Globalization and Patterns of Economic Development

By

Jeffrey D. Sachs

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I. Introduction

In *The Wealth of Nations*, published in 1776, Adam Smith predicted that globalization would be a force for economic progress. He wrote that "[t]he discovery of America, and that of a passage to the East Indies by the Cape of Good Hope, are the two greatest and most important events recorded in the history of mankind," since those events would allow "the most distant parts of the world" to "relieve one another's wants" and "encourage one another's industry" (Smith [1776] 1976: Vol. 2, p. 141). Smith held that productivity improvements arise from the division of labor and that the division of labor is limited by the extent of the market, so that an expanded global market would be a spur to economic development. The notion that globalization would result in an acceleration of economic growth has been dramatically confirmed in the past two centuries. Two long phases of globalization, the first dating roughly from 1870 until 1914, and the second, the period from around 1950 till now, have been periods of especially rapid economic growth at the global scale.[1]

Smith sagely stressed that not all parts of the world would benefit equally from the expansion of world markets. He noted that some countries, such as China, adopted national policies to cut the economies off from global commerce and thus from the benefits of global-

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[1] According to Maddison (1995), the world GDP per capita, in constant international dollars, grew annually by 0.6 percent during 1820–1870, 1.3 percent during 1870–1913, 0.9 percent during 1913–1950, and 2.1 percent during 1950–1992. Growth was fastest during the two periods in which international trade expanded the fastest, 1870–1913 and 1950–1992.

ization.[2] He noted, with great humanity, that the "natives ... both of the East and West Indies" had actually *suffered* from globalization, under the oppression of European force, which enabled the Europeans "to commit with impunity every sort of injustice in those remote countries" (Smith [1776] 1976: Vol. 2, p. 141).[3] Smith further emphasized that certain remote parts of the world were simply not part of the dynamic processes of the global economy by virtue of their physical isolation:

> All the inland parts of Africa, and all that part of Asia which lies any considerable way north of the Euxine [Black] and Caspian seas, the ancient Scythia, the modern Tartary and Siberia, seem in all ages of the world to have been in the same barbarous and uncivilized state in which we find them at present. The sea of Tartary is the frozen ocean which admits of no navigation, and though some of the greatest rivers in the world run through that country, they are at too great a distance from one another to carry commerce and communication through the greater part of it. There are in Africa none of those great inlets, such as the Baltic and Adriatic seas in Europe, the Mediterranean and Euxine seas in both Europe and Asia, and the gulphs of Arabia, Persia, India, Bengal, and Siam, in Asia, to carry maritime commerce into the interior parts of that great continent ... (Smith [1776] 1976: Vol. 1, p. 25)

He also pointed out that landlocked countries, even when connected by river navigation to the ocean, would have special troubles, since it is always in the power of the coastal economy "to obstruct the communication between the upper [landlocked] country and the sea" (Smith [1776] 1976: Vol. 1, p. 25).

In summary, Smith identified *national policies*, *geopolitics*, and *physical geography* as three factors that would lead to divergent outcomes despite the common pull of globalization.

During the recent period of globalization, we again find that not all parts of the world share equally in the benefits of expanding world markets. Many developing countries are undoubtedly making good eco-

[2] Smith wrote that "Upon their present plan, they [China] have little opportunity of improving themselves by the example of any other nation; except that of the Japanese" (Smith [1776] 1976: Vol. 2, p. 202).

[3] Because germ theory was not understood for another hundred years after Smith's writing, he could not fully appreciate that part of the suffering also resulted from the transfer of European pathogens to the Americas and to formerly isolated populations of the Pacific.

nomic and social progress under the forces of globalization, while others are stagnating or suffering absolute declines in living standards. Development success stories such as China, where more than a billion people have experienced dynamic growth of around 9 percent per year in average per capita income as a result of China's opening to market forces and international trade, stand in sharp contrast to the developmental failures in much of Sub-Saharan Africa, which on average experienced an absolute decline in average living standards between 1980 and 1999.[4] Other poor regions, including parts of Latin America and Asia, have also experienced long-term stagnation or worse.

One of the most important challenges facing economics is to understand why globalization seems to help some places much more than others. Part of the answer, of course, rests with the differences in national economic policies. When countries pursue autarkic trade policies, as many developing countries did in the postwar era, it is no surprise that they fail to benefit from globalization.[5] Differences in physical geography, resource endowments, and other factors cause countries to experience very different patterns of economic development.

In this article I will describe five different patterns of development, and illustrate how each is related to the underlying geography, economic policies, and resource endowments of a country. These alternative patterns of development may be summarized as follows:

Endogenous growth is the process of self-sustaining increases in income generated mainly by technological innovation. Innovation raises national income, which in turn stimulates further innovation in a positive feedback process.

Catching-up growth is the process whereby an economy with a lower level of technology and income (the "follower") narrows the income gap with the higher technology and richer countries (the "leader") through a process of technological diffusion and capital flows from leader to follower.

Resource-based growth is the process whereby an economy experiences cycles of per capita income mainly as the result of resource booms and busts.

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[4] During 1980–1990, Sub-Saharan African (SSA) GDP grew at 1.7 percent per year, less than the population growth of 2.9 percent per year (implying a decline of 1.2 percent per year in per capita GDP). During 1990–1999, GDP grew at 2.4 percent per year, compared with the population growth of 2.6 percent per year, implying a decline of 0.2 percent per year in per capita GDP.

[5] See Sachs and Warner (1995) for a detailed comparison of trade policies and economic performance around the world. That study found strong evidence that open economic policies substantially raised economic growth rates.

Malthusian decline is a process of falling per capita income caused by population pressures outstripping the carrying capacity of the local economy, in circumstances in which the country is neither innovating nor successfully adopting technologies from abroad.

Economic isolation is a phenomenon of economic stagnation that results from an economy's physical or policy-induced isolation from world markets.

To help guide the discussion, Table 1 offers an illustrative assignment of countries into the five categories, using a very simple classification scheme.[6] A country is deemed to be an endogenous growth country if, in 1995, inventors resident in the country registered at least ten U.S. patents per million inhabitants of the country. Only 23 countries in the world pass this standard, but these 23 countries (with a combined 15 percent of the world's population) accounted for 99.2 percent of the patents issued in the United States in 1995![7] A country is classified as a catching-up country if its exports of manufactures in the machinery and transport sectors (SITC 7) plus the miscellaneous manufactures sectors (SITC 8) accounted for at least five percent of Gross National Product in 1995 (and if it is not an endogenous growth country). A country is classified as a resource-based economy if its commodity exports were greater than or equal to 10 percent of GNP in 1995 (and if it is not in one of the two previous categories).[8] A country is classified as in Malthusian crisis if it had a Total Fertility Rate greater than or equal to 4.0 in 1995 (and if it is not classified among the three previous categories). Finally, a country is classified as economically isolated if it is *landlocked* and not classified in one of the preceding categories. A few countries do not fit neatly into any of the categories, and a few dozen countries are not classified because of missing data (especially trade data by sector).[9]

Based on the classification scheme used in Table 1, we can identify certain characteristics of the five types of countries, as shown in

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[6] The classification is intentionally simple, and admittedly arbitrary, in order to highlight the basic ideas. My own studies are currently involved in a much more careful classification and testing of these categories.

[7] In all of the discussion that follows, the "universe" of countries is the 150 countries that had a population of at least 1 million residents in 1995.

[8] For these purposes, commodity exports are SITC 0, SITC 1, SITC 2, SITC 3, and SITC 4.

[9] Many of the countries not classified into one of the categories are formerly closed economies in the process of liberalizing their trade policies. The result is that trade is still a small share of the national economy, but not because of intrinsic geographical difficulties. Argentina and Brazil are in that category.

Table 1 – Categorization of Countries according to Growth Mechanism

Endogenous growth	Catching up	Primary producer	Malthusian	Isolated economies
Australia	Bangladesh	Algeria	Afghanistan	Armenia
Austria	Bulgaria	Angola	Benin	Azerbaijan
Belgium	China	Bolivia	Botswana	Belarus
Canada	Dominican Republic	Cameroon	Burkina Faso	Kazakhstan
Denmark	Hungary	Chile	Cambodia	Kyrgyzstan
Finland	Indonesia	Congo	Central African Republic	Moldova
France	Jamaica	Costa Rica	Chad	Turkmenistan
Germany	Malaysia	Côte d'Ivoire	Congo, DR	Uzbekistan
Hong Kong	Mauritius	Ecuador	Eritrea	
Ireland	Mexico	Gambia	Ethiopia	
Israel	Mongolia	Ghana	Gabon	
Italy	Nicaragua	Guinea	Guatemala	
Japan	Oman	Guinea Bissau	Haiti	
Korea	Philippines	Honduras	Iraq	
Netherlands	Poland	Kenya	Jordan	
New Zealand	Portugal	Kuwait	Laos	
Norway	Romania	Mauritania	Lesotho	
Singapore	Spain	Mozambique	Liberia	
Sweden	Sri Lanka	Nigeria	Mali	
Switzerland	Thailand	Papua New Guinea	Namibia	
Taiwan	Tunisia	Saudi Arabia	Nepal	
United Kingdom	Turkey	Sierra Leone	Niger	
United States	Vietnam	Syria	Pakistan	
		Tanzania	Paraguay	
		Togo	Rwanda	
		Trinidad & Tobago	Somalia	
		Uganda	Sudan	
		United Arab Emirates	Tajikistan	
		Venezuela	Zambia	
		Yemen		
		Zimbabwe		

Table 2. The measures in the table are simple averages of the country values, except for population, which is the total for the group. We find that taken as groups, only the endogenous growth and catch-up economies achieved positive per capita economic growth during 1990–1999. Primary commodity producers and Malthusian countries experienced stagnation or slight decline. We also see the strong geographical correlates of the various categories. The endogenous growth countries are

Table 2 – Characteristics of Countries according to Growth Categories

	Number of countries	Population (total for group, millions, 1995)	GNP per capita (U.S.$, PPP basis, 1995, average of countries)	Annual growth of GNP per capita (1990–1999, average of countries)[a]	Percent of population in temperate ecozones (average of countries)	Percent of population within 100 km off the sea (average of countries)
Endogenous growth countries	23	844	20,400	2.1	76	69
Catching-up growth countries	23	2,063	5,599	2.7	28	59
Primary commodity producers	32	465	3,694	0.0	9	44
Malthusian countries	31	466	1,782	–0.3	4	19
Isolated economies	8	74	2,372	na	14	0

[a] The growth rate calculations exclude the post-communist transition economies of Eastern Europe, the former Soviet Union, and Mongolia.

Source: Countries are categorized as described in the text and in Table 1.

overwhelmingly temperate and "coastal" economies (that is, with a high proportion of the population living in temperate ecozones and within 100 km off the coast).[10] The catching-up economies are also coastal economies, benefiting from close proximity to the endogenous growth countries or to international sea lanes. The primary producers and Malthusian countries are much further from the coast, and are much less located in temperate ecozones, indeed with less than 10 percent of the population in temperate ecozones.

In the next sections, I discuss these contrasting modes of growth in greater detail, stressing some of the geographical and historical determinants. The final section discusses the policy implications for managing globalization so that a much larger portion of the world can enjoy the fruits of sustained economic advance.

[10] Temperate ecozones, for this purpose, include the categories Cf, Cs, Dw, and Df zones of the Koeppen–Geiger climate classification.

II. Endogenous Growth

Perhaps the main lesson of two centuries of economic growth theory is that innovation, rather than capital accumulation, is the real fuel of long-term growth. We learn this, for example, from Solow's neoclassical growth model. In that model, the economy reaches a steady-state level of income per capita with zero long-term growth if there is no long-term technical change. The steady state is reached despite a positive saving rate (and hence continuing accumulation of capital), occurring at the point at which national saving just equals the amount of capital needed to cover depreciation and capital widening (i.e., to provide the growing population with the average level of capital per worker).[11]

Thus, technical change rather than capital accumulation lies at the core of long-term growth. Solow's famous decomposition of U.S. growth also proved the point in 1957, when he calculated that 87 percent of U.S. growth in the period 1910–1950 was due to shifts of the production function, and only 13 percent was due to capital deepening (a rise in the capital-labor ratio). Solow left open the possibility that capital deepening would play a large role once factor inputs – specifically human capital alongside physical capital – were better measured. And it is true that some of the 87 percent of U.S. growth impounded in the "Solow residual" includes the returns to increased education. Nonetheless, the bulk of U.S. long-term growth is surely accounted for by innovation. This would probably be even more evident if the data properly measured quality improvements, which in turn would raise long-term output growth as well as the share of long-term growth accounted for by technological advance.[12]

The theories of endogenous innovation pioneered by Paul Romer and others in the 1980s and 1990s emphasize the central message that innovation is an increasing-returns-to-scale activity in two distinct ways. First, the inducement to innovation is determined by the extent of the market. The idea behind a new invention has to be researched and developed just once, after which the same idea can be embodied in production an unlimited number of times. If marginal production costs are constant, average production costs fall, the larger the market is, since

[11] If q is the level of GDP per worker, k is the level of capital stock per worker, s is the saving rate, d is the rate of depreciation, and n is the rate of labor force growth, the steady state is reached at the level of capital stock such that $s\,q = (n + d)\,k$.

[12] Nordhaus' (1998) example of the remarkable (and largely unmeasured) rise in productivity in the technology of illumination, in the progress from candle power to incandescent bulbs to more advanced lighting technologies, illustrates the point of the undermeasurement of technical progress.

the fixed costs of R&D can then be spread over a larger production run. Second, the marginal productivity of innovative activity likely *increases* with the amount of resources invested in innovation. A research community of ten thousand workers will likely create more than ten times the innovation of a research community of a thousand workers. This is because ideas beget ideas, and new technologies beget new technologies.

As Romer stressed, these increasing-returns-to-scale properties open the possibility that the technologically advanced economies will increase their lead over the technologically laggard economies. Technological advances both expand the market and increase the efficiency of additional innovative activity. For both reasons, the pace of innovation will tend to rise over time, and the "rich" technological leaders will tend to extend their lead over the followers. Still worse for the laggard is the fact that in an internationally integrated labor market, the relatively few scientists in the laggard region will have the incentive to migrate to the technologically advanced region, thereby increasing the gap still further. In this way, globalization could potentially widen rather than narrow the income gaps between rich and poor nations. Of course, globalization can also speed the diffusion of technologies from rich to poor countries, thereby narrowing the gap, as discussed below.

Globalization should be a major spur to innovation, by increasing the extent of the market. It may also concentrate innovative activity if it creates a more integrated global labor market for scientists and engineers, who are then likely to aggregate in the highly innovative core economies. Most proxies of innovative activity (patents, R&D expenditures, numbers of scientific publications) suggest a huge spurt in such activities in the 1990s. The rapid growth of labor productivity in the United States since the early 1990s also supports the notion of a surge in innovation in line with the increasing globalization of the world economy.

I must stress, however, the important point that market forces are generally not sufficient by themselves to produce a high flow of innovations. Even market-driven innovations depend on basic science, which in general requires substantial government support. The United States, for example, is now investing around $85 billion of public funds towards basic science, because it is understood that market forces by themselves do not give sufficient incentive for basic scientific inquiry (the fruits of which are widely disbursed, and not typically owned by the scientific researcher). Moreover, innovation depends on a complex set of institutions, ranging from government laboratories to nonprofit

academic institutions to profit-oriented businesses. The effective interplay of these institutions is necessary to produce a steady flow of innovation.

Economists in the United States and Europe sometimes describe endogenous growth as a general property of market economies, without recognizing that only a small part of the world produces the vast proportion of new innovations. One good measure of innovation is the patenting activity of inventors around the world. The U.S. Patent Office keeps track of the nation of residence of the lead inventor for each patent issued in the United States. In 1995, around 101,000 patents were issued, out of which 55,000 were issued to U.S. inventors (according to residence) and 45,000 to foreign inventors. The concentration of those foreign patents is striking: 10 countries, with 13 percent of the world's population outside of the United States, account for 91 percent of the patents issued to non-U.S. inventors. If we consider the top ten countries *including* the United States (and dropping Sweden from the list), we find that this group of countries accounts for 95 percent of the patents and 13 percent of the world's population.

Measuring per capita innovative activity as patents per million population, we can examine the patterns of patenting around the world. The most striking finding is that virtually all of the high-patent-intensity countries are in the temperate zone, a point I return to later.[13] The tropics, with few exceptions, contribute very little to the U.S. patents. If we define a tropical country as one in which at least half of the population lives in tropical or sub-tropical ecozones,[14] then the tropical countries account for 43 percent of the world's population, and 19 percent of the world's GNP (in purchasing-power-parity-adjusted terms), but a scant 2 percent of the patents issued in the United States in 1995.

The reasons why the temperate regions enjoy endogenous growth while the tropical regions do not is a matter of speculation, discussed at length in Gallup et al. (1998), Bloom and Sachs (1998), and Sachs (2000). There are good reasons to believe that tropical ecosystems hinder economic development through their effects on human health and food productivity. The tropical environment is much more supportive of infectious disease, both because bacterial pathogens flourish in warm environments, and because key vector-borne diseases such as malaria require warm temperatures for the survival and infectivity of the inter-

[13] The exceptions are Hong Kong, Singapore, and a part of Taiwan.

[14] For this purpose, the tropical ecozones are the A zones in the Koeppen–Geiger classification, and the sub-tropical zone is the Cw zone.

mediate vectors. The tropical environment also hinders food productivity through several channels. High temperatures cause bacteria in the soil to decompose soil organic materials at a very high rate, causing soils to loose nutrients and physical structure more easily. In addition, high temperatures can reduce net photosynthetic output by causing the plant to use more of the output of photosynthesis for the plant's own survival (i.e., plant respiration) rather than for food production. Tropical areas also face particularly difficult problems of water control (due to high rates of evapotranspiration), pests, post-harvest losses, and various plant and livestock diseases. All told, the tropical ecosystems have probably hindered human longevity in recent history, and reduced urbanization because of the low productivity of food systems.

To the extent that tropical ecosystems indeed cause a loss of productivity, the disadvantage of the tropics could be amplified over time to the extent that innovations are ecologically specific, and do not easily cross ecological barriers. In that case, the richer temperate-zone regions would support a higher level of innovation, which in turn would raise the size of the temperate-zone economies, which in turn would stimulate more temperate-zone innovations. The poorer tropics would also innovate, but with a smaller market, the innovation would be slower, and the overall pace of endogenous growth would be less. The proportionate gap between the temperate and tropical regions would widen over time, as has been observed for decades.

III. Catching-Up Growth

If home-grown innovation were the only major source of technological advance, it is likely that a few countries would surge in economic activity (as innovation spurred more innovation and the inflow of scientists from the rest of the world), while the rest stagnated. And yet some countries with little innovation activity, such as China during the period 1980–2000, achieved spectacular rates of economic growth. The key to such growth is the fact that technologies cross national boundaries, even if many technologies have a hard time crossing ecozones. Countries can reap the gains of innovation even if they are not themselves the innovators (especially if they are in the same ecozones as the innovators). The diffusion of technology has been a feature of all of human history (see Diamond [1997], on the diffusion of agricultural technologies within Eurasia).

A simple dynamic model, utilized for example by Krugman in an insightful 1979 article, shows the benefits and limits of technological

diffusion in raising living standards. Suppose that L is the per capita income of the technological leader, and F is the per capita income of the technological follower. The leader, suppose, enjoys a simple endogenous growth process in which proportional growth is a constant denoted by n:

$$(1/L)\, dL/dt = n.$$

The follower enjoys a rising living standard as a result of technology diffusing from the leader to the follower. Assume (as is conventionally done in such models) that the technological diffusion is an increasing function of the gap in living standards between the leader and the follower, so that the increase in F is itself a function of the gap between L and F. Specifically, assume that for some constant value c:

$$dF/dt = c\,(L - F\,).$$

Define R to be the relative income of the follower, so that

$$R = F/L < 1.$$

We can write the law of motion for R in the following way:

$$dR/dt = c - (c + n)\, R.$$

Consider the long-term equilibrium growth dynamics. In the long run, when R is a constant ($dR/dt = 0$), we have $R = c/(c + n) < 1$. The leader and follower both grow at the rate n, but the follower always lags behind the leader in level of income. The permanent gap or shortfall is $n/(c + n)$. For example, if the leader grows at 3 percent per year, while the *technological* diffusion closes the gap between L and F at a rate of $c = 2$ percent, then the follower will have a long-term income F that is 40 percent of the leader's L (= 2/(2+3), or 2/5, or 40 percent). Both economies will grow at 3 percent per annum, but the follower will always lag behind the leader.

This simple model highlights the benefits of technological diffusion for the lagging country, but it also highlights the advantages of technological innovation for the leader. Countries that rely wholly on imported technologies will lag behind the technological innovators, even if they are able to absorb the new technologies of the leading countries at a fairly rapid rate (high value of c). Thus, countries successful in achieving catching-up growth should typically strive to support home-grown innovation as well, to become endogenous growth economies in their own right. This will typically require substantial public investments in higher education and government scientific la-

boratories, as well as carefully designed laws governing intellectual property rights and the interactions of government laboratories, universities, and private business.

While all countries enjoy some benefit of technological growth in the leading country, the rate at which technology diffuses from leader to follower differs sharply around the world. A region that is geographically isolated, for example, is much less likely to benefit from technological diffusion. Its value of c will be lower, so that its long-term income level relative to the leader is also likely to be lower. A region that is politically isolated from technological leaders (such as North Korea has been for decades) is also likely to have a very low value of c.

In fact, the process of technological diffusion depends on economic institutions and policies to a significant extent. Technologies can be imported into an economy in several ways, including the following: licensing of technologies, especially those under patent; importation of capital goods in which the new technologies are embodied; and attraction of foreign direct investment, in which multinational companies undertake production within the economy using technologies not previously available within the economy. Economic institutions can be fashioned to encourage technology transfer, for example by favoring technology licensing or foreign direct investment. Countries with rising levels of export earnings are able to afford rising levels of imported capital goods.

Two kinds of countries, therefore, have won the race in absorbing technologies from abroad. Countries with successful export-promotion policies, such as Korea and Taiwan, have earned the foreign exchange necessary to import technologies from abroad. Also, countries that have been able to attract large flows of foreign direct investment have similarly been able to upgrade technologies with particular success. China, Malaysia, and Singapore are especially notable recipients of large FDI flows in the 1980s and 1990s. More recently, Mexico and Eastern European economies, such as Hungary and Poland, have similarly been successful in attracting FDI.

Which geographical characteristics best describe these successful cases of catch-up growth? The successful countries are generally those that are proximate to major markets or that are on major international sea lanes, and thus face low transport costs in shipping goods to major markets. In the Americas, it is Mexico, Central America, and the Caribbean island states that have been most successful in the 1990s in attracting FDI and thereby attracting technology. South American countries, further from the major U.S. market, have lagged farther behind.

In Europe, it is the post-communist countries on the border of Western Europe (including the Baltic States, Poland, Czech Republic, Slovakia, Hungary, Croatia, and Slovenia) as well as the North African states bordering the Mediterranean (especially Morocco, Tunisia, and Egypt) that have benefited from their geography to achieve solid catching-up growth. In Asia, it is the countries proximate to Japan (Korea, Taiwan, coastal provinces of mainland China) and countries that lie on the sea lanes connecting Asia and Europe (such as Indonesia, Malaysia, Singapore, Thailand, and Mauritius) that have most successfully achieved catching-up growth.

There is little doubt that successful catching-up involves a positive feedback process between technological diffusion and human capital accumulation. Initially, human capital is low in the laggard economy, and technologies are rudimentary. The country may achieve some modest inflow of technology by attracting labor-intensive export-oriented foreign direct investment, for example, labor-intensive assembly operations in export-processing zones. These simple assembly operations (such as cutting and sewing garments, or assembling electronics components on a mother board) generate income, some modest skills, and the resources to invest in improved education. The combination of rising skill levels and rising educational attainment leads to an upgrading of the foreign investment facilities. Electronics firms, for example, may progress from pure assembly operations to the local manufacturing of component parts and the final testing of finished products. Eventually, as discussed below, the educational attainment and technological sophistication may rise sufficiently so that the economy becomes an endogenous-growth innovator in its own right.

IV. Resource-Based Growth

In the early days of 19th century industrialization, the largest increases in output per capita were achieved by mobilizing energy and other natural resources in new ways. The steam engine permitted a vast increase in mechanical energy, for purposes of production and transport of goods. Access to coal reserves became a *sine qua non* of early industrialization, since coal was too bulky to move economically at long distances. Local supplies of other raw materials, such as iron, silver, gold, hydrocarbons, and diamonds, were also keys to local development. Climatic and soil conditions that could support agricultural commodities, such as sugar, cocoa, coffee, and tea, were also early pathways to economic development. The advent of the railway in the middle of the 19th cen-

tury allowed a vast increase in the regions of the world that could profitably be "harvested" for their natural resource deposits.

As highly developed economies shifted increasingly towards a knowledge base, and as transport and communications costs fell markedly, the actual ownership of raw materials became less and less essential to economic development. Natural-resource-scarce economies in East Asia, such as Japan, Korea, and Taiwan, became wealthy by exporting technology-intensive manufactured goods and importing the primary commodities that were needed for their production and for final consumer demand. It has often been noted in recent years, in fact, that natural-resource-rich economies have fared particularly badly in the past half century, with resource-rich countries growing less rapidly than resource-scarce economies. (See Sachs and Warner [2000] for a recent survey of the data and issues.)

Several theories have been offered for this observation, though none has been definitively established. The first, made famous by the Argentine economist Raul Prebisch in the 1950s, is that natural resource economies are vulnerable to a secular loss in the terms of trade, as technological innovations in the leading countries lead to substitutes for natural resources, and thereby drive down their relative prices in the long run. Latin America and the Caribbean islands have suffered repeated economic reversals as a result of technological advances in the richer countries, which reduced or eliminated the value of key natural resource exports. For example, the Caribbean sugar cane producers suffered sharp reversals in the mid-19th century when Europe developed temperate-zone beet sugar production. Chile suffered a devastating reversal when its exports of nitrates, used in Europe as fertilizer, were replaced by synthetic ammonia fertilizers developed by German industry in the 1910s. Brazil's natural rubber exports were decimated by the development of synthetic rubber. And on it has gone. Until today, the commodity exporters in Central and South America still experience enormous volatility in world prices for exports, and many countries show evidence of a long-term loss of terms of trade.

One key question is whether a large stock of natural resources in fact hinders the development of technology-intensive or knowledge-intensive industries. Theory suggests that resource-rich economies might suffer from a dynamic "Dutch Disease" effect, in which a large natural resource sector results in a strong value of the real exchange rate, thereby making it unprofitable to produce in sectors capable of technological diffusion or innovation. This kind of effect seems to be starkly evident in many oil-rich economies. The large oil sectors in the Gulf States,

Venezuela, and a few other oil-rich countries have clearly supported very strong national currencies, which have rendered unprofitable almost all non-oil tradeable sectors. The oil-rich economies thereby bob in the sea of world oil trade, rising when oil prices are high, and falling into crisis when oil prices are low.

Finally, I must mention the range of political economy theories that link large stocks of natural resources to unusually high levels of rent-seeking activities. In essence, when much of the national wealth is in the form of resource deposits, which are typically owned by the state, a considerable amount of national entrepreneurial activity may be invested in the negative-sum struggle over ownership of the resource rents, rather than entrepreneurial activities, such as the development of new technologies or industries. Some researchers have recently argued that large resource deposits can even raise the likelihood of war or civil violence, for the same reason that they induce a domestic struggle over resource rents.

Economic theory suggests that the main way for a natural-resource-based economy to achieve competitiveness in non-resource sectors is through the accumulation of human capital. A strong exchange rate will not block new sectors from emerging if the skills of the labor force are also increasing. One basic theme of successful development of resource-rich economies, therefore, is for the state to reinvest the resource rents in publicly supported education. One of the difficulties, however, of many resource-rich economies is that the owners of the resource rents (i.e., the state elites) often have little regard for the masses of the population and are unwilling to direct the resource rents towards broad-based education. In some cases, they may even *fear* that mass education will ultimately undermine their control of the resource rents.

V. Malthusian Decline

Many of the world's poorest countries are not even sustaining their meager levels of GNP per capita. They seem to be experiencing a long-term decline in living standards that transcends the effects of terms-of-trade shocks or cyclical phenomena. Sub-Saharan Africa is the most disturbing case of an impoverished region suffering outright declines in living standards. Somewhat less dramatically, the Andean region seems also to be stuck with stagnant or even falling living standards.

Many of these countries are experiencing severe demographic pressures that can justifiably be called a Malthusian crisis. Thomas Malthus, of course, was the early 19th century parson and moral philoso-

pher whose dire warnings about population growth outstripping food availability led to economics itself being labeled the "dismal science." Most economists dismiss Malthusian pessimism out of hand, since food productivity on the global scale has more than kept pace with population growth in the two centuries since Malthus wrote. But Malthusian decline can operate at a local or regional scale even if it does not apply at the global scale. I suggest that certain parts of the world, including many of the world's poorest countries, are experiencing declines in per capita GNP because rapid population growth is unrelieved by technological progress.

Sub-Saharan Africa's Malthusian crisis is fundamentally rooted in its extraordinary tropical ecology, which combines an intense transmission of infectious disease with low productivity of food production. The low food productivity contributes to widespread undernutrition, which further increases the burden of disease, since undernutrition is immunosuppressive. That is, undernutrition increases the populations' susceptibility to episodes of infection as well as to the severity of those disease episodes.

A growing body of evidence suggests that the heavy disease burden depresses African economic growth through several channels. Some are direct: disease episodes and premature mortality rob the labor force of healthy and experienced workers. Others are indirect: the heavy burdens of malaria, HIV/AIDS, and other infectious diseases depress the inflows of foreign direct investment. Perhaps the most important, but least appreciated, is the effect of the high disease burden on population growth and age structure. When children face very high rates of mortality, parents tend to compensate by having many children. In fact, the high fertility rates tend to overcompensate for the infant mortality, since risk-averse parents have enough children to ensure, with high probability, that at least some will survive into the old age of the parents. The somewhat paradoxical result is that *high infant mortality rates are associated with high rates of population growth.* (See Sachs [2000] for further discussion.)

The high fertility rates and the resulting high rates of population growth in Africa cause Africa's population to be heavily concentrated in young ages. Per capita income is reduced because so much of the population is under the working age. There are other important effects as well. Poor households with large numbers of children are unable to invest heavily in the health and education of each child. Fertility theory suggests that households face a "quantity-quality tradeoff" when investing in children. High fertility rates are associated with low invest-

ments in human capital per child, while low fertility rates tend to be associated with high investments per child.

The combination of rapid population growth, low levels of technological advance, and low investments per child in human capital have all contributed to Africa's deepening poverty crisis. (See Bloom and Sachs [1998] for a quantitative assessment of these factors in Africa's slow growth.) The rising population, heavily concentrated in the rural areas among peasant households, is putting extreme stress on the African ecology. The land area per agricultural worker has apparently been falling, as has food output per capita in many countries. Populations are being pushed into increasingly marginal areas, often characterized by a heavy disease burden (as when populations move into regions subject to malaria or schistosomiasis or other tropical diseases). As food production intensifies in marginal lands, fragile ecosystems are experiencing environmental degradation, such as soil loss or salinization of irrigated lands or depletion of underground acquifers. At the same time, impoverished households are facing a rising burden of diseases, both traditional infectious diseases, such as malaria and tuberculosis, and of course the HIV/AIDS pandemic, which has become Africa's most extreme health crisis in recent years. HIV/AIDS afflicts an estimated 25 million Africans as of 2000, and has caused an estimated 11 million African deaths through the year 1999.

Africa's health and population dynamics have been unrelieved by technological advance or even by structural changes in the African export economy. Despite twenty years of "structural adjustment" programs supervised by the IMF and World Bank, Sub-Saharan Africa remains almost entirely dependent on the same small number of primary commodity exports as in 1980. Indeed, since those commodities suffered a severe decline in world prices while Africa's population was rising at a rapid rate, Africa in fact suffered a sharp decline in exports per capita between 1980 and the late 1990s. At the same time, African inventors were granted almost no U.S. patents during the 1990s (with inventors in Sub-Saharan African countries other than South Africa receiving just two U.S. patents in 1998!).

VI. Economically Isolated Economies

It is remarkable that regions that Adam Smith identified as geographically disadvantaged – the interior of Africa and the landlocked regions of Asia – are still among the poorest and slowest growing in the world today. Smith's observations about the importance of coastal access, I

have noted, hold true today, even in an age of electronic communications, not to mention rapid air, rail, and road travel. Sea-based freight is still by far the cheapest form of international transportation, and countries that are far from coastal ports face a tremendous burden in the shipment of bulky products.

There are 28 landlocked countries with a population of at least one million people in Latin America, Africa, and Asia. Not one of these countries is rich or growing rapidly on a consistent basis. The wealthiest of all of these landlocked countries in terms of per capita GNP is Botswana, which ranked 38th in the world in PPP-adjusted per capita GNP in 1995 among the 150 countries with a population of at least one million. The next richest was ranked 68th (Belarus), while 18 of the 28 countries ranked between 100th and 150th in per capita GNP. Botswana, of course, benefits from having a small population sitting on top of the world's greatest diamond mines.

While some of these countries have achieved periods of at least modest growth (Bolivia, Botswana, and Uganda are three such examples), in general the growth is modest by international standards, and is often a result of catching up to past income levels after an economic disaster or other special factors. Thus, Uganda's real per capita GNP in 1998 was at about the same level as per capita GNP in 1972. It fell precipitously in the chaos of the 1970s and 1980s, and then began to recover sharply under the stability and improved economic policies of the 1990s. Bolivia's real per capita GNP in 1999 was similar to the level of 1979. Botswana's good growth performance is a result of massive diamond discoveries that have been particularly well managed.

The main problem with the landlocked countries is that international trade is sharply hindered by the geographical isolation of these countries. Foreign investors, in particular, do not view these impoverished regions as effective platforms for export-oriented foreign direct investment. Thus, these countries are typically unable to attract the kind of assembly operations in garments, electronics, footwear, and other sectors, which have been important stepping stones to economic development in more favorably located economies. Foreign investors come, if at all, only to exploit primary commodities with a high value per unit weight – such as oil and gas, diamonds, and other metals – since such commodities can be profitably exploited even when transport costs are high.

In principle, new information technologies should enable distant regions to overcome their geographical liability. A landlocked region can be an effective exporter of internet services, for example. The main problem, of course, is that those new technologies require an adequate-

ly high skill level to be exploited effectively. Landlocked countries are often burdened by extremely low levels of education, and so are not equipped to take advantage of the new IT possibilities. In the few places that are so equipped (e.g., the interior cities of Bangalore and Hyderabad in Southern India), the IT sector can indeed flourish and support economic growth despite the interior locations. We should recognize, additionally, that low-cost, high-bandwidth IT connectivity requires fiber optic connections to the world internet backbone, and this, too, favors coastal cities near to oceanic submarine cables.

One practical implication of landlockedness is a high rate of migration of workers from the interior to the coast in search of jobs. This occurs within economies (e.g., the migration from the Chinese hinterland to the coastal provinces) as well as across economies. It is estimated that perhaps half of Burkina Faso's labor force works in Côte d'Ivoire and Ghana, and that perhaps 15–20 percent of Bolivia's population has migrated to Argentina and Brazil.

VII. Policy Implications for a Divided World

The purpose of this essay is not to propose a new geographical determinism, or still less a counsel of despair. It is rather to stress that globalization, by itself, hardly guarantees that much of the developing world will be able to achieve rapid economic growth – unless additional steps are taken to ensure that more of the poor countries are able to benefit from the widening global markets. Countries are still strongly affected by their physical geography, natural resources, and inherited endowments of skills, social stratification, and social institutions. The most favored countries are able to achieve catching-up growth on the basis of a diffusion of technologies into these economies, often supported by large capital inflows. Other countries, however, are too geographically isolated, or too subject to disease, or too dependent on a few primary commodities to achieve catch-up growth, much less endogenous economic growth based on home-grown innovation.

The implications for national and international economic policies depend very much on which kinds of countries we are considering. The most urgent cases are the very poor countries in Malthusian decline, weighed down by very rapid population growth that is often impinging on fragile tropical ecosystems. In most cases, the rapid population growth is a reflection of several interacting factors: a high disease burden leading to high infant and child mortality rates; a low status of women; and a high proportion of the population in rural areas, without dy-

namic urban export-oriented economies. These countries often do not benefit strongly from technological advances in the rich countries, in part because the technologies needed in the tropical ecozones are not developed by the rich temperate-zone economies.

These Malthusian cases require a multi-pronged development strategy. On the one hand, they typically need to make a major investment in improved public health and education (especially of girls), both of which will serve to raise the productivity of the workforce while also contributing to a drop of fertility rates and population growth rates. Since many of these countries are too poor to face their public health and education crises out of their own resources, there is a need for well-targeted and monitored international assistance to the health and education sectors. Similarly, there is an urgent need for the leading scientific countries to direct much more of their scientific prowess towards the special problems of tropical health and agriculture.

The dozens of poor countries heavily dependent on primary commodity exports will be stuck with low economic growth and high volatility until they succeed in diversifying their economies towards higher-technology sectors. Export diversification requires a sound set of economic institutions aimed explicitly at attracting new technologies and enterprises outside of the traditional commodity sectors. Special institutions, such as export processing zones, tax holidays, industrial and science parks, and the like, have played an important role in countries, such as Malaysia or Mexico, which have successfully made the transition from commodity dependence to diversified manufacturing exports. A critical aspect of this transition is that the developing country must be assured of access to the rich country markets. Mexico, for example, is undoubtedly benefiting not only from its 2,000 mile border with the United States, but especially from its treaty relations with the United States and Canada under the North American Free Trade Agreement, which guarantees to foreign direct investors in Mexico that these firms will have free and unhindered access to the U.S. market. Part of the difficulty of making the transition from primary commodity exports is the Dutch Disease phenomenon. As noted earlier, one key to overcoming the Dutch Disease is through major investments in human capital, since even countries with strong real exchange rates can be competitive in a broad range of tradeable sectors if the domestic human capital is high enough.

The main challenge for countries that are already succeeding in catching-up growth is to make the gradual transition to endogenous growth. This is a very great challenge, which requires a substantial and long-term national investment in science and technology. Only a hand-

ful of developing countries have made a transition to endogenous growth in the past quarter century, the most notable cases being Israel, Korea, and Taiwan. In all three cases, governments devoted substantial resources to higher education and to national scientific laboratories. Students were encouraged to study abroad in world-class universities. The public-sector spending on research and development was often greater than one percent of GNP, a much greater effort than is made by most developing countries.

Finally, the economically isolated countries are likely to continue to face real difficulties in sustaining rapid economic development. It is not easy to induce foreign investors to come to remote regions far from international trade. This is true within countries, as China will learn with its attempts to shift at least some foreign investment away from coastal provinces and into the Chinese Far West. It is even more true when the interior regions are landlocked countries, so that goods must pass through international borders in order to get to a sea port. As Adam Smith warned, the coastal economies often do not make it very easy for their landlocked hinterland neighbors. While there is no magic answer for these landlocked and often very remote locales, four guidelines should remain paramount in policy thinking: First, these countries should strive, with all international support that is needed, to ensure that they have access to international ports without undue political interference. Second, road and rail infrastructure from the interior to the port is of course of the highest priority. Third, we should expect some continuing migration from the interior to the coastal economies. And fourth, telecommunications connectivity should be promoted to enable the landlocked regions to develop internet-based export sectors (e.g., software writing, telemarketing, data transcription, back-office accounting operations) that can compete effectively despite large overland distances.

These brief remarks give only a hint of the complex policy challenges that lie ahead if globalization is to serve well for a much wider part of humanity.

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Abstract: Globalization and Patterns of Economic Development. – One of the most important challenges facing economics is to understand why globalization spurs economic growth to a greater extent in some parts of the world than in others. While part of the answer rests with differences in national economic policies, such policy differences are only part of the story. Differences in physical geography and resource endowments also cause countries to experience very different patterns of economic development in the global economy. In this article, five different patterns of economic development are described, and it is illustrated how they are related to the underlying geography, economic policies, and resource endowments of a country. JEL no. F02, O11, O57, P51

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Zusammenfassung: Globalisierung und Muster der wirtschaftlichen Entwicklung. – Eine der größten Herausforderungen für Ökonomen ist es zu verstehen, warum die Globalisierung das Wirtschaftswachstum in manchen Teilen der Welt stärker vorantreibt als in anderen. Zwar läßt sich diese Frage zum Teil mit Unterschieden in der jeweiligen nationalen Wirtschaftspolitik erklären; dies ist aber nur ein Teil der Antwort. Auch Unterschiede in der physischen Geographie sowie in der Ressourcenausstattung können dazu führen, dass Länder einen unterschiedlichen wirtschaftlichen Entwicklungsverlauf in der Weltwirtschaft erfahren. Der Autor beschreibt fünf unterschiedliche Muster einer ökonomischen Entwicklung und erläutert, wie diese mit den zugrunde liegenden geographischen Gegebenheiten, mit der Wirtschaftspolitik und mit der Ressourcenausstattung eines Landes zusammenhängen.