher saving rate (we discuss this issue more in Chapter 10). It is a major statistical challenge to precisely estimate the magnitude of these two effects.

Despite these issues, such empirical growth research has helped analysts better understand some of the broad characteristics associated with rapid growth, albeit very imperfectly. The broad thrust of the conclusions from research across countries is consistent with many studies of individual countries. Although the debate is far from over about which variables influence long-run growth, how they do so, and the magnitude of the effect, this research has helped provide broad clues about why some economies grow faster than others. The most rapidly growing developing countries tend to share six broad characteristics.[13]

1. MACROECONOMIC AND POLITICAL STABILITY

Stability is good for growth. Economic and political instability undermine investment and growth and are especially hard on the poor, who are least able to protect themselves against volatility. Consider the Democratic Republic of the Congo (formerly Zaire), which suffered through inflation rates averaging an astonishing 2,800 percent

[11]For critiques of the cross-country approach, see Durlauf et al., "Growth Econometrics;" and David Lindauer and Lant Pritchett, "What's the Big Idea? The Third Generation of Policies for Economic Growth," *Economia* 3, no. 1 (Fall 2002).

[12]A seminal study on the robustness of explanatory variables across different specifications is Ross Levine and David Renelt, "A Sensitivity Analysis of Cross-Country Growth Regressions," *American Economic Review* 82, no. 4 (September 1992), 942–63.

[13]Economist Xavier Sala-i-Martin has examined a wide range of studies and identified a list of variables that are most consistently and robustly found to be closely associated with economic growth. See Xavier X. Sala-i-Martin, "I Just Ran Two Million Regressions," *American Economic Review* 87, no. 2 (May 1997), 178–83. The specific list of key areas used here is similar to that suggested by Lawrence Summers and Vinod Thomas in "Recent Lessons of Development," *World Bank Research Observer* 8, no. 2 (July 1993), 241–54.

per year between 1990 and 2002 and civil and cross-border wars involving troops from at least five other countries. It is not surprising that its growth and development performance was about the worst in the world: "growth" of −7.2 percent per year (meaning that average incomes fell by 60 percent over 12 years), life expectancy fell from 52 to 45 years, and infant mortality rose from 128 to 139 per thousand.

Relatively low budget deficits over time (with corresponding high rates of government saving), prudent monetary policy (which keeps inflation in check), appropriate exchange rates, suitable financial markets (depending on the stage of development), and judicious foreign borrowing at sustainable levels are the key elements to macroeconomic stability. Stability reduces risk for investors, whether they are multinational conglomerates or coffee farmers considering planting more trees. A high rate of inflation, for example, makes prices and profits much less predictable, undermining growth.[14] Volatile short-term capital flows can lead to wide swings in the exchange rate, affecting prices throughout the economy and undermining investment. In extreme situations, volatile capital flows can lead to full-blown financial crises, as we explore more deeply in Chapter 13.

Political stability is, of course, also good for growth and development. Civil and cross-border wars, military coups, and other incidences of political instability undermine investment and growth. Once again, the poor are the most vulnerable and least able to protect themselves from the consequences of political unrest. In the late 1990s, nearly one-third of the 42 countries in sub-Saharan Africa were embroiled in cross-border or civil wars, which took a huge toll on human lives, infrastructure, institutions, and economic activity and commerce. Figure 3–2 shows sharp declines in income, averaging 28 percent, after civil war in seven developing countries. By contrast, most of the relatively successful developing countries during the last several decades were politically stable for long periods of time. Although some of the successful countries experienced periods of instability, for the most part they were short-lived. Economist Paul Collier and others have pointed out the insidious negative cycle of civil war in low-income countries: poverty increases the risk of conflict, and conflict undermines growth and entrenches poverty.[15] Of course, the absence of war is no guarantee of economic growth. Cuba, Jamaica, and Kenya were politically stable for decades but still experienced low growth.

[14]The negative association between inflation and growth has been demonstrated in numerous studies, prominent among them Robert Barro, "Inflation and Growth," *Review* [Federal Reserve Bank of St. Louis] 78, no. 3, 153–69 (May–June 1996).

[15]See Paul Collier, "On the Economic Consequences of Civil War," *Oxford Economic Papers* 51 (1999), 168–83; and Paul Collier, V. L. Elliot, Håvard Hegre, Anke Hoeffler, Marta Reynal-Querol, and Nicholas Sambanis, *Breaking the Conflict Trap: Civil War and Development Policy* (Washington, DC: World Bank and Oxford University Press, 2003). Collier summarizes this and related work in *The Bottom Billion: Why the Poorest Countries are Failing and What Can Be Done About It,* (Oxford: Oxford University Press, 2007).

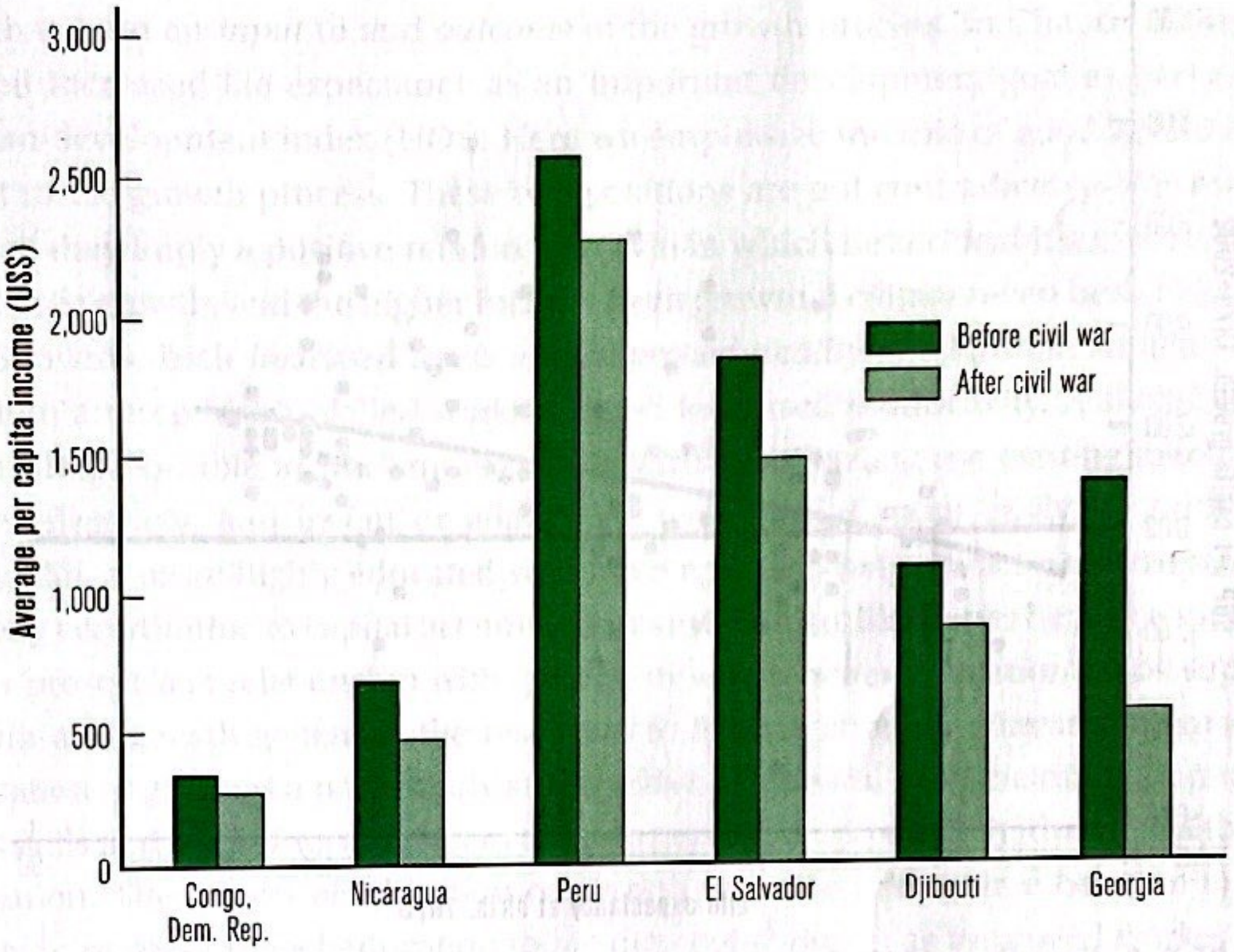

FIGURE 3–2 GDP per Capita before and after a Civil War

In these six countries, average income was 28 percent lower after the civil war than before.

Sources: Civil war data from Paul Collier, V. L. Elliot, Håvard Hegre, Anke Hoeffler, Marta Reynal-Querol, and Nicholas Sambanis, *Breaking the Conflict Trap: Civil War and Development Policy* (Washington, DC: World Bank and Oxford University Press, 2003). Gross domestic product per capita data from *World Development Indicators 2004*, (Washington, DC: World Bank), http://data.worldbank.org/data-catalog/world-development-indicators.

2. INVESTMENT IN HEALTH AND EDUCATION

Countries with *longer life expectancy* (and therefore better health) tend to grow faster, after accounting for other factors affecting growth, as shown in Figure 3–3.[16] A longer life expectancy indicates general improvements in the health of a population, which in turn means a healthier and more productive labor force. Thus, one way that life expectancy affects growth is by influencing productivity. In addition, a higher life expectancy might also boost saving and capital accumulation because businesses may be more likely to invest where workers are healthier and more productive. Moreover, people are more likely to invest in education to deepen their skills if they expect to live longer and reap greater benefits. Accessible basic healthcare facilities, clean water and sanitation, disease control programs, and strong reproductive and

[16]See, for example, World Health Organization, *Macroeconomics and Health: Investing in Health for Economic Development, Report of the Commission on Macroeconomics and Health* (Geneva: World Health Organization, 2001). For a brief nontechnical summary, see David E. Bloom, David Canning, and Dean Jamison, "Health, Wealth, and Welfare," *Finance and Development* 41, no. 1 (March 2004), 10–15.

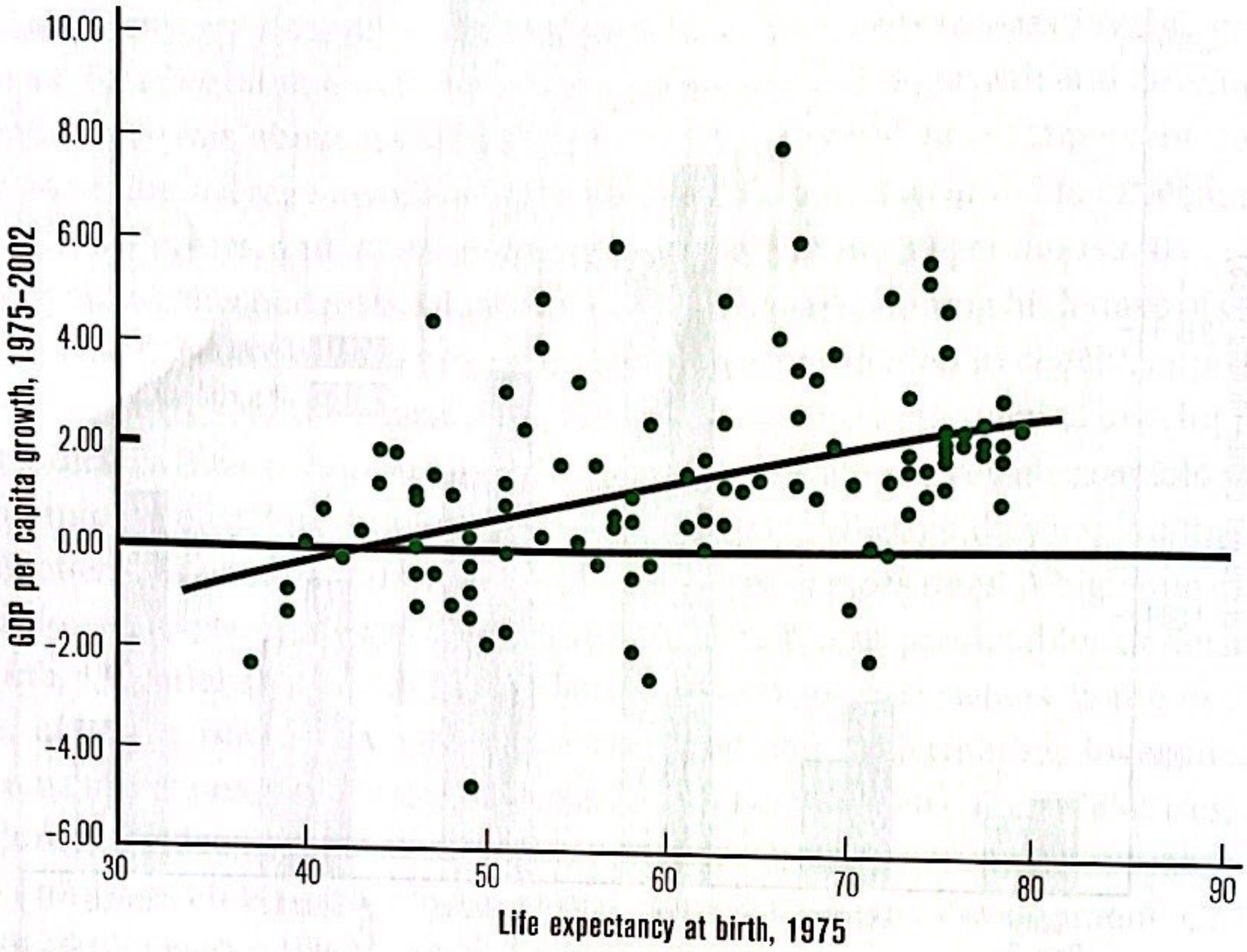

FIGURE 3-3 Growth and Life Expectancy

maternal and child health programs help countries lengthen life expectancy and improve worker productivity.

Malaysia's efforts to reduce malaria and improve health are a good example. When settlers first began to arrive in what is now Kuala Lumpur in the 1850s in search of tin, nearly half died of malaria. A century later, things had improved, but malaria and other diseases were still a problem, and life expectancy in 1960 was just 54 years. Growth during the 1960s was still a respectable 3.4 percent per year. An active government malaria control program began to make significant inroads, and by 1975, the number of malaria cases had been cut by two-thirds relative to 1960. Partly as a result, life expectancy increased to 64 years. Improved health (along with several other factors) contributed to a surge in growth, which accelerated to about 5 percent per year between 1976 and 1996, slowing only in the wake of the 1998 East Asian financial crisis. The incidence of malaria has continued to decline, falling to just above 7,000 confirmed cases in 2009.[17]

Note that the relationship between life expectancy and growth works both ways: Better health helps spur faster growth, and faster growth (and higher income) helps improve life expectancy, as we discuss in more detail in Chapter 9. That is, better

[17]The data on the incidence of malaria come from the World Health Organization, World Malaria Report 2011," available at www.who.int/malaria/world_malaria_report_2011/en, accessed February 2012. The country profile for Malaysia is available at www.who.int/entity/malaria/publications/country -profiles/profile_mys_en.pdf, accessed February 2012.

health is both an *input* to and *outcome* of the growth process. In Chapter 2, we discussed increased life expectancy as an important development goal as part of the human development index (HDI). Here we emphasize the role of good health as an input to the growth process. These two positions are not contradictory—far from it. Rather, they imply a positive reinforcing cycle in which better health supports faster economic growth, and the higher income from growth facilitates even better health.

Similarly, both *increased levels and improved quality of education* should translate into a more highly skilled workforce and increased productivity. A skilled workforce should be able to work more quickly with fewer errors, use existing machinery more effectively, and invent or adapt new technologies more easily. As with better health, a more highly educated workforce may also help attract new investment, thereby contributing to capital accumulation as well. Also, like better health, education has a pro-cyclical relationship with growth, in which better education helps support growth and growth generates the resources to finance stronger educational systems. Education of girls has a particularly strong effect on growth, both the direct impact on their skills and the indirect impact in the next generation on their children's health and education. The impact of education on growth can take a long time because investments in primary school education today may not show up as improved worker productivity for many years. The quality of service delivery is just as important as quantity. It is not enough to build schools and increase enrollment rates; teachers have to show up, be motivated, and have adequate basic supplies (such as textbooks) to do their job.[18]

As discussed in Chapter 8, most micro-level studies in individual developing countries show very high rates of return to education, especially girl's education. However, in macro-level cross-country studies, the statistical strength of the relationship often is relatively modest. This may be due to difficulties in accurately measuring the quantity and quality of education across a large number of countries in a consistent way. It also suggests that a better-educated workforce is no guarantee of more rapid economic growth. Human capital, just like physical capital, can be squandered in an environment that is not otherwise supportive of economic growth.

3. EFFECTIVE GOVERNANCE AND INSTITUTIONS

The role of governance and institutions in economic growth in development began to receive serious attention only beginning in the early 1990s (Box 3–3). This work was heavily influenced by the research and writing of Nobel Prize–winning economist Douglass C. North of Washington University.[19] Since that time, many studies have found a positive relationship between economic growth and the strength of the rule

[18]These issues are explored more deeply in Chapter 8 and in the World Bank's world development report, *Making Service Work for Poor People* (Washington, DC: World Bank and Oxford University Press, 2004).

[19]See, for example, Douglass C. North, *Institutions, Institutional Change, and Economic Performance* (New York: Cambridge University Press, 1990).

BOX 3-3 INSTITUTIONS, GOVERNANCE, AND GROWTH[a]

The role of institutions and governance in supporting and sustaining economic growth began to receive strong attention in the 1990s, following the path-breaking work by Nobel Prize–winning economist Douglass C. North.[b] In its broadest definition, institutions include a society's formal rules (for example, constitutions, laws, and regulations), informal constraints (such as conventions, norms, traditions, and self-enforced codes of conduct), and the organizations that operate within these rules and constraints.[c] There are many different kinds of institutions that influence growth and development. Dani Rodrik and Arvind Subramanian suggest four broad types of economic institutions, to which we add a fifth for political institutions:

- *Market-creating institutions* protect property rights, ensure that contracts are enforced, minimize corruption, and generally support the rule of law. Without these institutions in place, markets are likely not to exist or to perform poorly; by contrast, strengthening them can help boost investment and entrepreneurship. Examples include an independent judiciary, an effective police force, and enforceable contracts.
- *Market-regulating institutions* deal with market failures, such as imperfect information and economies of scale. These institutions limit monopoly power and help provide the basis for building and managing public goods, such as roads and fisheries. Examples include regulatory agencies in telecommunications, transportation, water and forestry resources, and financial services.
- *Market-stabilizing institutions* ensure low inflation, minimize macroeconomic volatility, ensure fiscal stability, and avert financial crises. Central banks, exchange rate systems, ministries of finance, and fiscal and budgetary rules are all market-stabilizing institutions.
- *Market-legitimizing institutions* provide social protection and insurance, focus on redistribution, and manage conflict. These institutions help

[a]This text draws heavily on the discussion of institutions found in *Finance and Development* 40, no. 2 (June 2003), particularly Dani Rodrik and Arvind Subramanian, "The Primacy of Institutions (and What This Does and Does Not Mean)"; and Jeffrey D. Sachs, "Institutions Matter, but Not for Everything."

[b]Douglass C. North, *Institutions, Institutional Change, and Economic Performance* (New York: Cambridge University Press, 1990).

[c]North distinguishes between the formal rules and informal constraints (which he includes in his definition of institutions) and organizations (which he excludes). He refers to institutions as the "rules of the game" and organizations as "the players." In common usage, however, many people use the term *institutions* to cover both the rules and the organizations.

protect individuals and corporations from shocks or disasters or from adverse market outcomes. Examples include pension systems, unemployment insurance schemes, welfare programs, and other social funds.

- *Political institutions* determine how society is governed and the extent of political participation. In many countries, there is a strong focus on the key institutions that support democracy, including a free press, elections, competitive political parties, and participatory politics.

A large body of evidence now shows a robust relationship between stronger institutions, rapid economic growth, and improved development outcomes. The evidence is based partly on major advancements in the ability to better measure governance and institutions, such as the data compiled by Dani Kaufmann and Aart Kraay at the World Bank Institute.[d] Strong institutions are central to managing financial systems, building public education and health systems, ensuring efficient trade and commerce, and governing legal systems. Much of neoclassical economic theory on well-functioning markets is based on the assumption that fundamental institutions are in place (such as contract enforcement, perfect information, and the rule of law). But in many low-income countries, these key institutions are weak or nonexistent.

Understanding the importance of institutions for growth brings us only so far, however. Economic analysis tells us very little about the specific forms of institutions that are best suited for a particular environment (for instance, common law versus civil law). There is significant debate about which institutions are most important for low-income countries, their specific form, and the relative importance of institutions versus other factors. Although some analysts claim that institutions dominate all other factors in the growth process, the bulk of the evidence suggests that other factors play an important role, such as policies, geography, and resource endowments. Much of the research indicates that institutions themselves are heavily influenced by geography, history, resource endowments, and the extent of integration with the global economy.

Perhaps even more important, theory and research do not tell us much about how institutions change and how a country with weak institutions can best strengthen them. Institutions change only slowly, but fortunately they do change. Deepening our understanding of how institutions affect growth and development, the appropriate form for institutions in different circumstances and how institutions change over time are major challenges for economists and development specialists in the future.

[d]Available at http://info.worldbank.org/governance/wgi/index.asp.

of law, the extent of corruption, property rights, the quality of government bureaucracies, and other measures of governance and institutional quality.[20]

Stronger governance and institutions help improve the environment for investment by reducing risk and increasing profitability. Investors are more likely to make long-term investments where they feel property rights are secure and their factory, machines, or land will not be confiscated. Strong legal systems can help settle commercial disputes in a predictable, rational manner. Low levels of corruption help reduce the costs of investment, reduce risks, and increase productivity, as managers focus their attention on production rather than influencing politicians and government officials. Strong government economic institutions, such as the central bank, ministry of finance, ports authority, and ministry of trade can help establish effective government policies that influence both factor accumulation and productivity.

The most effective governments established institutions that helped facilitate (rather than hinder) strong economic management, effective social programs, and a robust private sector. Governance in the most rapidly growing countries varied widely from very effective (Singapore and Botswana) to more mixed (Indonesia and Thailand) but generally was better than in slower-growing countries.

4. FAVORABLE ENVIRONMENT FOR PRIVATE ENTERPRISE

Sustained economic growth requires millions of private individuals to make decisions every day regarding saving, investment, education, and job opportunities. Small-scale farmers, business owners, factory workers, and market stall vendors all strive daily to increase their incomes, and the regulatory and policy environment has a significant effect on their success or failure. For many countries, *agricultural policies* are central to the growth process. Where governments have pushed farm-gate prices low to keep food prices cheap or forced farmers to sell their products to government-owned marketing boards, agricultural production (and farmer income) has suffered. The most dramatic example of reducing restrictions of farmers is China's moves to decollectivize agricultural production in the early 1980s and to allow farmers to sell their produce on markets. China's agricultural output soared in the decade that followed. Farmers need reasonable access to fertilizers, seeds, and pesticides, and the construction of rural roads has had a dramatic impact on rural incomes in many countries, such as Indonesia. Absolute free markets are not necessarily the solution—some countries have subsidized fertilizer or other inputs to encourage their use,

[20]See, for example, Stephen Knack and Philip Keefer, "Institutions and Economic Performance: Cross Country Tests Using Alternative Institutional Measures," *Economics and Politics* 7, no. 3 (1995), 207–27; Daniel Kaufmann, Aart Kraay, and Pablo Zoido-Lobatón, "Governance Matters," World Bank Policy Research Paper No. 2196, October 1999; World Bank, Washington, DC; and Daron Acemoglu, Simon Johnson, and James Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review* 91, no. 5 (December 2001), 1369–401.

whereas others have used buffer stocks to counter large swings in prices—but policies that consistently push against markets (rather than helping strengthen markets) almost always fail in the long run.

The climate for small-scale businesses and manufacturing is also important for long-term growth. While some regulation is crucial for well-functioning markets, most governments in developing countries impose unnecessarily high costs on businesses through licensing, permits, and other restrictions. Hernando de Soto's *The Mystery of Capital* demonstrated the damaging effects of heavy business regulation and weak property rights.[21] When the regulatory burden to start a business is high, fewer entrepreneurs bother to start businesses, and when they do, they tend to operate on a smaller scale and in the informal sector. Moreover, government investments in infrastructure, at the core of capital formation, are central. No matter how favorable the policy environment, businesses cannot operate if the electricity shuts off every day, the water is brown, and the phones do not work.

5. TRADE, OPENNESS, AND GROWTH

Most economists agree that international trade plays an important role in economic growth. In discussing this role, however, it is important to distinguish between the volume of trade and trade policy. Economists Jeffrey Frankel and David Romer surmounted significant statistical challenges to demonstrate that trade (as a proportion of GDP) causes growth.[22] They find that a 1 percentage point increase in the ratio of trade to a country's GDP increases income per capita by at least 0.5 percent. Trade, they conclude, plays this role by encouraging countries to accumulate both physical and human capital and by increasing productivity. This finding is consistent with earlier studies that hypothesized trade could contribute to growth by facilitating transfers of both capital and technology and by creating incentives for competitiveness. Yet the conclusion that trade as a share of GDP contributes to growth says nothing directly about the relationship between trade *policy* and growth.

Casual observation suggests that outward orientation (a set of policies designed to encourage exports) contributes to growth. For instance, it's widely accepted that outward-oriented trade policies contributed to the rapid growth of many economies in East Asia, whereas inward-oriented trade policies (that had the effect of discouraging exports) contributed to slow growth in much of Latin America and sub-Saharan Africa. Yet, economists continue to debate the evidence in support of such

[21]Hernando de Soto, *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else* (New York: Basic Books, 2000). The World Bank and International Finance Corporation maintain an extensive program to monitor the costs of doing business in 183 economies. Data and publications from the Doing Business project are available at www.doingbusiness.org, accessed February 2012.

[22]Jeffrey Frankel and David Romer, "Does Trade Cause Growth?" *American Economic Review* 89, no. 3 (June 1999), 379–99.

conclusions. Part of the controversy lies in constructing measurable indicators of trade policy orientation. For instance, economist David Dollar constructed an indicator of outward orientation based on real exchange rate distortion and volatility.[23] He found that, for the period 1976–85, the developing countries that were most open to trade had an average annual growth rate of 2.9 percent per capita, whereas the most closed portion of his sample countries experienced negative growth of −1.3 percent.

In a highly influential study, economists Jeffrey Sachs and Andrew Warner constructed a composite indicator of openness to trade in which countries were deemed either open or closed based on several trade policy indicators.[24] They found openness to have a substantial influence on growth, concluding that open countries (between 1970 and 1989) grew at least 2 percentage points faster on average than did closed countries. Applying the Sachs-Warner indicator to a longer time period, economists Romain Wacziarg and Karen Horn Welch found that open economies over the period 1950–1998 had an average growth rate of income per capita of 2.7 percent as compared with an average growth of of 1.18 percent in closed economies, a margin of nearly 1.5 percentage points.[25] In a prominent response to these studies, however, economists Francísco Rodriguez and Dani Rodrik question the validity, interpretation, and robustness of these policy indicators, concluding that the evidence linking pro-trade policies to growth remains inconclusive.[26] We address these issues in depth in Chapters 17 and 18.

6. FAVORABLE GEOGRAPHY

A striking fact is that there are no rich economies located between the Tropic of Cancer and the Tropic of Capricorn other than Singapore and a few small, oil-rich countries. Figure 3–4 shows that the poorest countries in the world are almost all in the tropics, while the richest countries tend to be in more temperate zones. Even within the temperate zones, the regions closer to the tropics tend to be less well off: Northern Europe is richer than southern Europe, the northern part of the United States is wealthier than the southern parts, and southern Brazil is better off than the north part of the country. In Latin America and Africa, the wealthiest countries are located in the temperate south: Chile, Argentina, and South Africa.

[23]David Dollar, "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976–1985," *Economic Development and Cultural Change*, 40, no. 3 (April 1992), 523–44.

[24]Jeffrey Sachs and Andrew Warner, "Economic Reform and the Process of Global Integration," *Brookings Papers on Economic Activity* 26 (1995), 1–118.

[25]Romain Wacziarg and Karen Horn Welch, "Trade Liberalization and Growth: New Evidence," *World Bank Economic Review* 22, no. 2 (June 2008), 187–231.

[26]Francísco Rodriguez and Dani Rodrik, "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence" (pp. 261–338), in Ben S. Bernanke and Kenneth Rogoff, eds., *NBER Macroeconomics Annual 2000* (Cambridge, MIT Press: National Bureau of Economic Research, 2001).

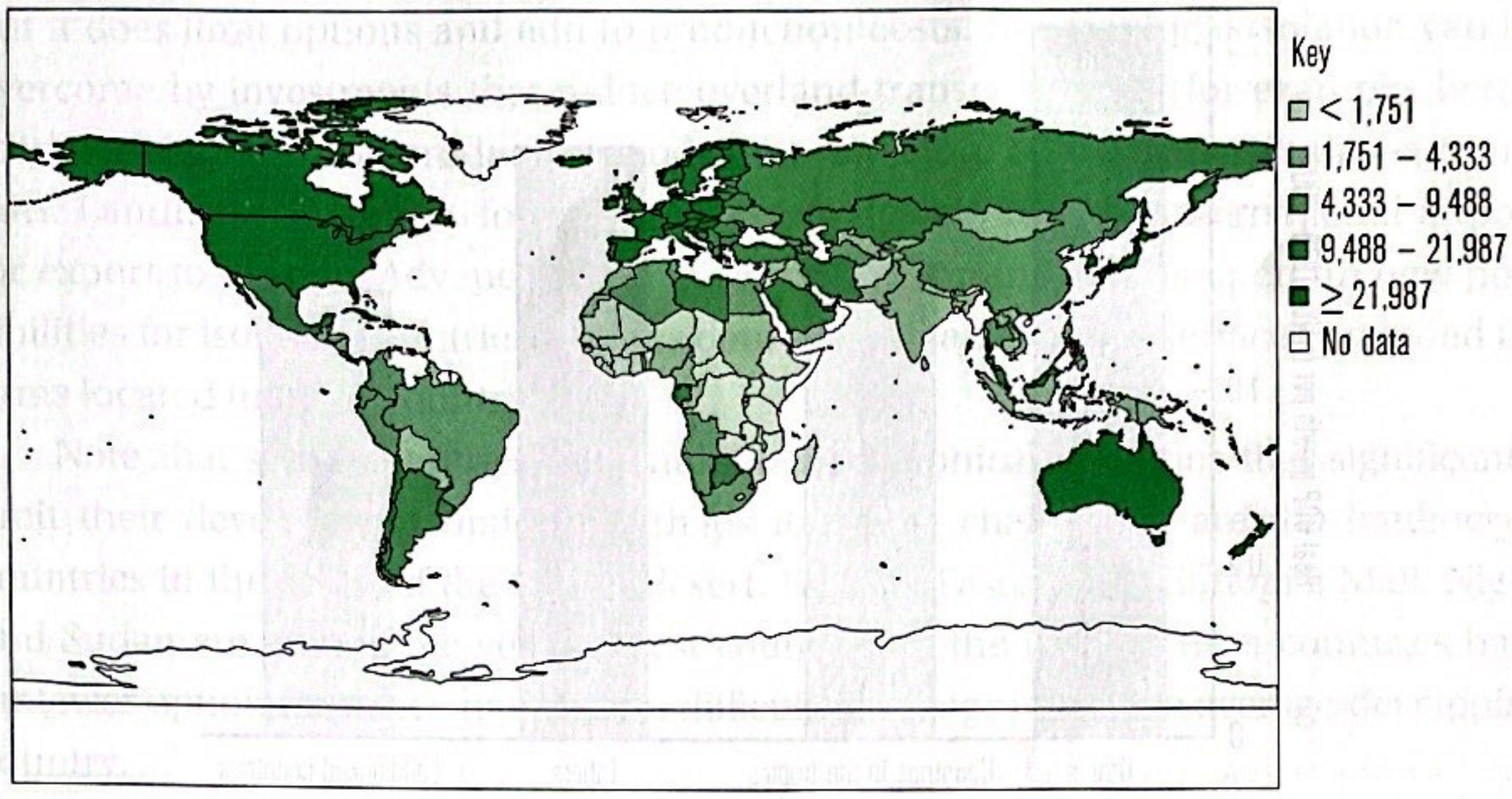

FIGURE 3–4 Income Levels and Geography

Data are gross domestic product per capita in 2009 (constant 2005 international dollars, PPP).

Source: World Bank, "World Bank Indicators," http://databank.worldbank.org.

Several studies have shown a strong relationship between location in the tropics, other geographical characteristics, and growth.[27] Figure 3–5 shows that the average growth rate per capita between 1975 and 2009 for countries located in the tropics was significantly lower than for countries outside the tropics. Tropical countries have to deal with a greater burden from virulent diseases, erratic climate, and at least in some areas, very poor-quality soil for agriculture. Most of the world's most virulent diseases are centered in the tropics, including malaria and HIV/AIDS. These diseases seriously undermine worker productivity and add to healthcare costs. Similarly, although erratic climate can occur anywhere around the world, floods, droughts, and violent storms tend to be more concentrated in the tropics. Hurricanes and typhoons, of course, are by definition tropical phenomena. Hotter climates make a long, hard day of outdoor work much more difficult, reducing labor productivity (one way Singapore has compensated for being in the tropics is by air-conditioning the vast majority of buildings in the country, a step that is much easier for a small city-state like Singapore than for most other countries). And while some tropical regions have very fertile soils (as in the rich lands in Java, one of the main islands of Indonesia), most of the great Sahara desert is in the tropics, as are the arid lands of northern Brazil. These characteristics work to reduce both factor productivity and

[27]Studies that explore the impact of geographical factors on levels of income and growth rates include Robert Hall and Charles Jones, "Why Do Some Countries Produce So Much More Output per Worker Than Others?" *Quarterly Journal of Economics* 114 (February 1999), 83–116; and John Gallup and Jeffrey Sachs, "Geography and Economic Development" (127–78), in Boris Pleskovic and Joseph Stiglitz, eds., *World Bank Annual Conference on Development Economics 1998* (Washington, DC: World Bank, 1998).

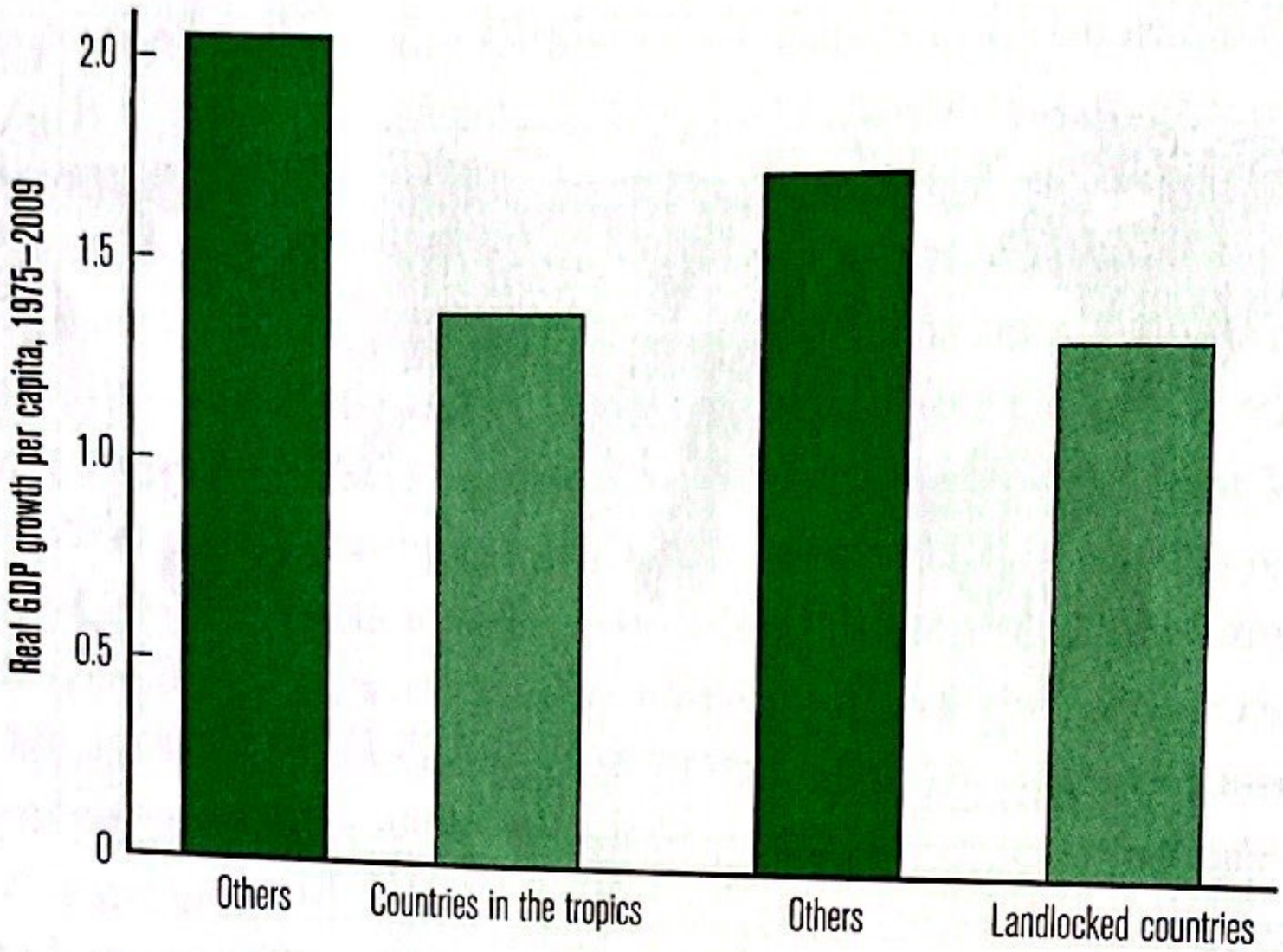

FIGURE 3–5 Geography and Growth

GDP, gross domestic product.

Source: Penn World Tables 7.0, http://pwt.econ.upenn.edu/php_site/pwt_index.php, accessed May 2011.

the incentives for investment and factor accumulation. Location in the tropics does not necessarily preclude growth and development because some of the burdens can be alleviated at least partially through policies and institutional development, but it clearly creates difficulties and obstacles that make growth and development more difficult.

Another geographical feature that can affect growth is isolation from major markets, such as for landlocked countries and for small island nations (for example, located in the Pacific Ocean). These isolated countries face higher transport costs and fewer economic opportunities than do coastal economies and countries located nearer to major markets. Landlocked African countries face overland shipping costs that can be three times higher than their coastal neighbors'. Higher transport costs make imports more expensive, which both reduces income left for consumption and raises production costs. They also make it more expensive to export products to other countries, reducing profits.

Not all landlocked countries have had poor economic performance. Switzerland and Austria are in some ways the exceptions that prove the rule. Although they are landlocked, they are far from being isolated, as they are located in the heart of Europe. Perhaps the clearest exception is Botswana, which has deftly managed its vast diamond mines to generate sustained growth for the last four decades. Figure 3–5 shows that economic growth in landlocked countries has averaged 1.29 percent since 1975 (excluding Bhutan and Botswana, this figure falls to 0.99 percent), while in coastal economies, growth averaged 1.71 percent, about one-third higher (and nearly twice as high excluding Botswana). Being landlocked does not mean growth is impossible,

but it does limit options and add to production costs. Geographical isolation can be overcome by investments that reduce overland transport costs (for example, better roads or trucks) or by producing goods that rely more on air rather than sea transport. Landlocked Uganda, for example, grows flowers near its international airport for export to Europe. Advancements in satellite communications open up new possibilities for isolated countries, such as data entry or accounting services provided for firms located in other countries.

Note that some countries face multiple geographical obstacles that significantly limit their development options. Perhaps the most challenging are the landlocked countries in the midst of the Sahara desert; Burkina Faso, Chad, Ethiopia, Mali, Niger, and Sudan are among the very poorest countries in the world. These countries have far fewer options and face much more difficult challenges than the average developing country.

These six broad areas are not a complete list of the characteristics that influence factor accumulation, productivity, and economic growth, but they are among the most prominent attributes identified by research and experience. It is important to recognize that this list is not absolute: There is significant variation across countries, and these characteristics are neither a guarantee of success nor a set of rigid requirements for growth. Some countries have done relatively well in many of these areas and still have not experienced rapid economic growth. At the same time, while almost all of the fastest-growing countries score well in most of these areas, some do not. Our understanding of the precise pathways through which each of these factors influence growth is far from complete. However, the evidence does show that these characteristics are among the most important factors supporting factor accumulation, productivity, and growth.

SUMMARY

- Countries have varied widely in their experiences of economic growth since 1960. While some economies, such as Madagascar and Zambia shrank slightly in per capita terms, others such as Botswana and China increased their per capita incomes by factors of 15 to 19 between 1960 and 2009.
- Theories of economic growth have identified several key dimensions of the growth process. Factor accumulation—the expansion of a country's capital stock along with the growth of its labor force—is critical. These are the principal inputs for production of national output.
- In the long run, factor accumulation alone cannot sustain rapid growth in per capita income. Long-run growth depends on being able to produce more output per unit of input. This is the definition of productivity growth. Productivity growth is ultimately a reflection of technical change (which

we can think of as the invention of better recipes for producing national output).

- Productivity growth is measured as a residual. It is the increase in output that is not explained by increased use of inputs. Any errors in the measurement of either inputs or output spill over into our estimate of productivity growth. The goal of sources of growth analysis is to decompose a change in output into the portion explained by the changing use of each input and the unexplained portion that we designate as productivity growth.
- Sources of growth analyses indicate that capital accumulation tends to contribute substantially to growth in low-income countries, while increases in the size and quality of the labor force and productivity growth also make important contributions. Productivity growth tends to account for a larger share of growth in high-income countries.
- Some of the key country characteristics most closely associated with rapid growth include economic and political stability, investments in health and education, strong governance and institutions, a favorable environment for private enterprise (including agricultural, regulatory policies), and more-favorable geography. Participation in international trade is also strongly associated with economic growth. Our understanding of precisely how these and other factors affect the growth process is far from complete.