Changes in the Wealth of Nations

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In his book *The Wealth of Nations,* Adam Smith (1776) challenges the mercantile view that a nation becomes wealthier as its stocks of gold and silver increase. He argues that the wealth of a nation is not measured by its supply of precious metals, but by the productivity of its labor force. An increase in the amount of gold bullion in a country may make its currency worth more than another country's, but the gold increase will not increase the relative worker productivity in the two countries. Accepting Smith's definition of a nation's wealth leads naturally to per-capita gross domestic product (GDP) as the appropriate measure of that wealth.

In this article, we use per-capita GDP data to determine what we call the *economic development facts.* We systematically examine the nature of the distribution of wealth across nations and describe how this distribution has evolved over specific historical periods. We also describe the wealth mobility of nations, that is, the changes in the relative wealth of individual nations.

Such a systematic report is important for two reasons. First, data serve as a test of theory. Any theory inconsistent with the development facts cannot help us understand the differences in the wealth of nations—or evaluate economic policies that might help reduce those differences. (For a description of the successes and failures of existing theories, see the article by James A. Schmitz, Jr., in this issue.) Second, data can play an important role in the creation and evolution of successful theory. If we know what the development facts are, we should have a better idea what features belong and don't belong in a model of economic development.

We emphasize that this study is factual rather than empirical. We have no underlying probability models here, and we draw no inferences to larger populations. We simply report what happened over the time periods for which we have been able to find useful data. Our approach is thus in the tradition of Simon Kuznets (1966). His reporting of the growth facts was important in Robert M. Solow's (1970) development of the neoclassical growth theory. This theory was a major advance in economics. It has proven useful not only in accounting for the growth facts, but also in accounting for business cycle fluctuations and determining the welfare consequences of economic policies. We hope that our study will stimulate the creation of theories that will prove as useful in analyzing the area of economic development.

Our study reveals that the most prominent features of the data over the time periods examined—primarily, 1960–85—are wealth disparity and wealth mobility. These features can be summarized as four development facts:

- In every year studied, there is great wealth disparity

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among countries. In 1985, for example, the highest-output countries were 29 times richer than the lowest-output countries.

- Wealth disparity has not increased or decreased. The distance between the richest and poorest countries remained essentially the same throughout the 1960–85 period.
- The wealth distribution has shifted up: the richer got richer, but the poor did too. Therefore, no absolute poverty trap exists.
- There have been development miracles and disasters. During the 1960–85 period, 10 countries increased their wealth relative to the wealth leaders by a factor of 2 or more. These miracles were matched by an equal number of development disasters: during the same period, the relative wealth of another 10 countries decreased by a factor of about 2.

These are the facts that a theory of development must be consistent with if it is to be taken seriously.

Methodology

Sources of Data

In the past, analyses of the evolution of the wealth distribution and wealth mobility have been restricted to a set of currently rich countries because these were the only countries for which per-capita output data were available over a sufficiently long period of time. Today sufficiently long data series are available for most countries of the world. We use one main data set, supplemented with data from three other sources.

☐ *The Main Data Source*

Our primary data set is that of Robert Summers and Alan Heston (1991). They have compiled observations for 138 countries for the nearly 40 years between 1950 and 1988.

Unfortunately, however, observations for all 138 countries in the Summers and Heston data set are not available for all years. Because we want to consider the largest population of countries over the longest period of time, we use their data for just the 26 years between 1960 and 1985. As long as observations for a country are available for all years in the 1960–85 period and as long as that country had a population in 1969 of at least 1 million, that country is included in our analysis. We exclude countries with populations smaller than 1 million because the wealth of such countries is too easily affected by external factors. Missing data and small populations are the only reasons we exclude countries.[1]

In 1969, 120 countries in the world had a population of at least 1 million. Of these 120 countries, complete data are not available for 18. Eliminating these countries reduces our data set to a total of 102 countries for the 1960–85 period.

☐ *Other Data Sources*

Obviously, we would like to have data that extend over longer time periods. The problem is that the further back we go, the set of countries for which data are available shrinks. The number of countries for which we have been able to find observations dating back at least to the beginning of the 20th century is 29. When possible, we will also consider this 29-country data set here.

This longer data set comes from three different sources. Observations for 16 of the 29 countries are those of Angus Maddison (1991). These 16 countries are all advanced industrialized countries, and observations on them begin in the year 1820. We supplement Maddison's data with data from the work of J. Bradford De Long (1988) and Pierre Van der Eng (1992). The De Long data begin in 1870 for Maddison's 16 plus 6 other countries. These others were, according to De Long, very similar to the Maddison 16 in their 1870 potential for development. The Van der Eng data begin in 1900 and include data for Japan and for 7 other Asian countries not included in either the Maddison or the De Long data. A problem with combining data from these three sources is that while the periods they cover overlap, the specific years for which they actually have data differ.

For a list of all the countries and years included in our study, grouped by the source of their data, see the Appendix.

Types of Comparisons

We compare the wealth of nations in two different ways: across different countries at one point in time and across different points in time for individual countries.

☐ *At a Point in Time*

To compare wealth across nations at a point in time, comparable measures of per-capita GDP must be constructed. All our data sources construct such measures using a common set of prices. Summers and Heston, De Long, and Van der Eng use a common set of prices made up of the weighted averages across countries of the relative prices

[1]Summers and Heston rate the quality of data for each country in their survey. We do not exclude countries based on these quality ratings because we think even the poorest-rated data in the survey contain valuable information.

of each good in a particular basket of final goods and services. Here we refer to this set of prices as *world prices.* Maddison uses the relative prices of final goods and services in the United States in 1985.

Another approach to measuring output for international comparisons has often been used, but is not as good. This is to value each nation's basket of the quantities of final goods and services at domestic prices and then convert that measure of output into a common monetary unit by multiplying it by the exchange rate. The problem with this exchange rate method is that the amount that one currency can buy when exchanged for another currency is not the same across countries or across time. A U.S. dollar, for example, buys much more in India than in Japan. Similarly, in 1985 a U.S. dollar bought less in western Europe than in the United States, but in 1965 the reverse was true. Such differences in exchange rates do not reflect differences in productivity.

The distortions that result from this exchange rate method are not insignificant. When international prices are used instead of exchange rates to compute wealth in 1988, for example, Japan goes from being 10 percent wealthier than the United States to being only 70 percent as wealthy as the United States, and India's output goes from 2 percent to 5 percent of U.S. output. This factor difference of 20 between the United States and India probably still overstates the true difference in standards of living between the two countries, since the informal economy is probably a much larger fraction of total output in India than in the United States. The market basket of goods is also very different in a poor country like India than in a rich one like the United States. Still, the factor difference of 20 is a much more accurate indication of the difference in standards of living than the factor difference of 50 implied by the use of exchange rates.

Because our per-capita GDP figures are based on world prices, our comparisons of wealth better measure differences in standards of living than previous comparisons based on exchange rates.

When making comparisons of relative wealth across countries at a point in time, we measure GDP slightly differently for our two data sets. For our 102-country data set, we divide each country's year t per-capita GDP measured in year t world prices by U.S. year t per-capita GDP measured in year t world prices. For our 29-country data set, we divide each country's year t per-capita GDP measured in base-year world prices by U.S. year t per-capita GDP measured in base-year world prices. We refer to both of these measures as a country's year t *relative wealth.*

We would have preferred to use the year t measures of relative wealth that used year t world prices for both of these data sets. But we had to use measures constructed with base-year world prices for the 29-country data set because neither Maddison nor De Long nor Van der Eng provide observations of year t per-capita GDP in year t world prices. Unfortunately, this may mean our measures of relative wealth will miss some changes. One country's wealth may increase or decrease relative to another country's wealth if the baskets of the relative quantities of final goods and services change or if the relative prices of final goods and services change. Changes in relative wealth brought about by a change in relative prices are relevant to a study of changes in the wealth of nations. The measures of relative wealth for our 29-country data set will not reflect any such changes.

□ *Across Points in Time*

While the use of year t prices in valuing year t quantities of final goods and services is a sensible procedure when comparing different countries' wealth at one point in time, it is not so reasonable when comparing one country's wealth at different points in time. The problem is that such measures of wealth may show changes over time even when the basket of the quantities of final goods and services produced has not changed. This would happen if, for example, the quantities produced did not change between two years, but the prices of all goods doubled: for those two years, the measures of wealth that use each year's prices would show a doubling.

Comparisons of a country's wealth at different points in time are thus typically based on measures of output that value the quantities of final goods and services produced in each year using prices for some base year. Such measures are commonly referred to as a nation's *real output.* By valuing the baskets of the quantities of final goods and services in different years with the same set of prices, the effect of a general increase in prices between periods on the measures of a nation's output in those periods is eliminated.

Maddison, De Long, and Van der Eng all use this base-year pricing procedure in making comparisons of wealth across time. We considered following them here, but then chose an alternative procedure for our 102-country data set. Our alternative procedure not only eliminates the effect of a general increase in prices, but also is consistent with our measures of relative wealth.

What we do is use a factor to transform each country's relative wealth each year into its 1985 value. We multiply the country's relative GDP in year t measured in year t world prices p_t by this factor:

$$(1) \qquad f_t \equiv (p_{1985} \cdot x_{\text{U.S.},t})/(p_{1985} \cdot x_{\text{U.S.},1985})$$

where $x_{\text{U.S.},t}$ is the vector of the quantities of final goods and services produced in the United States in year t. In words, f_t is the value of U.S. per-capita GDP in year t, measured in 1985 world prices, divided by the value of U.S. per-capita GDP in 1985, measured in 1985 world prices. In our procedure, the United States acts as a link between two points in time, thus allowing the comparison of a country's wealth at those two points. We refer to these transformed measures simply as *real wealth* or *real per-capita GDP.*

For our 29-country data set, however, we essentially follow Maddison, De Long, and Van der Eng and use each country's year t per-capita GDP in base-year prices.[2] For this data set, we cannot follow our alternative procedure because observations for per-capita output measured in current-year prices are not provided by Maddison, De Long, and Van der Eng. Still, we also call these measures *real wealth* or *real per-capita GDP.*

We could have picked a country other than the United States as the basis for measuring relative wealth and making this connection across two points in time. We chose the United States because its data are reliable; it has been the leading industrialized economy, as measured by output per capita, since 1890; and it produces a diverse basket of goods. That diversity is important because the effect of a change in relative prices on U.S. wealth would likely be small compared to the effect of such a change on the wealth of a country specializing in only a handful of goods.

Log Scales

In our charts displaying the results of our analysis, we use logarithm scales because our interest is in the relative wealth of nations at a point in time and across time. Specifically, most of our charts use log scales to the base 2. (On this scale, the number 0 corresponds to 2^{-0}, or 1 in relative levels; the number -1 corresponds to 2^{-1}, or 1/2 in relative levels; the number -2 corresponds to 2^{-2}, or 1/4 in relative levels; and so on.) An advantage of using the log scale is that in the log space, the distance between two points is just the absolute difference in logs. Thus, the distance between 1 and 1/2 and the distance between 1/2 and 1/4 are the same. This means that whenever the percentage growth rate between two points in time is constant, the path of the logarithm of per-capita GDP shows up as a straight line in that time interval. The steepness of the slope of the line is proportional to the growth rate between the two points.

Disparity Facts

Now that we have shown how we chose and augmented the data sets and have clarified the methods by which we examine and compare the data, we can turn our attention to our results: the development facts themselves. The first set of facts concerns the disparity shown by the distribution of the relative wealth of nations.

A Big Wealth Disparity . . .

The first development fact, and a prominent feature of Chart 1, is that in every year of the 1960–85 period the range of the distribution of wealth among nations is wide. That width indicates the tremendous disparity in per-capita GDP across nations. To attach a few numbers to this disparity, we calculate the average factor difference between the top and bottom 5 percent of the population of countries in our 1960–85 data set. In 1985, this factor difference was 29. Not surprisingly, the richest country in the world that year was the United States; the poorest was Ethiopia. The factor difference in 1985 per-capita GDP between these two extremes was 43.3.[3]

How does this disparity of wealth across nations compare with, say, the disparity of wealth across regions of a country? It is definitely much larger than the difference in per-capita output between states in the United States. In this country, the difference in per-capita output between the top and bottom 5 percent of states in 1985 was a factor of just 1.8.[4] In that year, the richest state was Connecticut, the poorest was Mississippi, and their factor difference was only 2.[5] Thus, the disparity in per-capita output

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[2]We do, however, normalize year t per-capita GDP in base-year world prices for each country to base-year U.S. per-capita GDP in base-year prices.

[3]For making such comparisons, it is really better to use measures of relative wealth. But for 1985, our measures of relative wealth and real wealth are the same.

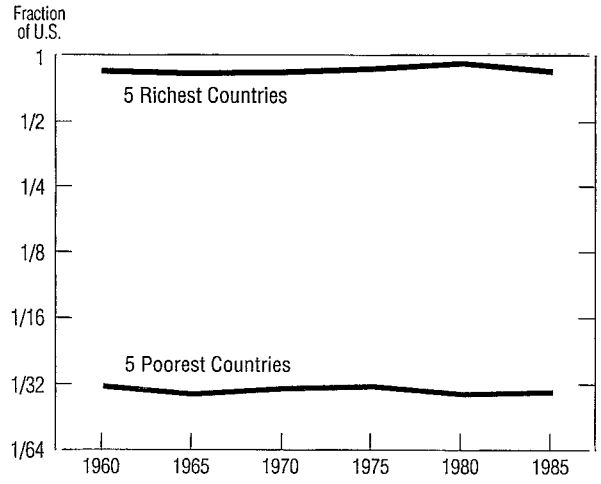
[4]The data for the states are income per capita, not output per capita. They do not include observations for Hawaii and Alaska, but do include observations for the District of Columbia. The state data are from U.S. Department of Commerce 1989.

[5]Actually, these numbers overstate the size of the difference in the per-capita incomes between the richest and poorest states. This is because the measures of states' GDPs use state-own or region-specific prices in valuing output instead of a common set of prices. Prices, especially housing and rental prices, are typically higher in richer states than in poorer states. The use of a common set of prices would thus translate into smaller wealth differences between the rich and poor states.

Chart 1

Wide and Steady Wealth Disparity

Average Per-Capita GDP Relative to U.S. Level
for the 5 Richest and Poorest Counties in the 102-Country Data Set
During 1960–85



Source of basic data: Summers and Heston 1991

across U.S. states pales in comparison to the disparity in per-capita output across nations.

What about differences in income across workers within a country? The difference in per-capita output between the highest- and lowest-paid workers within the United States is closer to the difference in per-capita output between the richest and poorest countries of the world. In the United States, workers in the bottom 5 percent of the distribution tend to be minimum wage earners. The output of a worker earning the minimum wage is roughly one-third of the average output. The median worker in the top 5 percent of the distribution, in contrast, produces three or four times the average. For the nations of the world, the bottom 5 percent of the distribution has output roughly one-fifth of the average while the top 5 percent of the distribution has output roughly five times the average. Thus, the disparity in output between the most- and least-productive workers within the United States is about as large as the disparity in per-capita output between the richest and poorest nations of the world.

. . . That Has Been Quite Constant

The second development fact is that this big wealth disparity has been quite constant over time. Lately, the question of whether dispersion of the logarithm of per-capita output has decreased within a set of countries over time has received a lot of academic attention. Such decreases in dispersion have come to be called *convergence*.[6]

☐ Two Measures of Dispersion

One common measure of the dispersion in a distribution is the simple range of the distribution. Chart 1 shows that *convergence* as measured by the range of this distribution does not apply to the 102-country data set examined here. In fact, the range of the distribution has not changed much at all.

Another common measure of dispersion is the standard deviation of a population. (This is sort of the average distance of the individuals in the population from the population's mean.) Chart 2 reports how the standard deviation of the logarithm of per-capita output of our large set of countries has varied over the 1960–85 period. Clearly, the standard deviation has increased; there has been some divergence in this period. In fact, over the full 26-year period, the standard deviation increased 18.5 percent. The increase appears to be fairly uniform up to 1980. Then, between 1980 and 1985, the standard deviation decreased slightly. So while the range of the distribution has not changed much, there is clearly more dispersion in 1985 than in 1960.

Are these results the same with different groups of countries and over a longer time period?

Let's look at the western European countries, which are a common group to study. For this group, the issue of convergence is related to the period of time being considered.

Chart 3 displays the standard deviation of the logarithm of relative wealth for the group of western European countries. The chart shows this measure for this group of countries calculated both from our 102-country data set covering the 1960–85 period and from our 29-country data set covering the 1870–1979 period.[7]

What we see in the chart is that over the post–World War II period, the standard deviation of the distribution of relative wealth decreased fairly steadily, from 0.55 in 1960

[6] *Convergence* is also used another way in the literature. This second type of convergence refers to on average faster development by poorer countries. Robert J. Barro and Xavier Sala-i-Martin (1992) have labeled this type of convergence β-*convergence* and the other type σ-*convergence*.

[7] The western European countries we study here are all those listed in the Appendix as part of the Maddison and De Long data except, of course, Argentina, Australia, Canada, Chile, Japan, New Zealand, and the United States. Also, because Greece and Turkey are not included in our 29-country data set, we drop them from the calculations of the standard deviations for the 1960–85 period.

to 0.42 in 1985. But over the much longer time period, the standard deviation showed no clear tendency to either decrease or increase. Over this longer period, that is, per-capita output in the western European nations has not tended to either converge or diverge.

Another group of countries that receives a lot of attention is the countries of southeastern Asia. According to our data, for these countries, the issue of convergence is not sensitive to the time period considered. In the postwar period and throughout the 20th century, there is no tendency for wealth to converge. Rather, the clear tendency has been for the dispersion of wealth to increase over all periods.

Chart 4 displays the standard deviation of the logarithm of per-capita GDP for the eight countries in the Van der Eng data set starting in 1900. This standard deviation increased steadily, from 0.28 in 1900 to 0.58 in 1950 to 1.26 in 1985. Now, the amount of dispersion among these eight countries might very well decrease dramatically in the next 50 years, but for the 1900–85 period, the dispersion has only increased dramatically.

This increase can also be seen in Chart 5, which plots the time paths for the wealth of these southeastern Asian countries. In 1900, the maximum wealth difference was less than a factor of 2. In 1985, this difference was greater than a factor of 16. Japan's wealth relative to the wealth of India and Burma increased especially dramatically in the 20th century.

Chart 2–4

The Standard Deviation Measure of Wealth Disparity

Based on the Distribution of Relative Per-Capita GDP

Chart 2 In All 102 Countries: Increasing?

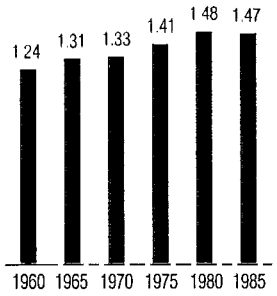


Chart 3 In Western Europe: Decreasing?

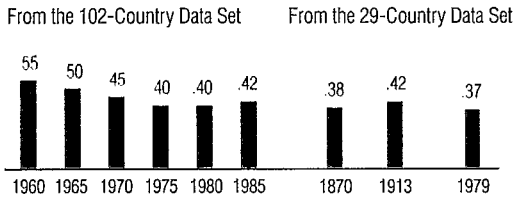
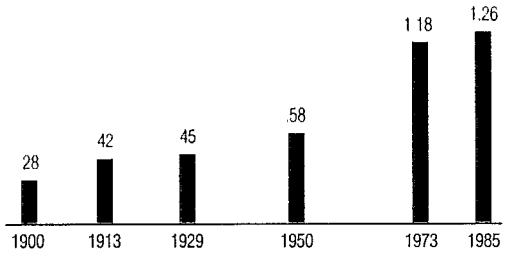


Chart 4 In Southeastern Asia: Definitely Increasing

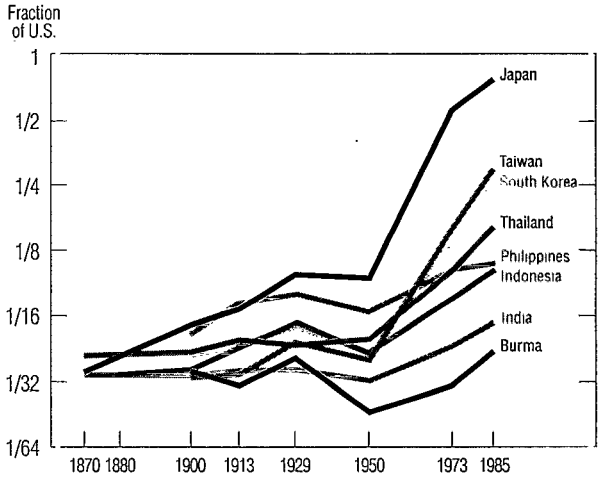


Source of basic data: Summers and Heston 1991, Maddison 1991, De Long 1988, Van der Eng 1992

Chart 5

Dramatic Divergence in Southeastern Asia

Per-Capita GDP Relative to 1985 U.S. Level for 8 Southeastern Asian Countries During 1870–1985



Source of basic data. Van der Eng 1992

☐ *The Distribution Itself*

Among all 102 countries, remember, the range of the distribution of relative per-capita GDP has been wide and more or less constant over the 1960–85 period, while dispersion within the distribution has increased somewhat. Chart 6 takes a look at the distribution itself. The chart shows how countries are distributed across the various intervals of relative wealth in 1960 and in 1985. The horizontal axis measures these intervals; the vertical axis measures the percentage of countries in each interval. (Again, the relative wealth intervals correspond to the log scale to the base 2.)

Clearly, the distribution of wealth has changed between 1960 and 1985: it has become much closer to a uniform distribution. In 1960, the distribution is essentially single-peaked, but it's far from normal. This is quite different from the distribution of the logarithms of household income within the United States, which is close to normal. Since 1960, some of the center mass of wealth has spread into the tails of the distribution, which is why in 1985 the distribution appears approximately uniform.[8]

Recall Chart 2, where we saw that the amount of dispersion in relative wealth as measured by the standard deviation increased over the 1960–85 period. We know that the standard deviation of a distribution which is uniformly distributed over an interval is always larger than the standard deviation of a single-peaked distribution over the interval. This change from a single-peaked distribution to one approximately uniform accounts for the increase in standard deviation we saw in Chart 2.

Mobility Facts

Although the wide disparity between the richest and the poorest countries persisted throughout 1960–85, that doesn't mean countries did not experience significant changes in wealth. Quite the contrary: Our data reveal two facts about such changes during this period. The total distribution of per-capita GDP shifted up during 1960–85. And individual countries experienced some *wealth mobility;* that is, in this period, some countries experienced large increases or decreases in wealth relative to the richest countries in the world.

The Distribution

Since a natural question when examining changes in the wealth of nations is whether the wealth of nations has been increasing over time, we first document the upward shift in the distribution of wealth.

The wealth of the richest nations surely has been increasing. Chart 7 shows GDP per worker hour in the leading industrialized market economy over the 1580–1989 period.[9] During these (roughly) 400 years, three different counties were the industrial leaders. The chart shows that each leader experienced increases in wealth while it was the leader, and each subsequent leader experienced larger increases than the previous one. The Netherlands, the wealthiest industrialized country during 1580–1820, experienced average annual growth of real GDP per worker hour of roughly 0.2 percent over this period. The United Kingdom, the leader during 1820–90, experienced average annual growth of 1.2 percent over this period, and the United States, the leader since 1890, experienced average annual growth of 2.2 percent during 1890–1989.

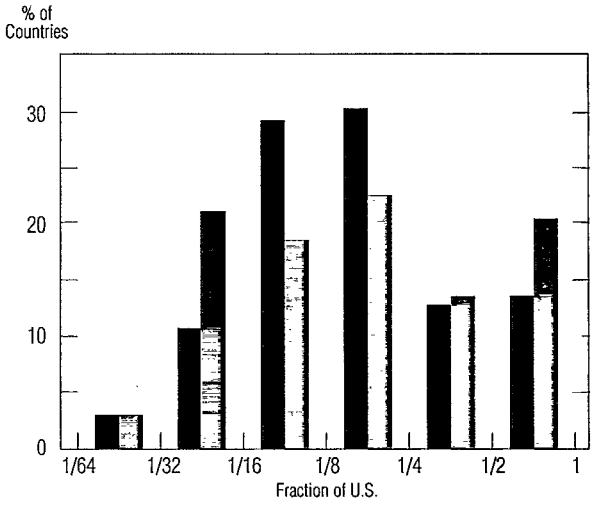
Over the long data period, the poor and, more general-

Chart 6

A Change in the Distribution of Wealth

Per-Capita GDP Relative to U.S. Level in the 102-Country Data Set

During 1960 ■ and 1985 ■



Source of basic data : Summers and Heston 1991

[8]The 1985 distribution is approximately uniform—but not exactly so. Very few countries, for instance, have relative wealth within the range of [1/64,1/32]. That is true in 1960 as well.

[9]This chart is from Maddison 1991 (p. 31). In this chart, we use GDP per worker hour instead of GDP per capita as the measure of a country's wealth because Maddison does not provide observations for GDP per capita going back to 1580.

ly, the nonleader nations' relative wealth also increased. For the Maddison 16, real GDP per capita increased by an average factor of 15 between 1820 and 1989. This translates into average annual compounded growth of 1.5 percent. For the 6 countries in the De Long data set that are not included in the Maddison 16, the average factor increase over the 1870–1979 period was 5 and the average annual growth, 1.25 percent. For the 7 countries in the Van der Eng data set that are not included in the Maddison 16, the average factor increase in real GDP over the 1900–85 period was 4 and the average annual growth, 1.6 percent.

Are such increases characteristic of a larger set of countries as well? For our data set of 102 countries, real per-capita GDP increased on average by a factor of 1.8 between 1960 and 1985. This translates into annual average growth in per-capita GDP of 1.9 percent. The increase is not limited to the high-, middle-, or low-income countries of the distribution, either. As is evident in Chart 8, the average of each of those three groups has been increasing over time. Both the median and the range of the distribution have clearly shifted upward.

☐ *A Slowdown*

However, while the range has shifted upward over time, Chart 8 also shows that the increases have not been uniform. Indeed, the latter years of the 1960–85 period saw a marked slowdown in the wealth increases for countries in the top, middle, and bottom of the distribution. A systematic examination of this slowdown requires that we consider all the countries in our data set, not just these three groups. For the set of 102 countries, the average factor increase in wealth over the first half of our time period (1960–73) was 1.46, which translates into an average annual rate of change of 2.9 percent. In contrast, the average factor increase over the second half (1973–85) was 1.18, which translates into an average annual rate of change of 1.4 percent. The 1973–85 slowdown is clearly not limited to a handful of countries.

How does this period compare to development in periods before 1960? Was the slowdown part of a much longer trend, or was it just characteristic of the most recent period? We cannot answer this question for the set of 102 countries. Data are not available before 1960 for a significant number of these countries; some did not even exist before 1960. We can, however, address the question within the set of 16 Maddison countries.[10]

The Maddison 16 display a growth slowdown between the 1950–73 period and the 1973–89 period. Their average annual compounded growth rate was 3.8 percent before 1973 and 2.1 percent after that. This slowdown does not represent a continuing downward trend, however. While the increases in per-capita GDP for these 16 countries is on average smaller during 1973–89 than during 1950–73, the average rate of increase is still larger in 1973–89 than in 1820–70, 1870–1913, or 1913–50. The average annual compounded growth rates for these periods are 0.9 percent, 1.4 percent, and 1.2 percent, respectively. From this perspective, the 1973–89 experiences of the 16 Maddison countries do not seem abnormally low.

☐ *No Absolute Poverty Trap*

Despite the development slowdown, remember, the bottom of the range of the distribution of per-capita GDP continued to shift up during the 1960–85 period. Chart 9 makes the point that for all but one of the 10 poorest countries (Zaire), per-capita wealth was higher in 1985 than in 1960. Therefore, the popular hypothesis that countries which start out below a minimum level of output will fail to grow seems not supported by the facts. [For examples of this hypothesis, see the work of Costas Azariadis and Allan Drazen (1990) and Gary S. Becker, Kevin M. Murphy, and Robert Tamura (1990).] During 1960–85, at least, the poor grew richer right along with the rich.

The Countries

We now turn to a systematic examination of wealth mobility during the 1960–85 period, starting with precisely what we mean by *mobility.*

☐ *A Definition*

Here *mobility* is the extent to which individual countries experienced changes in relative wealth over time. In effect, it is the movement of the individual atoms in a distribution over time. Therefore, even though a distribution is stable over time, the individual atoms within the distribution can move a great deal from one period to the next.

To see why, consider the following first-order autoregressive process:

$$(2) \qquad X_{it+1} = \rho X_{it} + \mu(1-\rho) + \varepsilon_{it+1}$$

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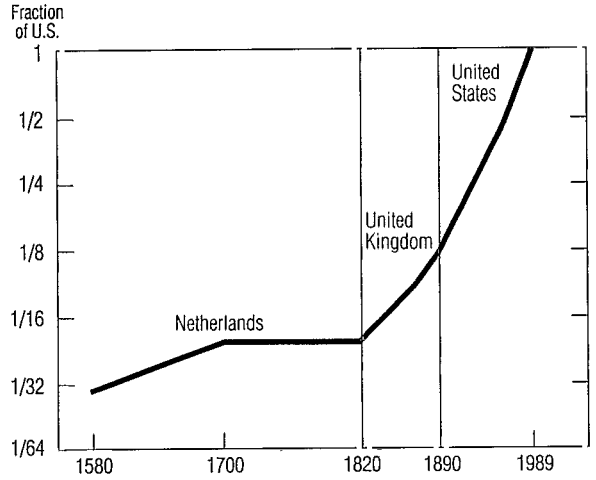
[10]Observations in the De Long data are only for 1870, 1913, and 1979, so we cannot determine whether the slowdown is characteristic of these data as well. For the Van der Eng data, however, we can compare development over the 1950–73 and 1973–85 periods, and the evidence of a development slowdown among the Asian countries during these periods appears to be dependent on the performance of Japan. Including Japan, the average annual rate of change drops from 3.6 percent in the 1950–73 period to 3.2 percent in the 1973–85 period. Excluding Japan, the average rate increases over the two periods.

Chart 7

The Richest Got Richer

GDP Per Worker Hour Relative to 1989 U.S. Level for Industrial Leaders During 1580–1989

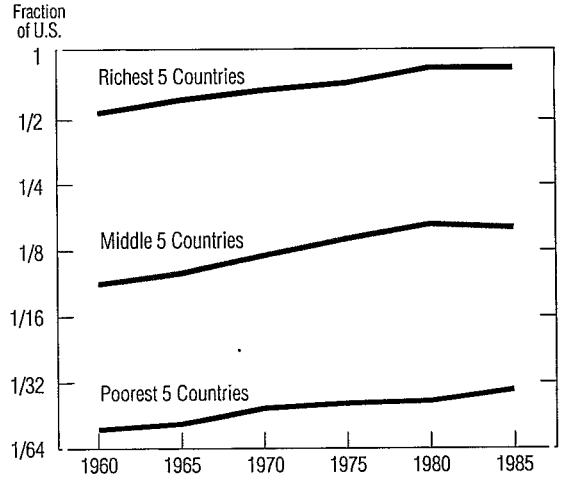


Source: Maddison 1991

Chart 8

A Widespread Upward Shift

Average Real GDP Relative to 1985 U.S. Level for Selected Wealth Groups in the 102-Country Data Set During 1960–85

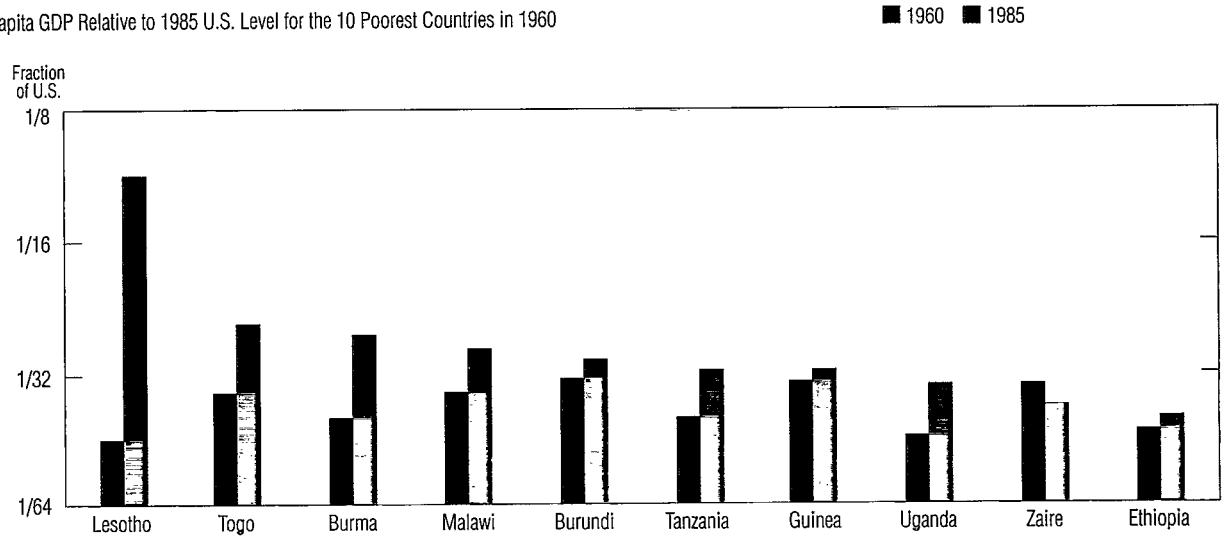


Source of basic data: Summers and Heston 1991

Chart 9

The Poorest Got Richer Too

Per-Capita GDP Relative to 1985 U.S. Level for the 10 Poorest Countries in 1960



Source of basic data: Summers and Heston 1991

where the ε_{it+1} are independently and identically distributed over both i and t and are normally distributed with mean zero and variance σ^2. For a large number of atoms, the distribution of X_i is approximately normal, with mean μ and variance $\sigma^2/(1-\rho^2)$, and is fairly stable over time. [With an infinite number of atoms, the distribution is normal with mean μ and variance $\sigma^2/(1-\rho^2)$ and is stable over time.] That is, if we took a series of snapshots of the density function of the distribution, one at each point in time, all the snapshots would look roughly the same.

Yet if we were to trace the paths of each individual atom X_i, we would find that X_{it} and X_{it+1} would typically not be identical. In fact, the position of X_{it} and X_{it+1} could differ substantially depending on the value of ρ in the autoregressive process (2). If ρ were selected to be zero, then X would be normally distributed with mean μ and variance σ^2. For this specification, the serial correlation between X_{it} and X_{it+1} would be zero and there would be no persistence in positions. If ρ were selected to be $2^{1/2}$, then X would be normally distributed with mean μ and variance $2\sigma^2$. And then the serial correlation between X_{it} and X_{it+1} would be positive. Note that if ρ were set equal to $-(2^{1/2})$, then the distribution would be the same as when it was $2^{1/2}$, yet the paths of two atoms, one in each distribution, that started at the same location, would look very different.

☐ *Rough Symmetry*

Let's look now at the distribution of changes in relative wealth over the 1960–85 period. Chart 10 shows this distribution for the changes expressed as average annual compounded rates. This average rate of change is equal to the annual rate of growth of a country's per-capita GDP measured in current prices less the annual rate of growth of U.S. per-capita GDP measured in current prices over the 1960–85 period. An average annual compounded rate of change of zero percent, then, implies no change in relative wealth over the 1960–85 period.

As Chart 10 illustrates, the distribution of relative wealth changes over the 1960–85 period is roughly symmetric. Over this period, the percentage of countries that experienced increases in relative wealth is roughly equal to the percentage that experienced decreases. Moreover, the percentage of countries with average annual compounded rates greater than 2 percent is roughly equal to the percentage with average rates less than that.

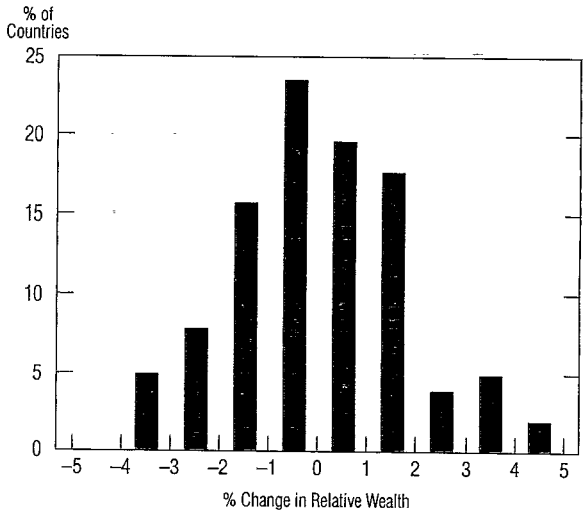
☐ *Miracles and Disasters*

Within this distribution, quite a few countries experienced very large increases or decreases in relative wealth—experiences we call *development miracles* and *disasters*. To make the magnitude of these changes more concrete, we list in the accompanying table the 10 countries with the largest increases in relative wealth and the 10 countries with the largest decreases in relative wealth over the 1960–85 period, and we express these changes as factor changes.

Chart 10

The Distribution of Wealth Changes

Average Annual Compounded Rates of Change in Wealth Relative to U. S. Levels in the 102-Country Data Set During 1960–85



Source of basic data : Summers and Heston 1991

Here's how we compute those factor changes. Let $y_{i,t}$ denote the relative wealth of country i in year t. Then for countries that experienced increases in relative wealth, this factor increase is just

$$(3) \qquad y_{i,1985}/y_{i,1960}$$

and for countries that experienced decreases in relative wealth, this factor decrease is just

$$(4) \qquad y_{i,1960}/y_{i,1985}.$$

Of the 10 development miracles listed in the table, the most spectacular is Saudi Arabia. The next most spectacu-

Development Miracles and Disasters

Countries in the 102-Country Data Set With Largest Changes in Relative Wealth During 1960–85 (Expressed as Factor Changes)

Increases		Decreases	
Country	Factor Change	Country	Factor Change
Saudi Arabia	3.32	Zambia	2.63
Lesotho	3.19	Mozambique	2.63
Taiwan	2.60	Madagascar	2.50
Hong Kong	2.59	Angola	2.38
South Korea	2.40	Chad	2.13
Egypt	2.38	Liberia	2.04
Congo	2.18	Ghana	2.00
Japan	2.10	Zaire	1.96
Singapore	2.09	Nicaragua	1.85
Syria	1.89	Afghanistan	1.75

Source of basic data: Summers and Heston 1991

lar is Lesotho (in southeastern Africa), which happens to have been the poorest country in the world in 1960. These two countries are followed by three southeastern Asian countries.

Of the 10 development disasters during 1960–85, the biggest losers were Zambia (in south-central Africa) and Mozambique (in southeastern Africa), followed closely by Madagascar. Most of the 10 countries that experienced the largest decreases in relative wealth experienced military conflicts during this period.

☐ *No Relative Poverty Trap*

The fact that Lesotho experienced such a dramatic increase in relative wealth suggests that there is no relative poverty trap either. The issue of whether there is a relative poverty trap is separate from the issue of whether there is an absolute one. Those countries at the bottom of the distribution may have remained trapped there even though the wealth distribution shifted up. But during 1960–85 they clearly didn't. While several countries that were among the poorest in 1960 were still among the poorest in 1985, some were not. In 1960, the five poorest countries were Burma, Lesotho, Ethiopia, Tanzania, and Uganda. In 1985, the five poorest countries were Ethiopia, Mali, Tanzania, Uganda, and Zaire. Two of the five poorest countries in 1960, Burma and Lesotho, were no longer among the poorest in 1985. Thus, neither an absolute nor a relative poverty trap exists.

☐ *Some Poor Losers*

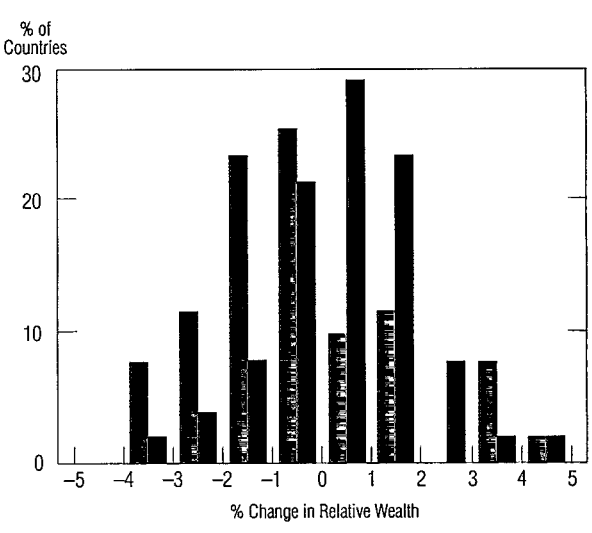
Still, none of the 10 countries that experienced the largest increases in relative wealth over the 1960–85 period could be considered rich in 1960 by 1960 U.S. standards. None of these countries had a relative wealth in 1960 that exceeded 0.30, and all but Japan, Singapore, and Taiwan had relative wealth less than 0.20. Despite the development experience of these countries, we can't say that poorer countries systematically outperformed richer countries in the 1960–85 period. Indeed, countries with relative wealth below the median in 1960 typically experienced smaller increases in relative wealth than countries with relative wealth above the median.

The fact that the initially poor countries didn't, on average, experience larger increases than the initially rich is highlighted in Chart 11. This chart shows the two distributions of changes in the relative wealth for the two types of countries over the 1960–85 period. The median level of

Chart 11

The Rich vs. The Poor

Distribution of Average Annual Compounded Rates of Change in Wealth Relative to U. S. Levels During 1960–85 for Countries Below and Above the Median Wealth Change in 1960



Source of basic data : Summers and Heston 1991

relative wealth in 1960 was 0.15. Apparently, the distribution of changes for the countries that started above the median stochastically dominates the distribution for the countries that started below the median. True, several initially poor countries experienced spectacular development over the 1960–85 period, but most of them lost ground to the initially rich countries.

Conclusion

The changes in the wealth of nations can be characterized by the great disparity between rich and poor and the constancy of that disparity over time and within the range of the distribution. But these changes can also be characterized by the upward shift of the distribution, which has meant that nearly all countries became somewhat richer, and by the demonstrated ability of some countries to spectacularly change their positions within the wealth distribution. These are the four development facts, and theories of economic development must be able to account for them. Any theory that fails to do so simply is not a development theory.

Appendix
Countries, Years, and Sources of Our Data Sets

The Main Data Set

For 1960–85, From Summers and Heston*

North and Central America	Europe	Asia	Africa	
Canada	Austria	Afghanistan	Algeria	Senegal
Costa Rica	Belgium	Bangladesh	Angola	Sierra Leone
Dominican Republic	Denmark	Burma (Myanmar)	Benin	Somalia
El Salvador	Finland	China	Burundi	South Africa
Guatemala	France	Hong Kong	Cameroon	Sudan
Haiti	Germany, West	India	Central African Republic	Tanzania
Honduras	Greece	Iran	Chad	Togo
Jamaica	Ireland	Iraq	Congo	Tunisia
Mexico	Italy	Israel	Egypt	Uganda
Nicaragua	Netherlands	Japan	Ethiopia	Zaire
Panama	Norway	Jordan	Ghana	Zambia
United States	Portugal	Korea, South	Guinea	Zimbabwe
	Spain	Malaysia	Ivory Coast	
South America	Sweden	Nepal	Kenya	
Argentina	Switzerland	Pakistan	Lesotho	
Bolivia	Turkey	Philippines	Liberia	
Brazil	United Kingdom	Saudi Arabia	Madagascar	
Chile	Yugoslavia	Singapore	Malawi	
Columbia		Sri Lanka	Mali	
Ecuador	Oceania	Syria	Mauritania	
Paraguay	Australia	Taiwan	Morocco	
Peru	New Zealand	Thailand	Mozambique	
Uruguay	Papua New Guinea		Niger	
Venezuela			Nigeria	
			Rwanda	

* Because of missing data, we have excluded from our analysis 18 large countries (those with a population of at least 1 million in 1969) which Summers and Heston include: Bulgaria, Burkina Faso, Cambodia, Cuba, Czechoslovakia, Hungary, Indonesia, Laos, Liberia, Libya, Mongolia, Namibia, Poland, Romania, the Soviet Union, the United Arab Emirates, Vietnam, and Yemen.

The Longer Data Set

For Years Listed, From Three Sources

Maddison			De Long		Van der Eng	
Australia	Italy	1820	Maddison's 16	1870	Japan	1870
Austria	Japan	1870		1913		1880
Belgium	Netherlands	1913	*PLUS*	1979	*PLUS*	1900
Canada	Norway	1950	Argentina		Burma	1913
Denmark	Sweden	1973	Chile		India	1929
Finland	Switzerland	1989	Ireland		Indonesia	1950
France	United Kingdom		New Zealand		Philippines	1973
Germany	United States		Portugal		South Korea	1985
			Spain		Taiwan	
					Thailand	

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The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.