VI. Divergence

Some thirty years ago geo-politicians and commentators spoke constantly of the countries of the globe as divided into three “worlds”: First, Second, and Third.

The “First World” was made up of those industrial countries that rallied to the side of the United States in the post-World War II Cold War. The “Second World” was made up of the Soviet Union and its satellites. The “Third World” appeared and grew as decolonization raised the number of independent nations seated at the U.N.; as many Latin American nations recognized that they had more interests in common with the newly-independent and decolonized than with, say, Sweden; and as poorer Communist-ruled nations that had not been occupied by the Russian army (Yugoslavia, China, and later North Korea and Vietnam) began to flex their muscles and assert their independence from Moscow.

To be of the “Third World” was to try to play off the United States against the Soviet Union (and hopefully receive large amounts of aid from both). To be of the “Third World” was to stress the differences between one’s own polity and economy and that of the industrial powers of the North Atlantic. To be of the “Third World” was to be—relatively—poor.

Now the “Second World” is gone. But the term “Third World” is still useful. It underscores the differences—the sharp economic divergence in living standards and productivity levels in the world today. To use the more common “developed” and “developing” nomenclature for groups of countries is to suggest that differences are narrowing.

They are not.

Those nations and economies that were relatively rich at the start of the twentieth century have by and large seen their material wealth and prosperity explode. Those nations and economies that were relatively poor have grown richer too, but for the most part much more slowly. And the relative gulf between rich and poor economis has grown steadily. Today this relative gulf is larger than at any time in humanity's previous experience, or at least larger than at any time since there were some tribes that had discovered how to use

fire and other tribes that had not.

That the pattern of economic growth over the twentieth century is one of striking *divergence* is surprising to economists, for economists expect *convergence.* World trade, migration, and flows of capital should all work to take resources and consumption goods from where they are cheap to where they are dear. As they travel with increasing speed and increasing volume as transportation and communication costs fall, these commodity and factor-of-production flows should erode the differences in productivity and living standards between continents and between national economies.

Moreover, most of the edge in standards of living and productivity levels held by the industrial core is no one's private property, but instead the common intellectual and scientific heritage of humankind. Here every poor economy has an excellent opportunity to catch up with the rich by adopting and adapting from this open storehouse of modern machine technology.

Yet economists' expectations have, throughout the past century, been severely disappointed.

We can view this particular glass either as half empty or as half full. Half empty: we live today in the most unequal, in terms of the divergence in the life prospects of children born into different economies, world ever. Half full: most of the world has already made the transition to sustained economic growth; most people live in economies that, while far poorer than the leading-edge post-industrial nations of the world's economic core, have successfully climbed onto the escalator of economic growth and thus the escalator to modernity. The economic transformation of most of the world is less than a century behind the economic transformation of the leading-edge economies—only an eyeblink behind, at least from a millennial perspective.

On the other hand, one and a half billion people live in economies that have *not* made the transition to intensive economic growth, and have *not* climbed onto the escalator to modernity. It is very hard to argue that the median inhabitant of Africa is *any* better off in material terms than his or her counterpart of a generation ago. And we cannot take a millennial perspective: the fact that students three thousand years from now may be somewhat fuzzy about whether widespread global poverty came to an end in the eighteenth, the twentieth, or the twenty-second century does not mean that we can be indifferent about the gulf between economies that are rich and

economies that are poor.

A. The iron curtain:

What are the sources of the enormous divergence in relative productivity and living standards we see in the world today?

[Figure: World map: the Iron Curtain]

Begin by looking at the snaky geographic line across Eurasia that used to be called the “Iron Curtain,” a name popularized by Winston Churchill in a famous speech given at Westminster College in Missouri in 1947. On one side were regimes that owed their allegiance to Karl Marx and to Marx’s viceroys on earth. On the other side were regimes that claimed during the 1946-1989 Cold War between Communism and Liberalism to be of the “free world”—and that were, if not good, at least less-worse guys. Only two of the twenty most genocidal twentieth-century regimes fall on “our” side of the Iron Curtain in the post-World War II era. That is a bad score, but by the (appallingly low) standards of the twentieth century nowhere near the worst score achieved.

Walk this geographical line from Poland to Korea, and then hop over to the only western hemisphere Communist satellite--Cuba--looking first left at the level of material welfare in the Communist country, and then right at the level of material welfare in the non-Communist country. Before Communism regions adjacent to the Iron Curtain were seen as having similar economic destinies. And the location of the Iron Curtain is a historical accident: it is where Stalin's Russian armies stopped after World War II, where Mao's Chinese armies stopped in the early 1950s, and where Giap’s Vietnamese armies stopped in the mid 1970s.

Notice as you walk that to your right, outside the Iron Curtain, the countries are far better off in terms of GDP per capita. They are not necessarily better off in education, or health care, or in the degree of income inequality: if you were in the poorer half of the population—and if you were not homosexual,

if you kept your mouth shut, and if you were not swept up in one of the anti-profiteer drives—you probably received a better education and had access to better medical care in Cuba than in Mexico until the collapse of the Soviet Union, and the end of Russian subsidies to Cuba at the end of the 1980s.

But the countries fortunate enought to lie outside what was the Iron Curtain are vastly more prosperous. Mexico today is, we think, some eight times as wealthy as Cuba, which few if any would have predicted in the mid-1950s before Castro seized power. Greece today is some six and a half times as well off as Bulgaria. Even the Philippines are five times as well off as Vietnam. And Taiwan—where the Chinese Nationalist Kuomintang Party retreated after losing the final late-1940s phase of their Civil War to Mao—is some nineteen times as well off as the Chinese mainland.

Depending on how you count, between two-thirds and seven-eighths of the potential material production and prosperity of a country has been annihilated if it fell under Communist rule. Communism was not only a source of genocide, it was also a source of economic stagnation and decline: not one of the brighter lights on humanity’s tree of good ideas.

The fact that a large part of the globe fell under Communist rule in the twentieth century is the first major factor making for enormous disparities in the world's distribution of economic wealth across nations. Moreover, figuring out how to move from a stagnant, ex-Communist economy to a dynamic, growing one is proving very difficult. It looks as if the “economies in transition” closest to the European Union will successfully become growing economies and democratic polities: Slovenia, Hungary, the Czech Republic, Poland, Lithuania, Latvia, and Estonia all appear to be making a success of their transitions from Communism.

What will happen elsewhere is still uncertain. What is happening in the rest of the former Soviet sphere is not very promising.

GDP per Capita Levels of Economies Behind the Iron Curtain with Those of Similarly-Situated Economies that Escaped Communist Rule

East-Block Country	GDP per Capita	Matched West-Block Country	GDP per Capita	Relative Gap
North Korea	700	South Korea	7660	0.91
China	490	Taiwan	9550	0.95
Vietnam	170	Philippines	850	0.8
Cambodia	150	Thailand	2110	0.93
FSR Georgia	580	Turkey	2970	0.8
Russia	2340	Finland	19300	0.88
Bulgaria	1140	Greece	7390	0.85
Yugoslavia	3240	Italy	19840	0.84
Hungary	3350	Austria	23510	0.86
Czech R.	2710	Germany	23560	0.88
Poland	2260	Sweden	24740	0.91
Cuba	460	Mexico	3610	0.88
Geometric Mean	**930**	**Geometric Mean**	**8030**	**0.88**

B. Dashed hopes for "convergence"

1. John Stuart Mill's hopes

The nineteenth-century British philosopher and economist John Stuart Mill hoped and believed that he would live to see the world economy's distribution of income and wealth draw closer together.[1] Cruel and inefficient tyrannies had always left countries impoverished, but—with the spread of democracy, liberty, education, and liberalism—Mill thought that cruel and inefficient tyrannies would soon be a thing of the past.

Resource and population pressure—too many mouths to feed given limited

[1] See John Stuart Mill (1848), *Principles of Political Economy* (); John Stuart Mill (), *On Liberty* ().

arable land and limited agricultural technology—had kept many other countries at the edge of famine. The amount of bread that the wage of a bricklayer would buy fell by a third, back to the level of 1300, during the glorious reign in England of Queen Elizabeth I. No matter what went on in high politics and courtly luxury, the mass of humanity was close to the edge of want. Life was nasty, brutish, and short.

But Mill was optimistic; Mill thought that the spread of birth control and the advance of technology would remove hunger from the world.

Mill looked out at a world where the industrial revolution, concentrated in northwest Europe, had as yet raised the standard of living of only a small proportion of the world's population. The advance of European living standards accompanied by stagnation elsewhere had opened huge relative wealth gaps between Europe and the rest of the world. Mill hoped and expected this wealth inequality to be transitory.

Democracy and literacy were spreading across the globe. The modern technologies of the industrial revolution were not the private property of any one man or group of men; instead, they were "public goods," open to all. Anyone who could read and observe could learn what were the key technologies that had made the industrial west so rich. And the material benefits from tapping the storehouse of industrial technologies were so great that businessmen and governments outside of Europe would strain every nerve to do so, and would bring their countries into the modern industrial age.

When they did so, the world's nations would draw together in terms of standards of living, and then human command over nature would continue to rise and the burden of labor to fall. For the industrial revolution was not a once-and-for-all jump in the level of technology alone, but a once-and-for-all jump in the level accompanied by a *permanent* upward shift in the rate of change.

2. The diffusion of technology

In many ways, Mill was correct.

The successive technological waves of the Industrial Revolution, roads and canals first, then textiles, then steam power in mining, then ironworking and railroads, and so forth, *did* permanently change the material conditions of human life. As technologies became more sophisticated, children became net consumers of household resources rather than net producers of resources for the household. Fertility dropped. Thus rates of population growth remained low while technology and available natural resources expanded. The industrial revolution was an enormous shock to the world economic order. It did gave Europe, and especially northwestern Europe, and especially Great Britain, an enormous edge in terms of productivity and technology. And the technologies of the industrial revolution did begin to diffuse.

In spite of stringent laws restricting the export of technologies and of skilled workers adopted by Britain, its technology leaked out to other countries. When the Lowells, Cabots, and Appletons of Boston wished to build a textile factory they hired a managing engineer, Paul Moody, from England. They gave him a substantial equity stake in the Waltham-based Boston Manufacturing Company that they had started and had based on Francis Cabot Lowell’s hurried and secret sketches of British textile machinery. Industrialization spread from old England to New England, and into Belgium, Germany, northern France, and beyond in Mill's lifetime.

3. Today’s reality

Yet thereafter the process of diffusion did not live up to Mill’s hopes. On the eve of the twenty-first century, the world is much richer than it was in J.S. Mill's day. But the distribution of the world's wealth between nations is more unequal than when J.S. Mill wrote. The economic history of the past century and a quarter is a history not of “convergence” but of “divergence”. The different countries and peoples of the world have not drawn closer together in relative living standards, but have drifted further apart.

The figure below shows the distribution of world real GDP per capita—by percentage of world population, not by nation-state—in 1995 and in 1870, as best as it can be estimated. The estimates are my own, and are imperfect not just because of limitations and errors of data but because of the unsolvable index number problems involved in trying to map material well-being into a single summary number. These estimates probably understate the magnitude

of economic growth at the high end of the world's income distribution (as I argued above, people living in the richest countries of the world today have between twenty and two-hundred times the material standard of living as their counterparts of a century ago). These estimates probably overstate the magnitude of economic growth at the low end of the world's income distribution. But they try to get the *relative* distribution of world income at a point in time correct.[2]

Even putting the deep conceptual problems of index numbers aside, the estimates reported below are still very, very imperfect. The 1995 measurements are of low quality. The 1870 GDP per capita estimates are of abysmal quality. there are a large number of additional *caveats* attached to these estimates. All variability in productivity and real GDP per capita *inside* of nation-states is suppressed: everyone in China is assumed to have the 1993 purchasing-power-parity concept real GDP per capita of $2,330.

But even with all their flaws I believe that the estimates paint a true picture. As Lant Pritchett says, the story of world economic growth since 1870 is one

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[2]If the underestimate of economic growth over the past century is greater at the high end and less at the low end of the world's income distribution, doesn't that mean that standard calculations *underestimate* how unequal the world income distribution is? Perhaps. Here we run into the limits of index numbers. We have been trying to summarize the complicated, multi-faceted considerations that make up the standard of living in a single number—real GDP per capita. We cannot do this without ambiguity and without distortion.

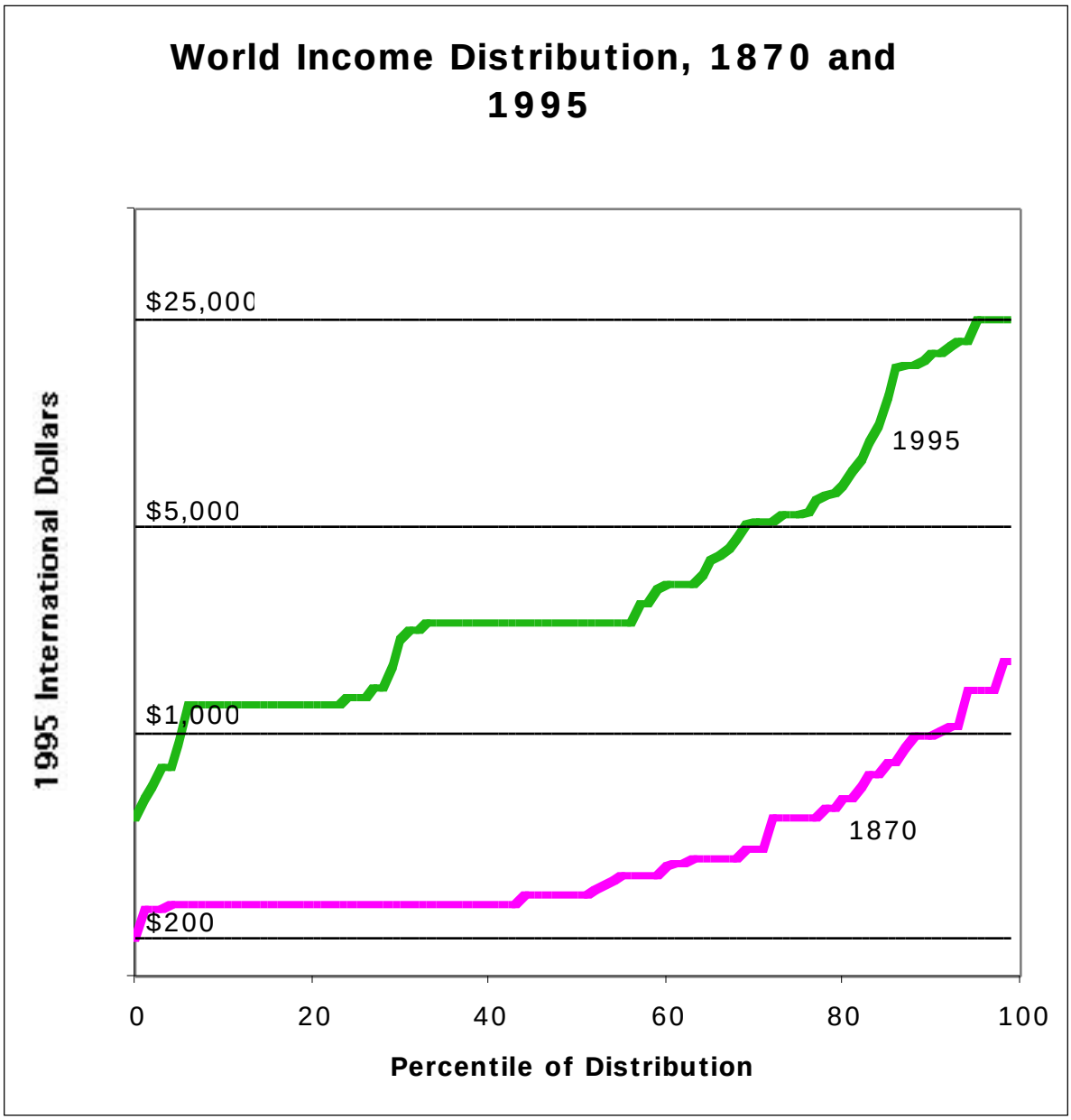
But in this case correcting for possible distortions would simply amplify the message of the figure above: the world is a much, much more unequal place in relative incomes than it was a century ago.

Question: Does this mean that the world's poorest people today are between three and thirty times as well off as their counterparts of a century ago? Are the underestimates of economic growth as significant at the low as at the high end of the world's income distribution?

Answer: There are underestimates, but they are probably not as large. This is not to say that the world's poorest today are as poorly off as the world's poorest of a century ago. First of all consider life expectancy: even in the poorest countries today, life expectancy at birth is fifty years, twice what it was a century ago. Even the imperfect penetration of modern medical technologies into the poorest parts of the third world have done marvels for human well-being.

But the benefits that the world's poor have gotten from the invention of new goods and new types of commodities are almost surely smaller than the benefits that the rich have received from the past century's waves of innovation. Suppose that the prices of a set of commodities that take up fifty percent of your budget fall in half: the increase in your real standard of living is approximately twenty-five percent. Suppose that the prices of a set of commodities that take up five percent of your budget fall in half: the increase in your real standard of living is approximately five percent. The rich today are in the first, and the poor today are in the second, category: it truly is the case that the material standard of living of the rich today is vastly greater than the calculations of *Historical Statistics* suggests relative to their counterparts of a century ago, and that the material standard of living of the world's poor today is somewhat greater than the calculations of *Historical Statistics* suggests, relative to their counterparts of a century ago.

of "Divergence, Bigtime".[3] The world is, in relative terms, a much more unequal place than it was a century ago. There has been no "convergence."



[3] See Lant Pritchett (1997), "Divergence, Bigtime," *Journal of Economic Perspectives*.

C. Growth and divergence, 1870-2000

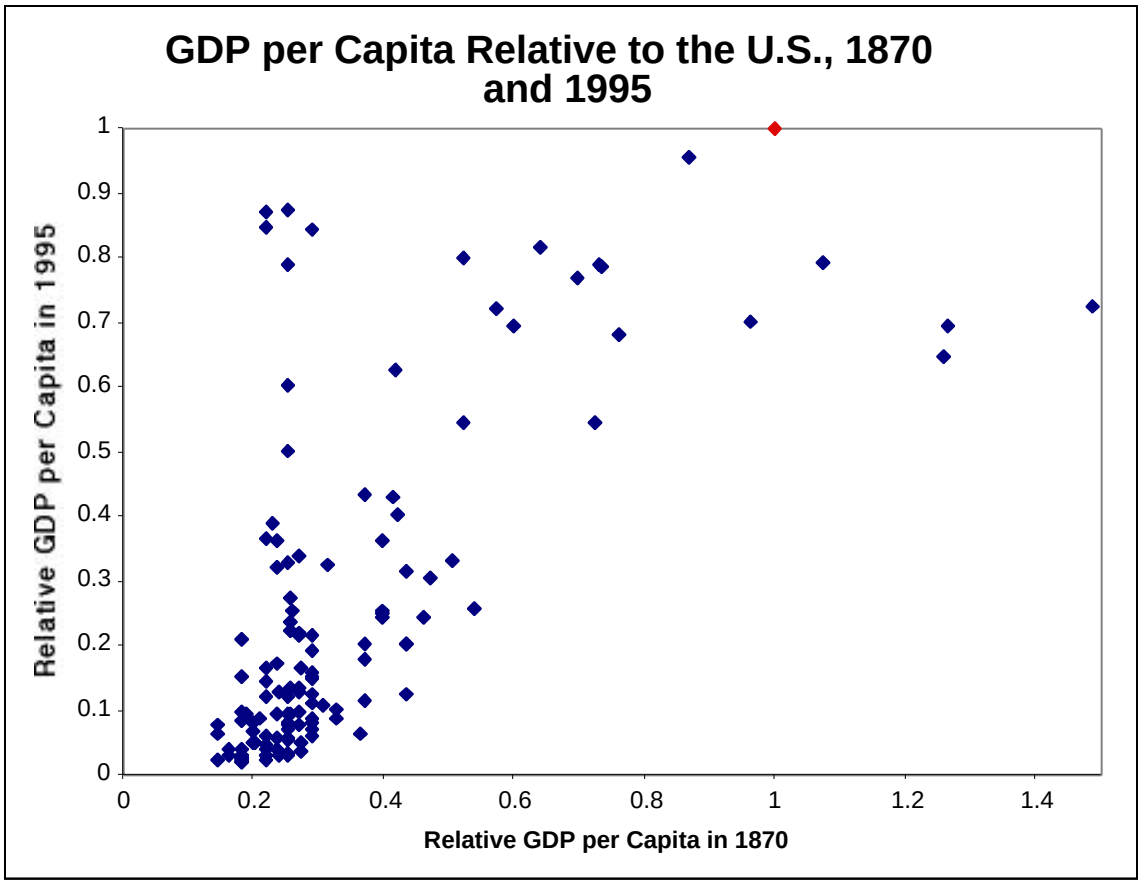
1. Falling behind, catching up, and forging ahead

The failure of convergence over the past century has three aspects. First, there is the failure of technology to diffuse to the world's poorer nations. Second, there is the failure of some of the economies that were among the world's richest at the turn of the twentieth century to maintain their relative pace. Consider Argentina, Norway, Chile, and Finland. All appear to have begun the twentieth century at about the same level of national product per capita. Yet today the Scandinavians have perhaps seven times the level of material wealth as do the South Americans. Both kinds of phenomena—the failure of the poorer nations to grab hold of and adapt modern technologies and the failure of economies that once were near the world's best-practice frontier to hold to their relative positions—are examples of falling behind.

Third, there is the extraordinary twentieth-century trajectory of the United States: an example of forging ahead. Between approximately 1890 and 1930—or perhaps 1890 and 1950—a host of innovative technologies and business practices were adopted in the United States and *nowhere else.* Europeans speak of "Fordism": taking the part—Henry Ford's assembly lines in Detroit, and his mass production of the Model-T Ford—for the whole. The fact that other industrial economies were unable to adopt the American techologies of mass production and mass distribution in the first half of the twentieth century gave the United States a unique level of industrial dominance and technological leadership.

These three phenomena—falling further behind by the poor, falling behind by countries that once seemed well-positioned to grow as fast as any in the twentieth century, and the forging-ahead of the United States—dominate the changes in the relative distribution of material wealth over the twentieth century. They have made the world's relative distribution of wealth at the end of the twentieth century vastly more unequal than it was at the end of the nineteenth. And it is in large part the initially-rich countries that have boosted their incomes relative to the others: for every y percent that one particular country was richer than another in 1870, your best forecast is that it would be 1.54 times y percent richer by 1995. (If the standard statistical assumptions of regression analysis held—which they do not—then there would be 95 chances out of 100 that the "true" amplification coefficient

governing the relationship between 1870 and 1995 GDP per capita differences would lie between 1.26 and 1.86.



But the phenomena of divergence is not all that has been going on. There are also stunning examples of catching-up: countries that have fulfilled economists' visions of convergence, and that have rapidly closed the gaps between their initial relative poverty and the world's best-practice levels of material productivity. Consider Japan, South Korea, Italy, Hong Kong and Singapore, and Taiwan. The examples of successful catching-up suggest that things could have been otherwise: that economists' hopes for convergence could have been fulfilled in the past century, and could be fulfilled in the next.

It is important to always keep in mind that in this context "stagnation" is a relative term. A few of the worst-performing countries have—perhaps—stagnated in absolute terms. But many of them have not.

For example, consider Argentina, one of the world's most disappointing performers in terms of economic growth in the twentieth century. Argentina has experienced substantial economic growth. *Officially measured* labor productivity or national product per capita in Argentina today is perhaps three times what it was in 1900.[4] True productivity, taking adequate account of the value of new commodities, is higher.

But the much more smoothly-running engine of capitalist development in Norway—no more, and probably less, rich and productive than Argentina in 1900—has multiplied *measured* national product per capita there by a factor of nine. In 1900 Argentina was a rich First World nation: in 1913 Buenos Aires ranked thirteenth among the cities of the world in density of telephones *per capita*. Even as late as 1929 Argentina ranked fifth in the world in automobiles *per capita*, ahead of every nation save the U.S., Canada, France, and Britain.[5] But over the course of the twentieth century it has been overtaken by Finland, Japan, Korea, Norway, and Taiwan; and perhaps by Brazil and Chile.

Too great a focus on winners and losers in a relative economic growth race tends to eclipse the fact that the world economy is a positive-sum game. In the long run all are enriched by and benefit from the early success of a few.

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

What is bad about falling behind is that the world's industrial leaders provide an easily viewable benchmark of how things might have been different, and of how much better things might have been. There was no destiny keeping Buenos Aires today from looking like Paris, Toronto, or Sidney. It was, but is no longer, a first world city—and it could have remained one.

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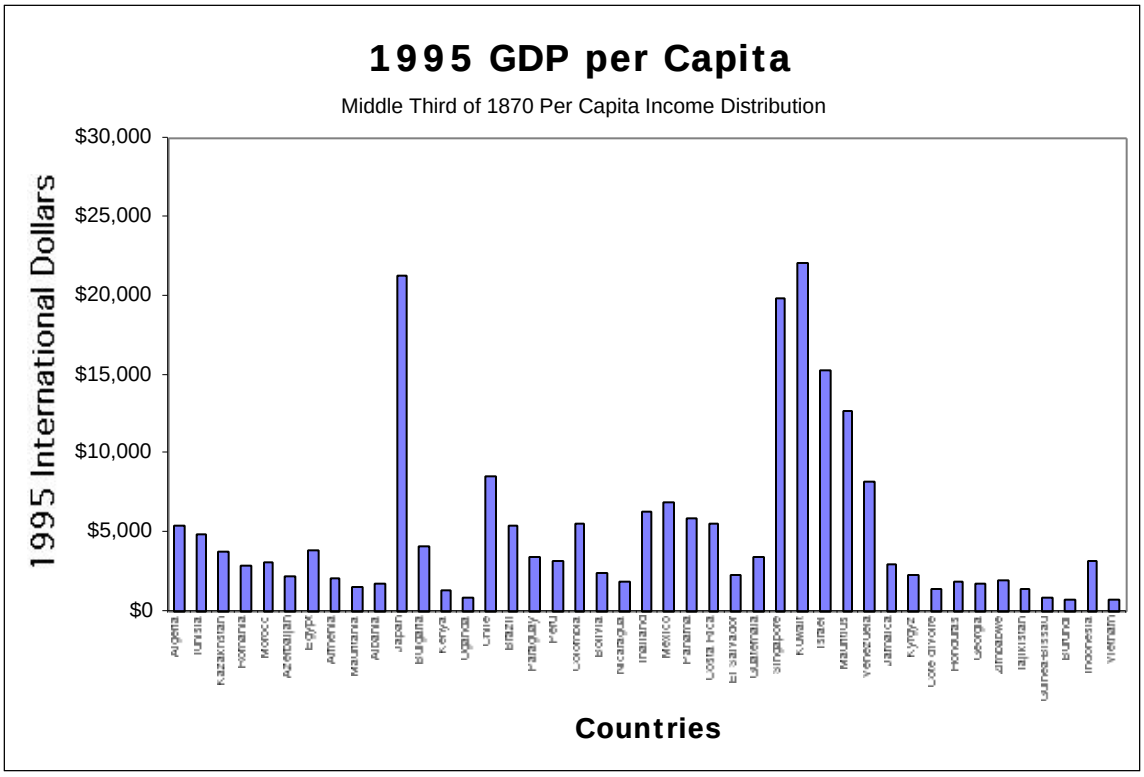
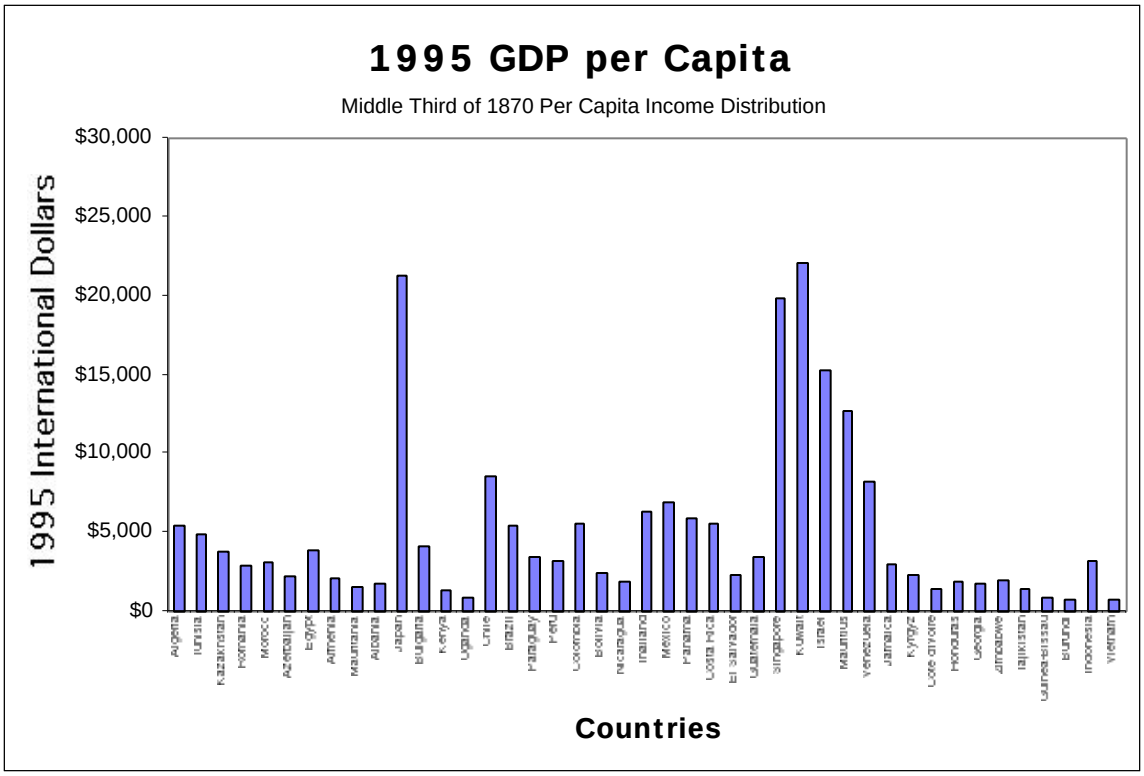
[4] Argentina sources. Carlos Diaz-Alejandro. Alan Taylor. Others

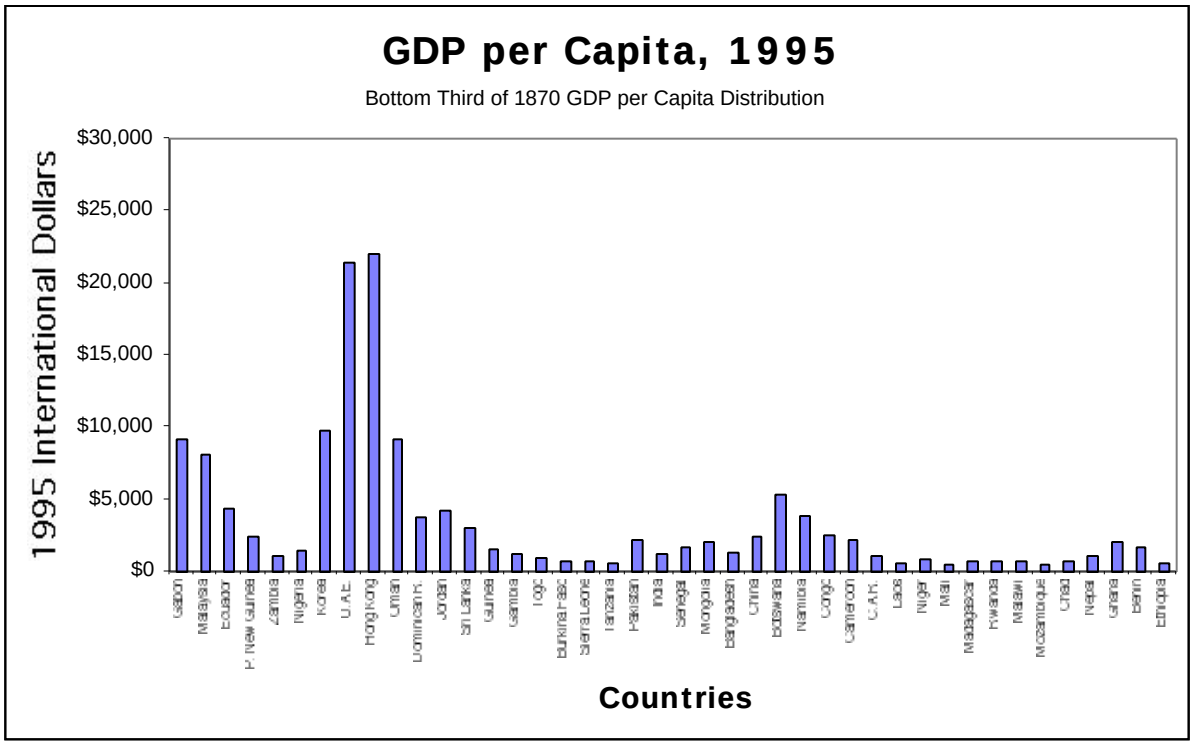
[5] See Flick (), *The Automobile Age* ().

Even more horrifying is the economic performance of sub-Saharan Africa since independence. There is little good reason to believe that sub-Saharan Africa (excluding South Africa) has experienced *any* improvement in standards of living or national product per worker over the past third of a century.[6] From the perspective of material wealth the years since the attainment of African independence from European colonial powers have, taken together, been a false start.[7] This is a tremendous disappointment given the signs of increasing wealth and development seen in the colonial period, and given the high hopes that existed at the time of decolonization.[8]



[6] Robert Bates (), *Markets and States in Tropical Africa* ().
[7] Rene Dumont (), *False Start in Africa* ().
[8] World Bank *World Development Report* footnote.


1995 GDP per Capita
Middle Third of 1870 Per Capita Income Distribution
1995 International Dollars
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Countries


GDP per Capita, 1995
Bottom Third of 1870 GDP per Capita Distribution
1995 International Dollars
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Countries

False starts and misdirected patterns of political economy appear to have extraordinarily severe consequences: the descendants of those who migrated from Sicily to New York or to Milan in the last years of the nineteenth century are today more than four times as well off as the descendants of those who migrated from Sicily to Buenos Aires. Relative economic decline is not confined to those nations that began the century far behind the industrial core in productivity. Great Britain, which in the nineteenth century played the same role in the world economy that the United States has played in the twentieth, has today a level of *per capita* national product perhaps two-thirds that of the United States, and noticeably below that of most western European nations.

2. Sources of divergence: culture

Such enormous disparities in relative growth spring from patterns of mistakes generated by patterns of rule and of political influence. The principal producers of material wealth are an economy's workers, and not its natural resources. The presence or absence of a "culture of entrepreneurship" is not usually a deciding factor: entrepreneurship can be found in many places, if the incentives and institutions are right.

Consider the Chinese diaspora. Throughout South Asia emigrants from China play key roles in trading and manufacturing, while China proper remains one of the poorest countries on earth. It is hard to imagine that any force other than China's governors—from the Chien Lung Emperor to Mao Zedong and Deng Xiaoping—who have kept China so poor.

Consider that at least some British observers in the early twentieth century believed that the Japanese did not have and could not learn the habits and patterns of behavior necessary for successful industrialization.[9] Consider that perhaps the most intelligent and far-sighted social scientist of the early twentieth century—the German sociologist Max Weber—argued that the Hindu, Buddhist, and Confucian traditions of East Asia militated powerfully against the development of modern market economies and industrial societies.[10] From today's viewpoint, from which the most important event in

[9] T.N. Srinivasan ()
[10] Max Weber footnote.

the past twenty-five years is the East Asian miracle, such confident predictions appear naïve.

And consider that cultures today are more malleable and more permeable than every before. Potential contacts between China and Italy are not limited to occasional travellers who bring back the concept of noodles, but consist of an enormous number of tourist visits, acts of economic exchange, and cultural broadcasts. If there are strands in any culture that can encourage and support enterpreneurship—and there are such strands in every culture—then they have every prospect of being able to support a growing, industrializing economy.

It is certainly possible for a government that wants to keep its culture largely pure, its people isolated—and its country poor—to do so to a large extent. Look at North Korea, or at Iran. But the work of maintaining poverty is in these cases being done not by the culture, but by those who control the coercive powers of the state.

3. Determinants of *Relative* Economic Growth:

What has determined which countries have wound up near the top (and which have wound up near the bottom) of today's world relative income distribution? It turns out that more than half of the variance in the world's relative distribution of GDP per capita by nation can be accounted for with one single factor: the relative long-run capital intensity of that country's economy. And if you add a second factor—what GDP per capita was half a century ago, back at the end of World War II—with these two factors alone you can account for fully five-sixths of the divergence in today's distribution of output per capita across nations.

The long-run capital intensity of the economy—its steady-state capital-output ratio—can be calculated in three steps. First, note that the rate at which the capital stock (denoted by "K") is increasing is equal to the share of output devoted to investment (denoted "i") times the level of output (denoted "Y") minus the product of the rate at which the existing capital stock depreciates (denoted "δ") times the existing capital stock K. Writing $^{dK}/_{dt}$ for the rate of change of the capital stock:

$$\frac{dK}{dt} = iY - \delta K$$

Second, note that the rate of increase in total output is equal to the current level of output times the sum of the proportional rate of increase of the population (denoted “n”) and the proportional rate of increase of output per capita (denoted “g”):

$$\frac{dY}{dt} = (n + g)Y$$

Third, note that the capital intensity of the economy will be constant—that the capital-output ratio will be at a steady state—if the rate at which the capital stock is growing is equal to the current capital/output ratio (denoted “K/Y”) times the rate at which output is growing:

$$\frac{dK}{dt} = \left(\frac{K}{Y}\right)\frac{dY}{dt}$$

Combining these three equations and rearranging :

$$iY - \delta K = \left(\frac{K}{Y}\right)Y(n + g)$$

$$iY - \delta K = K(n + g)$$

$$iY = K(n + g + \delta)$$

$$\frac{K}{Y} = \frac{i}{n + g + \delta}$$

gives the economy’s long-run steady-state capital intensity. Relative output per capita will then in the long run be proportional to:

$$Y \left(\frac{i}{n + g + \delta}\right)^{\left(\frac{\alpha}{1-\alpha}\right)}$$

where α is the “share” of capital in the economy’s total productive resources.

The figure below plots 1992 levels of relative GDP per capita against this summary measure of the economy's long-run capital intensity. The statistical relationship is clear and strong. A one percent rise in long-run capital intensity is associated with a 1.13 percent rise in total GDP per capita—corresponding to a "share" α of capital in the economy's productive resources of 53%.

Thus three factors appear to be most important in accounting for how a country has done in relative terms in its productivity growth over the past century:

- *The productivity gap vis-a-vis the world's best practice economies.* The further a country is behind the world's industrial leaders, the more scope there is for rapid industrialization and development—but the fact that there is a large gap to be closed means that a relatively poor economy is likely to stay relatively poor for a long time.

- *The rate of investment.* High *private sector* investment has two benefits. First, high investment means that the average worker has a better and more productive work environment: more structures investment means better work spaces, and more equipment investment means more machines to amplify productivity. Second, high investment—especially high machinery investment—is essential to use better technologies. A very large chunk of new and better technological knoweldge is *embodied* in the machines that are the principal creation of the industrial revolution, in the sense that new and more productive technologies are impossible to utilize without the appropriate capital equipment. Many factors affect the rate of investment, including:

    - national savings rates
    - foreign investment rates
    - tax systems
    - the extent of "kleptocracy"—the extent to which the government is best described as "rule by the thieves"
    - the real rate of interest
    - the economy's relative price structure--are the goods that make up investment relatively cheap or relatively dear
    - the degree of free trade

Most of these appear to affect economic growth primarily through their effects on the rate at which the stock of capital goods is built up, and not to have an independent effect working through other channels than the rate of investment.

· *The rate of population growth*. How close the society is to completing its demographic transition. A high rate of population growth means that existing savings and investment must be distributed over a rapidly increasing base of potential workers, and tends to lower the steady-state capital output ratio.

For completeness' sake it is important to add a fourth important factor:

· *Whether market forces or bureaucractic commands govern resource allocation.* Market forces exert pressure to allocate resources to their most productive uses. Bureaucratic commands exert pressure to allocate resources following other logics. A country like the Soviet Union or like Zambia can have a very large technology gap and a high measured rate of investment. But if investment is allocated and industries grow not by the profitability of its use but by the political power of its users, it will not do nearly as much good for productivity and economic growth.

4. Vicious and virtuous circles

The strong and robust relationship between long-run capital intensity and relative GDP per capita creates the potential for powerful virtuous *and* vicious circles—for the principal determinants of an economy's long-run capital intensity, its rates of population growth and its share of total GDP devoted to investment, are themselves as much consequences as causes of the relative level of GDP per capita.

Consider, first, the demographic transition.

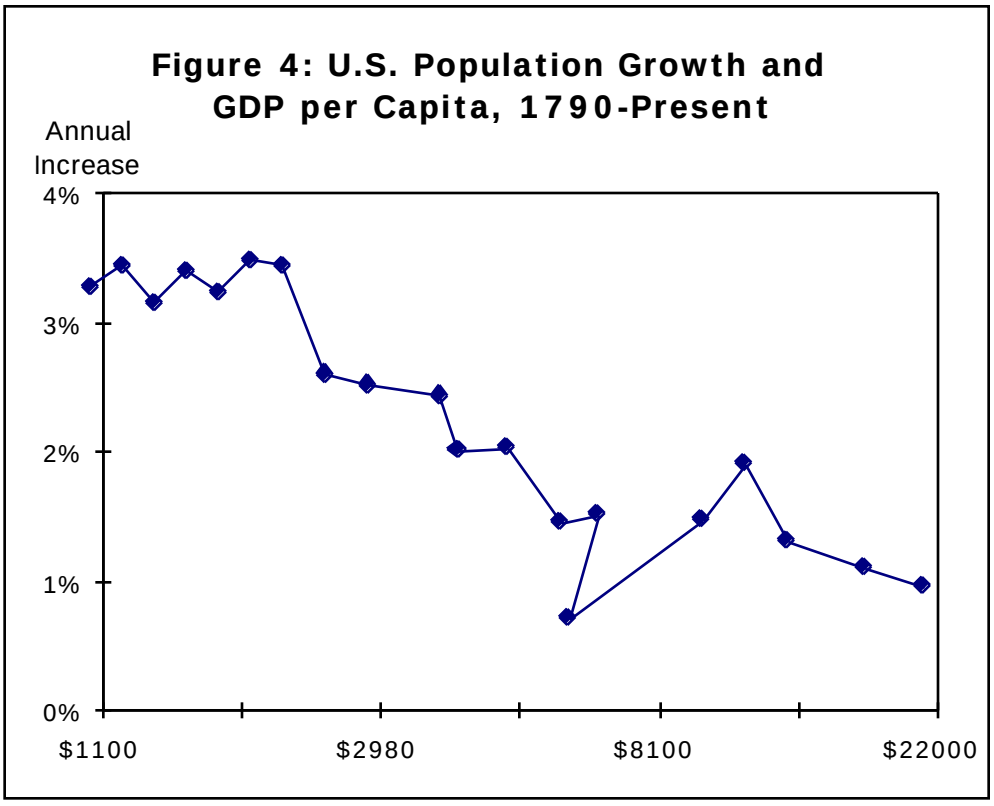
Sometime between the fifteenth and the eighteenth centuries the human race passed through what we all hope was its last "Malthusian" episode, in which rising population and limited agricultural resources led to nutritional deficits, higher than average mortality, and population stagnation. Since then the pace of productivity improvement in agriculture has kept ahead of agricultural resource scarcity and population growth (that has carried the

world's population from one to six billion so far). Nutrition has been relatively high by historical standards, natural fertility high as well, and natural mortality low.

In the past, the richest human populations appear to have also seen the fastest population growth. But starting perhaps in eighteenth century France a new pattern began to emerge, in which increases in GDP per capita led not to greater fertility and faster population growth but to lower fertility and slower population growth. The number of girls born per potential mother fell, and population growth rates slowed.

The figure below shows this pattern at work in the United States over the past two centuries: as GDP per capita has grown, the rate of natural increase of the U.S. population has fallen steadily. Once U.S. GDP per capita grew beyond the $2000 or so 1993 dollars level, fertility began to drop sharply enough to offset the declines in mortality that also accompanied better medicine and rising material prosperity. The rate of population growth, excluding net immigration, is now little over one percent per year—far below the 3.5 percent per year in natural population increase seen in the first half-century of the republic.

The pattern of rising material prosperity and falling natural population increase has had only one significant interruption in the United States in the past two centuries. The Great Depression of the 1930s saw a very sharp fall in childbearing, and a reduction in natural population growth in the 1930s to only 0.7 percent per year. In what Richard Easterlin (1982) sees as a delayed positive response to the Great Depression that balanced out the birth deficit of that decade, births rose to a level not seen since the nineteenth century in the "baby boom" of the 1950s.



The pattern of increasing material wealth and slowing population growth seen in the United States is typical of the pattern that has so far been followed by all nations that have successfully industrialized. Each tripling of GDP per capita is associated with an approximately one percentage point per year fall in the rate of natural population increase. A richer country has more literate women, and literate women—worldwide—are very interested in effective birth control. In a poorer country the average level of education is low, and children can be put to work at a relatively early age, thus augmenting the production resources of the household. In a richer country the average level of education is high, and children are a major drain on household cash flow for nearly two decades.

Children in relatively poor, low-productivity economies are much more like an “investment” good than are children in rich, high-productivity economies: they are a way to augment the economic resources of the household in a time span of a decade or so. By contrast, children in relatively rich, high-productivity economies are more like a “consumption” good.

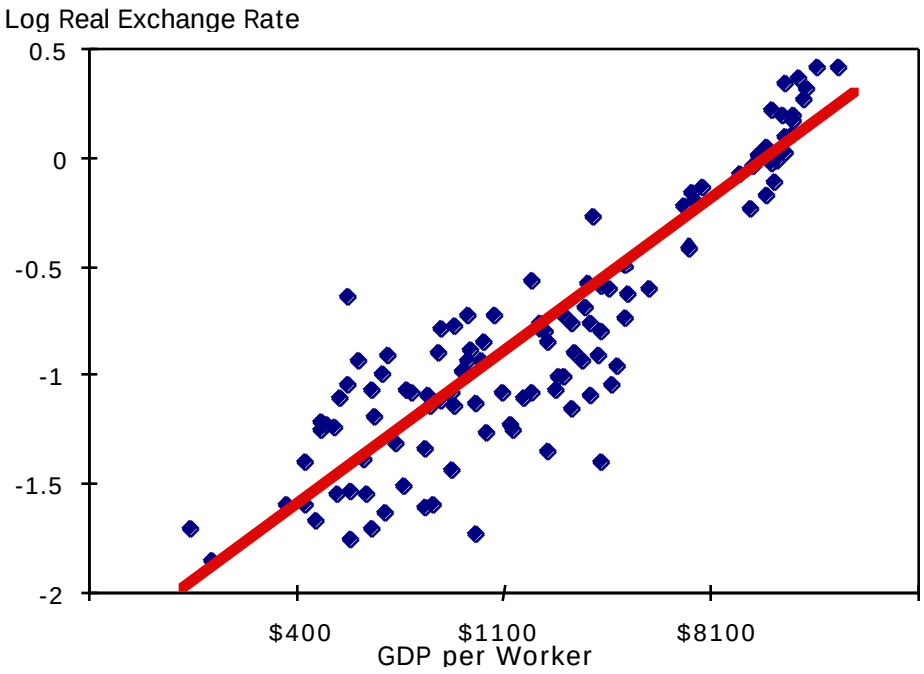
Thus we would expect—and we do see—a substantial correlation between high GDP per capita and low population growth arising not so much because low population growth leads to a higher steady-state capital-output ratio but because of the demographic transition: the changes in fertility that have so far been experienced in every single industrialized economy.

Consider, second, the relative prices of investment goods—of the capital equipment that a country needs to acquire in order to turn its savings into productive additions to its capital stock.

If you calculate the spread between the highest and lowest levels of GDP per capita in different countries today, and if you use current exchange rates to transform incomes in different currencies into each other, you find that the richest economy is some 400 times as rich as the poorest. By contrast, the spread using purchasing power parity-based measures—measures that attempt to translate dollars into rupiah and back in a manner that preserves overall purchsing power—is smaller, a factor of 50. The difference between the two is the level of the real exchange rate: the real exchange rate in the poorest countries is one-eighth of its value in the richest. Variations in GDP per capita levels account for 80 percent of the cross-country variation in the real exchange rate; each one percent rise in GDP per capita is associated with an 0.34 percent rise in the real exchange rate.

Real exchange rates move in order to make the prices of internationally-traded manufactured goods roughly the same in the different nations of the world (putting to one side over- or undervaluations produced by macroeconomic conditions, tariffs and other trade barriers, and desired international investment flows). Thus the eight-fold difference in real exchange rates between relatively rich and relatively poor economies is a reflection of an eight-fold difference in the price of easily-traded manufactured goods: relative to the average basket of goods and prices on which the “international dollar” measure is based, traded manufactures in relatively rich countries have only one-eighth their real price in relatively poor countries.

Figure 5: Log Real Exchange Rate, and Log GDP per Worker



This should come as no surprise. The world's most industrialized and prosperous economies are the most industrialized and prosperous because they have attained very high levels of manufacturing productivity: their productivity advantage in unskilled service industries is much lower than in capital- and technology-intensive manufactured goods.

And a low relative price of technologically-sophisticated manufactured goods has important consequences for nation-states' relative investment rates. In the United States today machinery and equipment account for half of all investment spending; in developing economies—where machinery and equipment, especially imported machinery and equipment is much more expensive—it typically accounts for a much greater share of total investment spending (see Jones, 1994; De Long and Summers, 1991).

Consider the implications of a higher relative price of capital goods for a developing economy attempting to invest in a balanced mix of machinery and structures. There is no consistent trend in the relative price of structures across economies: rich economies can use bulldozers to dig foundations, but poor economies can use large numbers of low-paid unskilled workers to dig

foundations. But the higher relative price of machinery capital in developing countries makes it more and more expensive to maintain a balanced mix: the poorer a country, the lower is the real investment share of GDP that corresponds to any given fixed nominal savings share of GDP.

Consequences for National Investment of Relative Poverty, and a High Price of Capital Goods

RER GDP per Capita Level	Price of Machinery	Savings Share of GDP	Investment Share
$24,000	100	20.0%	20.0%
$6,000	160	20.0%	15.4%
$1,500	257	20.0%	11.2%
$375	411	20.0%	7.8%
$95	659	20.0%	5.3%

The table above shows the consequences—the gap between nominal savings and real investment shares of GDP—that follow from the high relative price of machinery and equipment in poor countries that wish to maintain a balanced mix of investment in structures and equipment. For a country at the level of the world's poorest today—with a real exchange rate-based GDP per capita level of some $95 a year—saving 20% of national product produces a real investment share (measured using the "international dollar" measure) of only some 5% of national product.

In actual fact poor economies do *not* maintain balanced mixes of structures and equipment capital: they cannot afford to do so, and so economize substantially on machinery and equipment. Thus here are two additional channels by which relative poverty is a cause slow growth: first, relative poverty is the source of a high real price of capital, a low rate of real investment corresponding to any given nominal savings effort, and a low steady-state capital-output ratio; second, to the extent that machinery and equipment are investments with social products that significantly exceed the profits earned by investors (see De Long and Summers, 1991), the price

structures in relatively poor developing economies lead them to economize on exactly the wrong kinds of capital investment.

Thus we have our vicious circle. A poor country is one that has not completed its demographic transition and thus has a high rate of population growth. A poor country is one in which manufactured capital goods are expensive—and so even a considerable savings effort, in the sense of a large proportion of income held back from consumption, supports only a small investment outcome. Both of these factors mean that in a poor economy long-run capital intensity will be low—and this will make a poor economy even poorer in relative terms.

But there is also the possibility for virtuous circles: anything that increases national productivity and that sets the demographic transition in motion will—both through the Balassa-Samuelson effect that raises the real exchange rate and thus the power to purchase capital goods, and through the fall in population growth—induce an increase in long-run capital intensity and thus a much greater total increase in GDP per capita.

How importantant are these vicious and virtuous circles? De Long (1997) reported a series of simulations that suggested that upward or downward shifts in productivity in developing countries would have long-run effects on GDP some six times as large as standard growth-accounting calculations would allow.[11]

It is difficult to look at the cross-country pattern of growth over the past century without thinking that such vicious and virtuous circles *must* have been very important. What difference between Canada and Argentina in 1870 would have led anyone to forecast their—now more than two and a half-fold—difference in GDP per capita? Or the twenty-fold gap between Taiwan and India? Recognizing the endogeneity of the demographic transition and of investment has the potential to help us understand why the economic history of the past century and a quarter has proceeded as it did,

[11] Note that the growth accounting decompositions are not wrong, but incomplete: to the extent that the higher capital stock is a result of higher total factor productivity reducing the relative price of capital, and to the extent that higher total factor productivity pushes an economy further along its demographic transition to low population growth, exogenous shifts in total factor productivity have effects orders of magnitude greater than growth accounting procedures suggest, even without any powerful externalities in the production function.

without requiring assumptions of external effects that seem—perhaps—implausibly large.

5. Investment and politics

Of the direct causes of rapid growth, perhaps the most important is the rate of investment.

[Figure: heavy capital good being unloaded from hull of ship]

Why should investment play such a key role? It is, of course, no accident that the era in which European economic growth took off is called the *Industrial* Revolution. Blanqui, one of the first to use the phrase *industrial revolution* in print, identified its beginnings in the invention and spread of those "two machines, henceforth immortal, the steam engine and the cotton-spinning [water frame]."[12] Ever since, qualitative historical discussions of growth have emphasized the role of machinery investment in augmenting labor power. Historians of technology have long argued that the capital goods industries are uniquely well suited to serve as centers for technological diffusion to other sectors of the economy where such knowledge had practical applications.

This suggests a role for government intervention to advance industrial development: the government should step in because private investors do not face the right incentives to develop and invest early and heavily in modern machinery and equipment.[13]

Of course that governments *can* does not mean that governments *will.*

Over the past two decades, many have argued that the typical systems of regulation introduced in developing countries to accelerate development were in fact retarding development. First, they were preventing the economy from responding to international price signals by shifting resources to activities in which the country had a long-run comparative advantage. Second, they were inducing firms and entrepreneurs to devote their energies

[12] Blanqui ().
[13] *The East Asian Miracle*

to seeking rents by lobbying governments instead of seeking profits by lowering costs.

Taken as a group, poor countries have *not* closed any of the gap relative to the world's industrial leaders over the post-World War II period. Poor countries have relatively low shares of investment in national product: capital goods are relatively expensive, meaning that even a hefty savings effort translates into little increase in the capital stock; savings rates are relatively low; and taxes are siphoned off to maintain the incomes of politically powerful groups rather than to support public investment projects.

Yet economies that have managed to curb population growth and boost savings and investment have managed to close the gap vis-à-vis the world economy's industrial core faster than anyone would *ex ante* have believed possible.

The general conclusion is one that either Adam Smith or Karl Marx would have found natural: market economies prosper and grow when they are managed in the interests of the business class. When governments intervene to shift prices and quantities in order to distribute income away from the productive and entrepreneurial classes-both current and prospective future members of the *bourgeoisie*--and toward others, whether urban consumers, bureaucrats, or small-scale inefficient rice farmers--economic growth and development suffers.

Poor countries could grow rapidly if their governments took a long-run view of their people's interest and followed appropriate policies. But what pressures are there to push governments-especially unelected, non-legitimate modern dictatorships-to take a public-spirited long-run view? W.W. Rostow recounts a visit by President Kennedy to Indonesia in the early 1960s; Kennedy talked about economic development, and a South Asian development bank to provide capital for Indonesia's economic growth. The Indonesian dictator Sukarno's response? "Mr. President, development takes too long. Give me West Irian [province to annex] instead."[14]

[14] W.W. Rostow (), *Theories of Economic Growth* ().