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WHY ARE DIFFERENCES IN PER CAPITA INCOMES SO LARGE AND PERSISTENT?

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Why Are Differences in Per Capita Incomes So Large and Persistent?

According to the best available data (Summers and Heston, 1988 pp. 1–25), per capita incomes in many countries are only a tenth (and in a few countries only a fortieth) as high as in the richest countries. Some low-income countries are catching up with the rich countries, but others are falling farther behind, and the poor societies, on average, are growing no faster than the rich ones. Why are the differences in levels of per capita incomes across countries so huge? And so persistent?

The starting point of much of the best research on economic growth is the aggregate production function or growth-accounting framework set out by Robert Solow and ingeniously developed and applied by Edward Denison, John Kendrick, Dale Jorgenson, and many others. The crucial feature of this framework for the present purpose is that it assumes that societies are on the frontiers of their aggregate production functions: production is as high as it can be given the supplies of the productive factors and the available knowledge. This assumption is not only inherent in the definition of a production function, but it is also the norm in empirical work. There are exceptions, such as Edward Denison, who makes several ad hoc allowances for particular misallocations or other inefficiencies and usually even avoids the aggregate production function terminology. Nonetheless, the assumption that a society is at least approximately on the frontier of its aggregate production function, or at a minimum such that the extent to which it falls short of this frontier does not change over the periods studied, is either explicitly or implicitly part of almost all growth-accounting studies. The marginal product of a factor of production is almost always assumed to be equal to its price to producers, so the contribution of a given augmentation of the supply of a factor to a society's output will be calculated correctly only if the marginal private product and the marginal social product are the same. More generally, if there is a change in the effectiveness with which a society exploits its opportunities, then a standard and straightforward

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estimate of the contribution of any "source" of growth is wrong: the growth that is divided between augmentation of the aggregate factors of production and technological advance has in fact been partly caused by a change in the society's allocation of resources or in the degree to which it succeeds in realizing the gains from advances in knowledge.

1. How Migration Changes World Income

If we consider the migration of labor across the frontiers of countries, we can immediately see the assumption that societies are on the frontiers of their aggregate production functions from a different perspective. To the best of my knowledge, economists have not previously used migration across international boundaries to re-examine the aggregate production function approach or to consider other theories of economic growth. But some economists have made extremely interesting estimates of the effects of international migration on world income. In particular, Hamilton and Whalley (1984 pp. 61–75) have estimated how world income would change if more workers were shifted from low-income to high-income countries. Bhagwati (1984 pp. 678–701) has summarized the Hamilton–Whalley approach to this estimation in an extremely simple way.

Suppose there is only one "poor" region and one "rich" region. All the logically possible distributions of the world's population across these two regions can then be depicted on the horizontal axis of Figure 1. If all of the population were in the poor area or country, we would be at the extreme left at point L and if all were in the other area we would be at H. The vertical axes measure the addition to output from an additional worker in dollars. The diminishing return to labor in the rich area as migrants move in that direction is reflected in the downward sloping marginal product of labor or labor-demand curve D_h as we move to the right. Since the proportion of the world's population in the poor country increases as we move left, the D_l curve reflecting its marginal product of labor decreases as we move in that direction and increases as migrants move from the poor to the rich area.

If all other things remained equal, migration of labor from poor to rich countries would colossally increase world income: obviously, total income goes up by the difference between the wage the migrant worker receives in the rich country and what he earned in the poor country, or by amount AB in Figure 1. Hamilton and Whalley's calculations suggest that free immigration from poor to rich countries, even under relatively conservative assumptions, could double world income.

Hamilton and Whalley's findings are *not* brought in here as evidence in favor of unrestricted migration of labor. Unrestricted immigration might not even be feasible: it does not follow, because the combined income of, say, Bangladesh and Japan would more than double from free immigration from the former to the latter,

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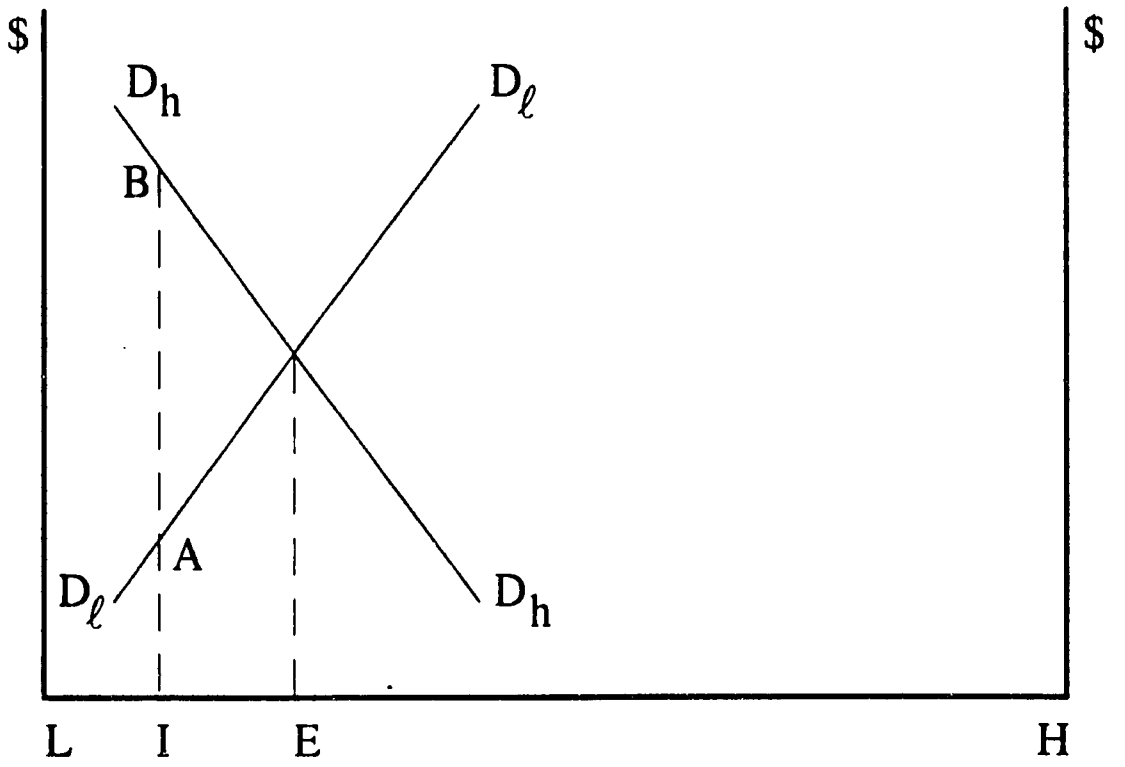
Figure 1 — Migration Changes World Income



that the Japanese would permit this immigration. With unlimited migration, moreover, other things might not remain equal and the marginal product of labor curves could shift in ways that reduced or eliminated the gains from migration. In any event, the question of how liberal or restrictive each country ought to be about immigration has nothing to do with the purpose of the present paper.

The pertinent point here is rather that the simple considerations that have already been mentioned are already sufficient to establish that the world as a whole is *not* on — or anywhere near — the frontier of its aggregate production function. One could, of course, define income-increasing movements of labor across jurisdictional frontiers as a "factor of production," but this would be an abuse of language.

2. National Boundaries Determine Economic Performance

The foregoing argument also reminds us that, whatever the causes of high per capita incomes may be, there is no doubt they are present in some countries and absent in others. Though there are also differences in per capita income across regions within countries, these differences are normally trivial in comparison with cross-national differences. Thus whatever generates economic growth manifestly varies across

national frontiers. This point is evident in the most striking way when rich and poor countries are adjacent to one another. Greatly different levels of per capita income have been observed on the opposite banks of a meandering river (the Rio Grande), on different sides of a front at which opposing armies happened to reach a stalemate (the dividing line between North and South Korea), and on alternate sides of a border made up mainly of arbitrary lines (the boundary that used to separate East and West Germany). Since national frontiers demarcate areas of different per capita incomes *exactly* — and sometimes also dramatically — they should be able to tell us a good deal about the determinants of economic performance.

There are two obvious things that can vary greatly across national boundaries. First, the variables considered in aggregate production function studies — the proportions of the different factors of production or the access to technological knowledge — may vary across frontiers (in part because of restrictions on the international migration of labor). Second, institutions and public policies are plainly also different from one jurisdiction to another. How important are each of these two considerations in explaining economic performance? And to what extent can each of them reasonably be regarded as exogenous in a theory of economic growth?

I will attempt to answer these two questions by aggregating the factors of production in the way that has been conventional in aggregate production function studies (and even in the economic thought of the last century), and then consider the significance of each of the aggregate factors in turn. That is, I will separately consider the relative scarcity or abundance of "capital," of "land" (with land standing for all natural resources), and of "labor" (with labor including not only human capital in the form of skills and education but also cultural attitudes towards work, saving, and entrepreneurship). It is also conventional, after the contribution of each of the aggregate factors of production has been calculated, to attribute the remaining or "residual" growth of productivity to the advance of knowledge, and so the level of technology and knowledge will also be considered separately.

To be sure, a sequential or "one source of growth at a time" procedure leaves out interactions that could only be captured with a simultaneous treatment. The aggregation inherent in the taxonomy of factors of production that I take from aggregate production function theory is also hazardous. Finally, the familiar taxonomy of sources of growth also does not explicitly take account of some considerations emphasized in endogenous growth theory. Fortunately, the insights that can be derived by using the conventional taxonomy from the old growth theory — and relating it to the standard assumption that societies are on the frontiers of their aggregate production functions — make it possible to see the new growth theory from a fresh perspective. As it happens, some surprising and plausible findings can be derived from a few trivially simple deductions and well-known facts.

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3. Public Good Characteristics of Productive Knowledge

Let us start with the access to productive knowledge. Is any substantial proportion of the differences in per capita incomes across countries due to differential access to technological knowledge? That is, to the *availability* and *price* of the stock of productive knowledge? This question can, I believe, only be properly determined by asking to what extent the stock of productive knowledge meets each of the two defining characteristics of a public good: nonexclusion and nonrivalness (Head, 1962 pp. 197–219; Olson, 1965, especially pp. 36–43).

Nonpurchasers can be excluded, at least to some extent, from free use of some discoveries through patenting, copyrighting, secrecy, and so on, but other discoveries lend themselves to free riding. Exclusion, of course, explains why many types of productive knowledge are provided through the market. Let us temporarily assume that those who possess productive knowledge can costlessly exclude nonpurchasers and then go on to consider nonrivalness.

If a good has complete nonrivalness, additional consumers or users do not add to its cost or diminish, degrade, or congest the supply to other users. The stock of knowledge has long been understood to be a nonrival good. Most of the stock of knowledge is also applicable throughout the world. Some technologies (especially in agriculture) are climate specific, and others (such as some labor-saving inventions) may be economically rational with the factor proportions of one country but not with those of another. These cases are surely not the general rule.

Since wider use of a nonrival good does not diminish the supply, the marginal cost of permitting another party or country to make use of such a good is zero. When a firm, even after great expenditures over a long period on research and development, discovers an economically valuable new idea, the marginal cost of its being available to an additional purchaser is essentially zero. The firm will naturally want to profit as much as possible from any monopoly it has in the idea and if exclusion is possible it will have a monopoly. But once an idea, however costly, has been discovered, the price the owner of the discovery charges will be lower because of the nonrivalness. The monopolist will, of course, satisfy the first-order conditions for profit maximization by choosing the quantity sold at which marginal revenue is zero. This means a price for the knowledge that, though obviously higher than the zero price that would be required for Pareto-efficiency, is lower than if the good were not a nonrival good and thus had a positive marginal cost of provision to an additional consumer (Olson, 1973 pp. 355–384, 1980, 1986b pp. 120–125). Therefore, even when knowledge is a good from which nonpurchasers can be totally excluded, it is made available to additional countries at a lower price because of its nonrival characteristic. This makes franchises, copyright fees, royalty payments, and other charges for knowledge to low-income countries lower than they would otherwise be.

Discoveries of laws of nature and many other basic intellectual advances are nonexcludable as well as nonrival. The discoveries of Newton and of Darwin, for example, were unpatentable. Because of their nonexcludability and nonrivalness these discoveries have been available without charge to the whole world and have not been diminished in usefulness because they have been used and reused by any number of firms in many different countries. Many other parts of the stock of knowledge also meet both of the defining conditions of a pure public good and are therefore available without charge to all countries.

Perhaps the nonexcludable discoveries are normally productive only after they have been combined with or embodied in some patent, machine, process from which nonpurchasers may be excluded. In that case, the poor countries will not obtain any free harvest from these advances. Whether or not this is normally the case is obviously an empirical question. The relative importance of the fact that owners of excludable discoveries hold monopolies, on the one hand, but can share these discoveries at zero marginal cost, on the other, is also an empirical matter.

4. The Low Cost of Foreign Technologies

So how large are the costs to a low-income country of access to the stock of productive knowledge possessed by high-income countries? So far, I have not been able to find any empirical study that attempts to answer this question, so I have tried to find some pertinent numbers.[1] The most pertinent numbers will be in the rapidly growing developing countries, for it is these countries that are succeeding in taking advantage of the modern stock of productive knowledge possessed by the developed countries.

From the fragments of pertinent information found so far, it is clear that, for some firms in some countries, royalty payments and the like are very large. Some firms that one might not think depended much on knowledge, such as some of those in the cosmetics industry in Thailand, make royalty payments that are large in relation to profits and even to sales; in the case of one firm, royalties and similar payments amounted to 22.5 percent of gross sales (see Santikarn, 1981).

Some aggregate data that are luckily available on Korea from 1973 to 1979 give us a striking aggregative finding. Royalties and all other payments for disembodied technology were minuscule — often less than one-thousandth of GDP. Even if we treat all profits on foreign direct investment as *solely* a payment for knowledge, the total is still small. If we add all of the profits, whether remitted or not, to royalties, the total is still less than one and a half percent of the *increase* in Korea's GDP over the period (Koo, 1982). Even total factor payments to nonresidents, which include

1 With the valuable help of Brendan Kennelly.

payments on borrowed money that could not possibly be a payment for knowledge, were fairly modest in relation to the increase in Korea's GDP. Thus, even on the most generous estimate, the foreign owners of productive knowledge obtain less than a twentieth of the gains from the really rapid economic growth that a poor country can achieve from "catch-up" growth.

Thus we cannot explain any substantial part of the *differences* in per capita incomes across countries in terms of differential access to — or high prices of — the available stock of productive knowledge. This is what many economists have long guessed might be the case. The data about the relatively trivial cost to South Korea of the world's stock of knowledge are nonetheless reassuring.

It is often said that, while the populations in some low-income countries include some highly educated people who are able to absorb the superior technologies of high-income countries, some other countries do not yet have the highly educated people needed to borrow modern technologies, so that the world's stock of knowledge is not in fact accessible to them. This argument implicitly overlooks the point that, if other things were equal, the rewards to those with rare and indispensable skills would be higher in the poor societies than in societies in which these skills were relatively plentiful; individuals with the missing skills would then move, sometimes as employees of multinational firms, to those low-income countries in which they were most needed.

Of course, as this paper has already argued, national frontiers not only demarcate areas of different factor proportions, but also the boundaries of different institutions and economic policies, so the movement of the missing skills from the rich to the poor countries may be inhibited, or sometimes even prohibited, because of deficiencies of the institutions and policies in the poor countries. In spite of institutional differences and regulations and limitations on foreign managers, technicians, and firms in many low-income countries, some movement of highly educated people from richer to poorer countries does occur. This suggests that, with the right arrangements, low-income countries could make use of the stock of productive knowledge in the rich countries. Thus no substantial part of the vast differences in per capita incomes between rich and poor countries appears to be explained by differential access to the world's stock of productive knowledge.

5. Diminishing Returns to Labor

Countries with access to the same global stock of knowledge may nonetheless have different endowments. Can differences in factor proportions explain most of the differences in per capita income across countries? Are poor societies on the frontiers of their aggregate production functions, yet able to produce relatively little because they have relatively low per capita endowments of the factors of production?

Many people have supposed that the poverty in the poor countries is due largely to overpopulation, i.e., to a low ratio of land and other natural resources to population. How can we obtain evidence on whether differences in this ratio are in fact the most important source of differences in per capita income?

Some new insights can be found by going back to the simple figure with which this paper began and asking how much migration from poorer to richer countries *changes* relative wage and income levels. If it is diminishing returns to land and other natural resources that mainly explains differences in per capita incomes, then large amounts of migration from poorer to richer societies will, if other things remain equal, necessarily reduce income differentials, since it obviously raises the resource-to-population ratio in the country of emigration and reduces it in the country of immigration.

Consider the country that has experienced much the highest proportion of outmigration in Europe, if not the world: Ireland. At the time of the census of 1821, Ireland had 5.4 million people and Great Britain a population of 14.2 million. Though the Irish people have experienced the same rapid rates of natural increase of population that have characterized other European peoples over most of the period since 1821, in 1986 Ireland had only 3.5 million people. By this time, the population of Great Britain had reached 55.1 million. Whereas the population density of Ireland was greater than that of Great Britain in 1821, by 1986 it was only about a fifth as great.[1]

If the lack of "land" or overpopulation is decisive, Ireland ought to have enjoyed an exceptionally rapid growth of per capita income, at least in comparison with Great Britain, and the outmigration should eventually have ceased. Not so. Remarkably, the Irish level of per capita income is still only about five-eighths of the British level and much less than half of the level in the United States, even though it is clear that in the United States, Britain, and many other countries, immigrants from Ireland tend to earn as much as other peoples. And the outmigration from Ireland is still going on. Clearly, it is not the ratio of land and natural resources to labor that has mainly determined per capita income in Ireland.

Now let us look at European immigration to the United States after the settlement of the US frontier was completed in about 1890. There was a huge migration of population from Europe to the United States between 1890 and the imposition of US immigration restrictions in the early 1920s. If diminishing returns to labor were the larger part of the story of economic growth, we would have seen an elimination or gradual reduction of the per capita income differential between the United States and Europe during this period. In fact, it is difficult to find traces of this vast migration on relative per capita incomes in the United States and the countries of

1 Northern Ireland is excluded from both Great Britain and Ireland. See Mitchell (1962), Mitchell and Jones (1971), Central Statistics Office (1986), Central Statistical Office (1988).

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emigration. In 1910 and in 1920 the US had a bigger lead in per capita income over many European countries than it had in the late nineteenth century. There was net immigration over this period from Britain to the United States, but per capita income in the US nonetheless grew more rapidly than in Britain. Many European countries did *not* narrow the gap in per capita incomes with the United States in the 19th century when they experienced a large outmigration to the US. Yet many of these same countries did nearly close that gap in the years after 1945, when they had relatively little emigration to the US, and when their own incomes ought to have been lowered by a significant inflow of migrants and guest workers. Similarly, from the end of World War II until the construction of the Berlin wall there was a considerable flow of population from the East to West Germany, but this flow did not equalize income levels.

Consider also the irrepressible flow of documented and undocumented migration from Latin America to the United States. If diminishing returns to land and other natural resources were the main explanation of the difference in per capita incomes between Mexico and the US, these differences should have diminished, and diminished most notably in the years when migration was greatest. Though over some periods the per capita incomes of Mexicans have increased faster than those of Americans, these periods do not seem to be explained by the extent of migration; in some periods, like most of the 1980s, when migration was apparently very large, the gap in per capita income between Mexico and the US widened.

Perhaps in some cases the curves in Figure 1 would cross when there was little population left in a poor country. Or conceivably they would not cross at all: even the person who turned the lights out in a country would have had a lower wage there than those of comparable skill in a richer country.

6. The Limited Importance of Natural Resources

Let us now shift focus from changes in land/labor ratios due to migration to the cross-sectional evidence at a given point in time on ratios of land to labor. Ideally, one should have a good index of the natural resource endowments of each country. Such an index should be adjusted to take account of changes in international prices, so that the value of a nation's resources index would change when the prices of the resources with which it was relatively well endowed went up or down. Regretfully, for lack of such an index, we must here simply examine density of population. Fortunately, the number of countries on which we have data on population and area is so large that population density alone tells us something.

Many of the most densely settled countries have high per capita incomes and many poor countries are sparsely settled. Argentina, once one of the higher per capita income countries but no longer a developed country, has only 11 persons per

square kilometer; Brazil has 16; Kenya, 25; and Zaire, 13. India, like most of the irrigated societies of Asia, is a relatively densely settled country, with 233 people per square kilometer. But high-income West Germany, with 246 people per square kilometer, is more densely settled than India. Belgium and Japan have half-again more population density than India, with 322 and 325 people per square kilometer, and the Netherlands have still more density with 357. Mexico, which most of us think of as subject to heavy population pressure, has only 41 people per square kilometer. There are even very densely settled countries that continue to absorb migrants when the migrants can sneak through the controls. The population of Singapore is 4,185 per square kilometer, that of Hong Kong, over 5,000 persons per square kilometer (UN, 1986). These two densely settled little fragments of land also have per capita incomes ten times as high as the poorest countries.

The foregoing cases could be exceptions, so we need to take all countries for which data are available into account and summarily describe the overall relationship between density of settlement and per capita income. If we remember that the purpose is descriptive and are careful to avoid drawing causal inferences, we can suggestively summarize the available data by treating the natural log of real per capita income as the left-hand variable and taking the natural log of population per square kilometer as the "explanatory" variable.

$$\ln PCGDP = 6.986 + 0.1746 \ln POPDENSITY, \; R^2 = .05, \; t\,stat = 2.7$$

Obviously, the per capita income of a country depends on many things and any statistical test that does not take account of all important determinants will be misspecified and thus must be used only for descriptive and heuristic purposes. It is nonetheless interesting — and for most people surprising — to find that there is a *positive* relationship between these two variables: the *greater* the number of people per square kilometer, the *higher* per capita income (the notion of statistical significance is not for a descriptive and misspecified equation, but for what it is worth the regression passes conventional tests of statistical significance.) The law of diminishing returns is indisputably true: it would be absurd to suppose that a larger endowment of land makes a country poorer. This consideration by itself would, of course, call for a negative sign on population density. Thus, even though the foregoing test explains relatively little of the variance, it is nonetheless interesting to ask what feature of the misspecification accounts for the "wrong" sign and to think of what statistical tests should ultimately be done. There is obviously a simultaneous two-way relationship between population density and per capita income: the level of per capita income affects population growth just as population, through diminishing returns to labor, affects per capita income. I suggested earlier in this paper that national frontiers demarcate areas with different institutions and

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economic policies, as well as (in the presence of restrictions on the mobility of labor and other factors of production) areas of different factor proportions.

The hypothesis that intrigues me is that the countries with better institutions and policies come to have higher per capita incomes than countries with inferior institutions and policies and that the higher incomes induce more immigration, notwithstanding the severe limits on immigration, and also usually enjoy lower death rates and thus often also a faster net natural increase of population. The effect of better institutions and policies in raising per capita income therefore swamps the tendency of diminishing returns to labor to reduce it, important as this latter effect is. It would be useful, with the aid of this conception, to undertake to examine a serious econometric test of this issue.

Though I have not previously happened to come upon studies that searched for signs of income-equalizing effects in international migration or cross-sectional quantitative studies of the relationship between population density and per capita income, there is a huge literature on whether population *growth* reduces the *growth* of per capita income. Given the intensity of the concern, going all the way back to Malthus in 1798, about overpopulation, and current disputes about population policy, it is natural that there should be a huge and often econometrically sophisticated literature on this issue. It is also natural that in this literature the focus should be on the natural increase of population rather than on migration.

Interestingly, the vast and subtle literature on whether population growth lowers or increases per capita income has not generated or justified any clear-cut scientific conclusion one way or another. Part of the reason why is evident when one glances at the data: per capita income increases about as rapidly in countries with high as with low rates of population growth (see, for example, Fig. 2 in Kelley's (1988) survey article). The naked eye (like the conflicting results of experts with different Bayesian priors and econometric specifications) suggests that something is going on that obscures the impact of the diminishing returns to labor.

My hypothesis, again, is that it is the tendency for countries with superior institutions and policies to have more immigration and lower death rates. But whether my own effort at a positive explanation is correct or not, all the evidence I have presented in this paper, and found in the huge literature on population growth and development, does surely justify at least a negative conclusion. That negative conclusion is that, whatever the true determinants of the huge international differences in per capita income may be, most of these differences in per capita income across countries cannot be explained by the familiar notion that the poor societies are uniquely lacking in the land or natural resources needed for economic development.

7. Manufacturing and Natural Resources

One reason why the ratio of natural resources to population does not offer an adequate explanation of current levels of per capita income is probably that many kinds of manufacturing and services need not be closely tied to natural resources. The minerals and energy needed for manufacturing can be imported, albeit at extra cost. The extent to which economic activity can be separated from deposits of raw materials and arable land has probably increased over time, as transportation technologies have improved and as products that have a greater value in relation to their weight, such as most services and manufactured goods like computers and airplanes, have become more important. London and Zürich are not great banking centers because of fertile land, and Silicon Valley is not important for the manufacture of computers because of deposits of silicon.

Even casual observation suggests that most modern manufacturing and service exports are not closely tied to natural resources. Western Europe does not now have a high ratio of natural resources to population, but it is very important in the export of manufactures and services. Japan has a relatively small quantity of natural resources per capita, but it is a great exporter of manufactures. And certainly the striking successes in manufactures of Hong Kong and Singapore cannot be explained by their natural resources.

8. Why Does Capital Flow from Poor to Rich Countries?

The factor proportion that is given the greatest emphasis in most aggregate production function studies is the ratio of capital to labor. Thus we must ask: (1) Are the great differences in per capita incomes across countries mainly explained by different amounts of capital per worker? (2) Can the quantity of capital in a country usefully be regarded as an exogenous factor in any theory that attempts to explain the great and persistent differences in per capita incomes across countries? If not, what explains the different amounts of capital per worker in different countries?

If the vast differences in real wages across countries are to be explained mainly in terms of differences in the ratio of capital stock to workers, the differences in this ratio have to be large. Everyone agrees that they are. The implications of this are immediately evident if we return to Figure 1 and relabel its horizontal axis and curves. If we replace the total world labor supply given along the horizontal axis of Figure 1 with the total world stock of capital, and assume the quantity of labor in the developed and undeveloped countries does not change, we can use Figure 1 to analyze diminishing returns to capital in the same way we used it to consider diminishing returns to labor.

The essence of the real-world situation is simply the converse of that with labor; most of the capital stock is "crowded" into the richest countries, so capital is predicted to have a much lower marginal product in these countries than it does in the capital-starved poor countries. This, in turn, implies a huge incentive for capital to migrate to the countries where labor is cheap and capital is dear. If both capital and labor can move, they obviously have an incentive to move in opposite directions, and in both cases the movement increases world income.

R. Lucas (1990 pp. 92–96) has calculated the marginal product of capital that should be expected in the United States and in India. Using reasonable auxiliary assumptions, Lucas found that, if an Indian worker and an American worker were assumed to supply the same quantity and quality of labor, the marginal product of capital in India should be *58 times* as great as in the United States. Lucas thought that the average skill per worker was much higher in the US than in India, but even when he assumed that it took *five* Indian workers to supply as much labor as one US worker, the predicted return to capital in India would still be a multiple of the return in the US.

In short, the differences in the stock of capital per worker between the poor and the rich countries are great enough so that they could explain the huge differences in per capita income. But these great differences in the capital-to-labor ratio imply that (if other things are equal) the return to capital in the capital-starved poor countries should be many times as high as in the developed countries. Do these fabulous, hundred-percent-or-more rates of return to capital that the standard neoclassical theory predicts should prevail in the poor countries really exist? The available evidence indicates that this is very doubtful; a study by Harberger (1978) concludes that the returns to capital are not substantially and systematically higher in poor than in rich countries.

Moreover, if other things were equal and the predictions of the neoclassical aggregate production function theory held true, there would be fantastic pressures for capital to migrate from the capital-rich countries to the capital-poor countries. On the basis of the familiar theory that the shortage of capital in the developing nations is the cause of their poverty, capital ought to be trying as hard to move from the United States to India or to Latin America, or from West Germany to Turkey, as labor is to move in the opposite direction. Certainly this is not what we observe. Many people in some capital-poor countries are trying to shift their capital, even at the risk of criminal punishment, into countries such as Switzerland and the United States.

These observations raise our second question: what explains the differences across countries in the amount of capital per worker? A theory that says that the poverty of the poor countries is due to their lack of capital does not get the job done if it does not also explain why the owners of capital do not shift their investments to the poor countries to reap the implied higher returns. Indeed, if other factors that

the capital-stock-per-worker argument leaves out were not operating, we know on theoretical grounds that the migration of capital would equalize *both* the return to capital and the real wage of labor across countries. This obviously has not happened and in many less developed countries it is not even beginning to happen.

9. Personal Culture and Private Human Capital

The adjustment of the amount of human capital per worker in Lucas's foregoing calculation for India and the United States raises a general issue: can the great differences in per capita income be mainly explained by differences in the third aggregate factor, labor; that is, by differences in the *human* capital per capita, or in other words, in the cultural or other traits of different peoples? The high incomes of people in the rich countries are often said to be due to cultural or racial traits that make the individuals in these cultural groups adept at responding to economic opportunities — they have the "protestant ethic" or the "Confucian ethic" or other cultural or national traits that make them hard workers, frugal savers, and imaginative entrepreneurs. Poor countries are poor because they lack these traits. The cultural traits that perpetuate poverty are, it is argued, the results of centuries of social accumulation and cannot be changed quickly. This explanation has been especially common in fields like anthropology and sociology, which focus intensely on "culture" and on how much it varies across countries and peoples.

An emphasis on the fundamental traits of peoples also occurs moderately often in economics. Consider, for example, David Landes's Ely Lecture to the American Economic Association in 1989 (1990 pp. 1–13). In this lecture, Landes brings a vast erudition about world economic history and the current world economy to bear, yet cannot explain the dismal economic performance of so many developing countries without referring to the characteristics of their peoples or cultures in poor societies. He regrets that there is "no nice way" to put his point and concludes that it is "human failure" that, in substantial part, explains the poverty of poor countries.

Whether Landes's argument is right or wrong, economists would at least have to agree that the quantity of labor in a production function cannot be specified correctly until a proper allowance is made for differences in human capital per worker due to education, culture, or whatever. Thus we must ask: are cultural or other differences in human capital per worker the main explanation of the great and persistent differences in per capita incomes across countries? This is a vague as well as a vital question because the word "culture," even though it is very widely used in research in diverse disciplines, does not have a sufficiently precise or operational definition.

For the purpose here, it is sufficient to distinguish "personal culture" — that is, "marketable human capital" — from "civic culture" — that is, "public-good human

capital." Personal culture is the human capital, attitudes, and preference ordering that determines how an individual reacts to *given* opportunities in a market or other context where that individual alone cannot change the political or institutional rules; it is approximately what people are talking about when they debate the role of the "protestant ethic," for example, in economic growth. It includes the individual's attitudes toward the trade-off between work and leisure, between present and future consumption, and between safe returns and entrepreneurial risk-taking, and every type of human capital that influences the return an individual would obtain in any activity where he cannot change the public policies or institutional structure.

By contrast, the public-good human capital or civic culture is the individual's beliefs and attitudes about what public policies and institutions are best. The public-good human capital of a population is valuable to the society in which the individuals are located, since it helps determine what institutions and public policies the society has. But in a large society where the typical individual can have no noticeable effect on the choices of the whole society, the public-good human capital an individual possesses is of no value to him personally and does not affect his relative earnings under given institutions and policies.

Both types of human capital or culture are the outcome of the socialization, education, and historical experience of a people, and both influence, in different ways, the level of per capita income of a people. The two types of culture nonetheless have to be separated in order to analyze how individual capabilities and choices, on the one hand, and public policies and institutions, on the other, affect economic performance.

With the aid of the foregoing distinction, we can search for discriminating empirical tests that will help answer the question of whether differences in human capital and culture among individuals in different national groups are the main determinant of differences in per capita income. We know that one reason why there is often more rapid intellectual progress in many parts of the physical sciences than in the social sciences is that experiments — that is, discriminating empirical observations or tests — are more often possible in the former than the latter. But on rare occasions "nature" or "history" performs "natural" experiments that provide solid information about cause and effect in the social sciences.

10. Neglected Natural Experiments Involving Migration

As it happens, migration from poor to rich countries provides researchers with a marvelous (and so far strangely neglected) natural experiment for testing those theories that attribute the differences in per capita income across countries to cultural (or other) differences in the ability or desire of individuals to take advantage of the economic opportunities that confront them. In the case of the migration to

the United States, at least, there are sufficient data on the outcomes of these natural experiments to permit some immediate conclusions. Contrary to first impressions, the natural experiments that will be considered here are not, in the aggregate, corrupted by any tendencies for international migrants to be unrepresentative of the societies from which they come.

When an individual migrates from a poor to a rich country, he may, in time, acquire the culture of the country to which he migrated. But the whole idea behind the theories that emphasize the cultural or other characteristics of peoples is that it takes some time to erase generations of socialization: if the cultural or other traits of a people could be changed overnight, they would not be significant barriers to development. The Latin American who swims the Rio Grande is not thereby instantly baptized with the protestant ethic. Thus *newly arrived* immigrants to a country have approximately the same culture they had before they migrated, but the institutions and public policies that determine the opportunities that they confront are those of the host country.

Clague (1991), drawing on the work of Borjas (1987 pp. 531--53), has found that individuals who had just arrived in the US from poor countries earned about 55 percent as much as native Americans of the same age, sex, and years of schooling, in spite of the handicaps the migrants had in adjusting to a new environment with a different language and arrangements. Thus individuals from countries where per capita incomes are only a tenth or a fifth as large as in the US earn more than half as much as comparable American workers.

It could be that migrants are dramatically different from their compatriots who did not migrate, so the foregoing observations on immigrants could be driven by selection bias. Yet the less developed countries often have much more unequal income distributions than the developed nations, so the incentive to migrate from these countries is greatest in the least successful half of their income distributions, and migration often clearly draws many people from the lower portion of the income distribution of the underdeveloped country (Borjas, 1990).

More important, no tendency for the more productive people in poor countries to be more likely to emigrate could explain the huge increases in wages and marginal products of the *migrants themselves*. The migrant himself earns and produces much more in the rich country than in the poor country and any unrepresentative attributes the migrant may have should not explain this difference.

The objection that migrants are on average more enterprising and energetic than nonmigrants can also be shown to be inapplicable by making comparisons of migrants from different countries to the US. If migrants in general are more enterprising than nonmigrants, then this should show up in the incomes of migrants, irrespective of the country from which they migrate. Thus the *relative* earnings of immigrants from poor countries and from rich countries to the United States will not be distorted by any general characteristic of migrants. It is, of course, possible

that there are different selection biases in immigrants from different countries, but it is unlikely that anyone will think that any such differential selection biases, if they exist, would negate the results that I will present.

According to the 1980 US Census, self-employed immigrants from Haiti to the US earned $18,900 per year, while those from West Germany earned $27,300; salaried immigrants from Haiti earned $10,900, those from West Germany, $21,900. Though Haitians earned two-thirds or half as much as West Germans in the US, the income per worker in Haiti was only about a *tenth* of that in West Germany. The income per worker in West Germany was nearly $22,000 greater than that in Haiti, yet (if the differences between the earnings of the West Germans and Haitians in the US institutional environment measure their respective endowments of marketable human capital) only about a third to a half of this difference can be explained by differences in marketable human capital or personal culture between Haitians and West Germans.

If the argument in this paper is correct, the remaining difference in income per worker between Haiti and West Germany was due to the superiority of West German to Haitian institutions and economic policies. To the extent that the inferiority of the Haitian educational system, compared to the West German educational system, explains part of the difference between Haitian and West German immigrants to the US, and to the extent that an educational system is a result of the institutions and policies of a country, then the result here understates the impact of institutions and policies on per capita income.

Roughly similar results hold when one does similar calculations for Switzerland and Egypt, Japan and Guatemala, Norway and the Philippines, Sweden and Greece, the Netherlands and Panama, and so on. It would be difficult indeed to imagine a set of selection biases that would negate the result that differences in marketable human capital or personal culture explain only a relatively small part of the huge differences in per capita income between the rich and the poor countries. The main source of the differences in per capita incomes across countries has to be something other than differences in the capacities of their peoples to respond to economic opportunities.

History has also performed some other experiments that lead to exactly the same conclusion. During most of the postwar period, China, Germany, and Korea have been divided by the accidents of history, so that different parts of nations with about the same culture and group traits have had different institutions and economic policies. As everyone knows, the economic performances of Hong Kong and Taiwan, of West Germany, and of South Korea have been incomparably better than the performances of mainland China, East Germany, and North Korea. The great differences in economic performance in areas of about the same cultural and national characteristics also raise grave questions about the adequacy of cultural or racial explanations of international differences in per capita income.

At the same time, it is also important not to read too much into the natural experiments that have been described. These experiments do *not* prove that cultural or other differences among peoples have no significance in any context. The newly arrived immigrants from some cultures earn more than newly arrived immigrants from other cultures. Though these differences are small in relation to the differences in per capita income between countries, they nonetheless remind us that cultural differences can still make a difference.

Moreover, the natural experiments of migration do not tell us anything about popular attitudes or prejudices regarding what public policy should be — they do not tell us anything about the public-good human capital or civic cultures of peoples. The migrants from poor to rich countries are normally tiny minorities in the countries to which they migrate, so they do not appreciably change the public policies or institutions of the host countries. Thus the natural experiments that we have just considered do not by themselves tell us what would happen if the civic cultures of the poor countries were to come to dominate the rich countries. If Latin American beliefs about how societies should be organized were to dominate North America and Middle Eastern beliefs were to dominate Western Europe, the whole system of institutions and policies might be different and economic performance might also change. This consideration must be kept in mind when interpreting the Hamilton–Whalley calculations mentioned earlier in this paper about the effect unlimited migration would have on world income. It also reminds us that the large and difficult question of what policies countries ought to have concerning immigration has nothing to do with the purpose of this paper — the evidence on immigration and immigrants is relevant here because of what it tells us about why the international differences in per capita income are so huge and persistent.

11. The Explanation That Remains: Institutions and Policies Determine National Income

This paper began with the familiar aggregate production function theory and its assumption that societies are on the frontiers of their aggregate production functions. It noted the large differences in per capita income across countries and sometimes even on opposite sides of the borders of adjoining countries. It asked why the differences in per capita incomes within regions of countries were so small in relation to differences across countries, why the great differences in per capita income matched national boundaries, and why the existing literature suggests that a reallocation of the world's population across national boundaries would probably about double world income. The paper also asked whether the great differences in per capita income across national boundaries were mainly due to differences in institutions and policies across countries, or whether they were mainly due to the

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causes that are explained within the aggregate production function framework: to differences in the proportions of the aggregate factors or to differences in the level of productive knowledge available to different countries.

If what has been said so far is correct, then most of the large and lasting differences in per capita income across countries cannot be explained by differences in access to the world's stock of productive knowledge, by differences in the ratio of population to land or natural resources, by any model that treats the quantity of available capital as an exogenous variable, or by differences in the quality of marketable human capital or personal culture. Neither the aggregate production function approach nor an anthropological-sociological model that emphasizes culture can by themselves explain the larger part of the international differences in per capita income.

Thus a process of elimination suggests what we should already have expected from direct evidence: that the institutions and policies in a society are probably the main determinants of its level of per capita income. I claim to have provided a great deal of direct evidence for this conclusion in other writings and thus will not repeat that evidence now. The strength of the relationship between the institutions and policies, on the one hand, and economic performance, on the other, of countries has been obscured for some observers by ideological preconceptions and controversies. The simple and familiar assumption that the quality of a nation's economic institutions and policies is given by the smallness — or the largeness — of its public sector, or by the size of its transfers to low-income people, does not fit the facts (Olson, 1986a pp. 245–269). But the idea that economic performance is determined mainly by the structure of incentives, which are in turn a result of institutions and public policies, is regularly supported (Olson, 1982, 1987a pp. 77–97, 1987b pp. 241–264, 1990).

Admittedly, an aggregative production function framework, even when supplemented by an analysis of culture, does not exhaust the list of possible noninstitutional and nonpolicy explanations of economic development. It is possible that some less aggregative framework, or some different system of classification of the hypothesized causes of the great cross-national differences in per capita income, would not have led, by the process of elimination, to institutions and policies. Still, the foregoing analysis has taken account of most of the aggregative variables that economists emphasize.

12. Neither the Old Growth Theory nor the New Growth Theory Is Sufficient

The findings in this paper are obviously also difficult to reconcile with the idea that most societies are on the frontiers of their aggregate production functions. Aggre-

gate production functions would need to be fundamentally redefined, with entirely different types of institutional and policy variables considered to be essentially "factors of production," in order to preserve the idea that most societies are on the frontiers of their aggregate production functions. On the other hand, the theoretical and empirical work on aggregate production functions has proved historically to be instructive in many applications in the most prosperous countries. It allows the researcher to get a quantitative and taxonomically comprehensive grip on the proximate or immediate sources of economic growth. It has also proved to be very suggestive, even in the preparation of this paper. Thus the present paper should be considered not so much a criticism of that theory as an outgrowth or extension of it. Nonetheless, if the findings here are correct, the assumption that societies are on the frontiers of their aggregate production functions has to be used with incomparably more caution than has been customary in the past.

Though the new growth theory began partly from studying the anomalies that arise from the assumption that societies are on the frontiers of their aggregate production functions, it does not sustain that assumption. The externalities or other sources of increasing returns in most endogenous growth models entail a market failure that keeps most or all societies from being on the frontiers of their aggregate production functions. This is a virtue of endogenous growth theory. At the same time, some new growth theory models leave the impression that there is only one externality or market failure that keeps societies from the frontiers of their aggregate production functions. This one externality is usually alleged to involve only human capital or research and development. If the present paper is correct, the societies of the real world, and especially the poorer societies, are characterized by innumerable inefficiencies, and it is misleading to focus too much on any one of them.

On this interpretation, the main contribution of endogenous growth theory is in explaining why, at the global level, there is as yet no sign of diminishing returns to research and development. Many endogenous growth models are not, however, especially apt instruments for explaining why some countries are rich and others are poor. Many of them do not explain why *some* poor countries grow at more rapid rates than other societies do, nor do they identify the changes in institutions and policies that can make a poor society become rich.

Some of them also obscure the point that, to get at fundamental causes of economic development, there appears to be no alternative to a careful examination of the processes of collective choice and collective action that determine the pattern of public policies and institutions in different countries.

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