DISEASE AND DEVELOPMENT IN HISTORICAL PERSPECTIVE

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Abstract
Health conditions and disease environments are important for economic outcomes. This paper argues that the main impact of disease environments on the economic development of nations is not due to the direct effect of health conditions on income, but rather because of their indirect effect via institutions. Health does affect income directly, but this can explain only a small fraction of today's differences in per capita income. In contrast, when previously isolated populations came into contact during the period of European colonial expansion, differences in disease environments had a major impact on the path of institutional development and consequently first-order consequences for economic growth. (JEL: I12, O12)

1. Introduction

Are differences in health conditions and disease environments a major cause of the huge gap in income per capita between rich and poor countries? An increasingly influential view argues that many countries, especially those in Africa and South Asia, are poor largely because their populations are unhealthy. For example, Bloom and Sachs (1998) claim that poor health conditions in Africa explain a substantial part of the difference between African growth rates and the average growth rates of other countries. More generally, Gallup, Sachs, and Mellinger (1999) write, "Tropical regions are hindered in development relative to temperate regions, probably because of higher disease burdens and limitations on agricultural productivity" (p. 5).

A recent World Health Organization Commission on Macroeconomics and Health (WHO 2001), chaired by Jeffrey Sachs, makes the case for a large Global Fund to fight HIV-AIDS, tuberculosis, and malaria: "in today's world, poor health has particularly pernicious effects on economic development in sub-Saharan Africa, South Asia, and pockets of high disease and intense poverty elsewhere" (p. 24), and "... extending the coverage of crucial health ser-

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vices . . . to the world's poor could save millions of lives each year, reduce poverty, spur economic development and promote global security" (p. i).

We definitely agree that improving health services would save millions of lives and that this is a highly desirable objective for global social policy. But the evidence that investing in health services would directly spur economic development and that differences in disease burdens today are a major factor in cross-country income differences is much weaker.

In this paper, we argue that while poor health, low life expectancy, and the prevalence of infectious diseases have adverse economic consequences, existing empirical studies suggest the effects are not large enough to explain much of today's very large cross-country differences in income per capita. Based on our previous work, we suggest that institutional differences, meaning differences in the social, economic, and political organization of societies, are the major reason for such large and persistent differences in economic performance (see Acemoglu, Johnson and Robinson 2001, 2002a).

Disease environments, however, play an important role in shaping the path of economic development when they affect institutional development. In particular, when two previously isolated populations come into contact, disease environments influence the balance of power between these populations and what type of institutions the more powerful imposes on the less powerful. In modern world history there have been two prominent episodes of this type. The first was the effect of European diseases in the New World after 1492, which greatly facilitated Spanish conquest of Amerindian civilizations. The second was the effect of local disease environments on the colonization strategies and settlement decisions of Europeans around the world from 1500 to 1900.

2. Health and Economic Development: The Case for a Direct Effect

The idea that health conditions matter for aggregate economic outcomes is intuitive. There are at least three reasons why societies with unhealthy populations may be poorer. All three channels are plausible and almost certainly present in practice:

1. Unhealthy people are less productive. People with poor general health will often be sick and miss work. Perhaps more important, they will also have lower levels of energy, reducing their productivity even when they are at work, and perhaps encouraging them not to work (e.g., Schultz and Tansel 1997).
2. Poor health conditions reduce life expectancy, which may reduce human capital investments because agents have shorter horizons. This effect will be important if average human capital in a society is a major factor for economic growth, and if the elasticity of the response of human capital investments to life expectancy is high.

3. Poor health may directly reduce human capital investments. For example, children may be sick or have less energy to attend school. Miguel and Kremer (2001) and Bleakley (2002) find evidence consistent with this view in the case of children infected with hookworm. Alternatively, workers with poor health may fail to invest in on-the-job human capital accumulation.

The data show a strong correlation between measures of the general health status of the population and economic performance (see, for example, Bloom and Sachs 1998, Gallup, Sachs, and Mellinger 1999, WHO 2001). In a prominent macrostudy, Gallup and Sachs (2000) suggest that better health conditions could improve annual per capita growth rates in malaria prone countries, such as sub-Saharan Africa, by approximately 1.3 percent. This estimate implies that, with similar health condition gaps as in the postwar period, healthier nations should have grown to be over thirteenfold as rich as the less healthy nations of sub-Saharan Africa since the beginning of the industrialization (modern growth) process (circa 1800)—the actual difference is around fourteenfold in 1995 PPP GDP per capita. Should we conclude that this correlation and these estimates reflect the causal effect of health on economic outcomes and that the direct effect of health and disease on economic development is of first-order importance? Not necessarily. The aggregate relationship between health and economic outcomes surely reflects the effect of income on health as much as—or perhaps more than—the effect of health on income. In fact, until recently, the high correlation between income and health was usually interpreted as reflecting the effect of income on health (e.g., Pritchett and Summers 1998).

The lack of a good instrument for disease is a major problem for existing macro studies of the effect of health on income. For example, some studies of malaria have an important omitted variable bias, because prevalence of malaria is correlated with European settlement and colonization strategies (see the discussion in Acemoglu, Johnson, and Robinson 2001). In its present state, the macro literature on this point is at best inconclusive.

An alternative strategy is to look at microdata on the relationship between health and economic outcomes. However, the existence of a positive effect of health on economic outcomes at the individual level does not imply a large aggregate effect. For example, healthy individuals may obtain better jobs or succeed in their competition against other individuals, but these effects might not translate into equivalent aggregate gains when the health of all individuals improves. The analogy here is with schooling as a job market signal; if the only role of schooling were signaling, high education individuals would earn higher wages, but an increase in all individuals' education would not necessarily create aggregate benefits.

Besides issues of translating micro estimates into macro effects, many of the micro estimates are simply too small to imply that health could be a first-order determinant of the economic growth of nations. This is the case even though

many of these estimates are likely to be upward biased because it is very difficult to control for the effect of economic outcomes on health, creating a positive simultaneity bias. It is also hard to find plausible instruments for individual health conditions—many of the micro-instrumental-variables estimates use individual or community characteristics that are most likely correlated with unobserved human capital and economic outcomes.

For example, Thomas and Strauss (1997) find a significant effect of height, which can be thought as a measure of general health status, on earnings using data from urban Brazil. The estimated effect is very small relative to cross-country differences in income. Thomas and Strauss (1997, p. 170) write: "To earn the same wage [in Brazil], an illiterate would thus have to be about 30 cm taller than a literate male, *ceteris paribus.*" A very large height increase would therefore be necessary to close a relatively small wage gap.

Schultz and Tansel (1997) look at the effect of illness and days disabled on earnings using data from Cote d'Ivoire and Ghana. Both countries are among the least healthy in the world. Average days disabled in both countries are about two days in four weeks. Using the OLS estimates of Schultz and Tansel (1997), reducing disabled days from the level in these two countries to zero, the healthiest possible outcome, would produce only a 2 percent gain in aggregate income. Using their IV estimates, which are likely to be biased upwards for a variety of reasons, this gain would be 17 percent, which is very small relative to the cross-country differences we observe in the data and relative to the macro estimates mentioned previously.

A number of other studies are surveyed by the Working Group 1 of the Commission on Macroeconomics and Health on "Health, Economic Growth, and Poverty Reduction" (Alleyne and Cohen 2002). Most of this research finds a significant effect of health on school attendance and work effort. Again, however, the magnitudes are not large enough for differences in health conditions to account for the bulk of income differences across countries.

The micro evidence therefore suggests that improving health conditions contributes to improving economic outcomes. This evidence and humanitarian reasons clearly make investments in the health of poorer nations a highly desirable social policy. Nevertheless, the available evidence also suggests that differences in disease environments and health conditions are unlikely to be a first-order determinant of the very large cross-country income differences that we observe today.

3. Did the Big Improvements in Life Expectancy Spur Economic Development?

A better assessment of the effect of health on the economic growth of nations requires an analysis of the relationship between measures of general health conditions and aggregate economic outcomes. To obtain the causal effect of health on economic development, we need to isolate a source of exogenous

variation in aggregate health conditions across countries. In Acemoglu, Johnson, and Robinson (2002b), we look at the extension of established public health measures to high-mortality areas of the world beginning in the 1930s and more effectively after World War II. These events provide an interesting opportunity to look at the effect of large increases in life expectancy on economic growth.

In the early 1930s, life expectancy was generally low in many parts of Latin America, South Asia, and Africa. The main sources of high mortality varied by country, but typically included respiratory tuberculosis, malaria, pneumonia, smallpox, cholera and various diarrhoeal diseases. These high rates of mortality reflected a variety of factors, but mostly lack of public health infrastructure and clean water, generally poor sanitary conditions, deficiencies in public education, and the prevalence of infectious diseases. Between the mid-1930s and early-1950s, there were considerable investments in public health infrastructure and improved sanitary conditions, increasingly supported by international organizations, such as the U.N. There also developed a better understanding of infectious diseases, following from the germ theory of disease, while new drugs became widely available and spread quickly from relatively rich to relatively poor countries.

In Acemoglu, Johnson, and Robinson (2002b) we use a variety of strategies to look at the effect of these mortality reductions on future economic growth. Our results, while still preliminary, show no evidence of large economic growth benefits from these mortality reductions. For example, between 1930 and 1960, largely because of the factors discussed above, the gap in life expectancy between the OECD (Western Europe, North America and parts of Oceania) and Latin America narrowed by nine years, and the gap between the OECD and South and Southeast Asia (in particular, Mauritius, Sri Lanka, India, Indonesia, and the Philippines, the countries for which we have data) narrowed by 3.5 years. But neither during this period, nor during any of the subsequent forty years, is there any evidence of convergence in income between these groups of countries. On the contrary, OECD economies appear to have grown somewhat more than the other two groups (see Acemoglu, Johnson, and Robinson 2002b, for a more detailed analysis).

These findings, of course, do not imply that health conditions do not matter for economic performance. But they do suggest that differences in life expectancy or other health conditions are unlikely to be a first-order determinant of differences in long-run economic development over 100–200 years or in postwar growth performance.

4. Disease and Development in Historical Perspective

In addition to their direct effects, disease environments and health conditions can play an important indirect role in shaping economic development when they affect institutional choices. In recent history, there are two prominent episodes when contact between populations with different types of immunities and

diseases has affected institutions (see Crosby 1972, and McNeill 1976, for other instances where diseases have affected previously isolated peoples).

4.1 European Conquest of the New World

How Spanish conquistadores conquered the Inca and the Aztec empires and quickly came to dominate South America is well known. Shortly after the contact with the American Indians, deadly Eurasian diseases spread rapidly in these populations. Mortality estimates vary widely, even among serious researchers, but a consensus view would be at least 50 percent; see Crosby 1972, McNeill 1976, McEvedy and Jones 1978. Jared Diamond (1997, pp. 77–78) describes the general phenomenon eloquently (though his estimate of population declines is at the top of the range): "Smallpox, measles, influenza, typhus, bubonic plague, and other infectious diseases endemic in Europe played a decisive role in European conquests, by decimating many peoples on other continents. For example, a smallpox epidemic devastated the Aztecs after the failure of the first Spanish attack in 1520. . . . Throughout the Americas, diseases introduced with Europeans spread from tribe to tribe in advance of the Europeans themselves, killing an estimated 95 percent of the pre-Colombian Native American population."

These astounding mortality rates among the native population were decisive in Europeans taking complete control of South America. Helped by these diseases, and their relative immunity, Europeans quickly shaped the social organization, institutions, and economic activities of these areas in order to profit from their colonial enterprise. The Spanish first confiscated large quantities of gold and silver, then took over existing Inca and Aztec tribute systems and set up mining based on forced labor. Other Europeans soon followed with similar extractive institutions, including slave plantations.

It is plausible that without rapid initial population declines and the associated social disruption, the establishment of European domination over the Americas would have been much slower and perhaps even less complete. Europeans had no large disease advantage in Asia or Africa, and these societies did not collapse on initial contact. Consequently, Europeans were not able to take effective control of these areas until much later. In both Asia and Africa, Europeans established sufficient coercive force to maintain profitable trading ties, for example in the East India Companies and the African slave trade, but they had to rely heavily on the cooperation of local rulers until full colonization in the nineteenth century.

Therefore, in the Americas, the diseases that Europeans brought—specifically, the difference between American and European disease environments—played a first-order role in allowing rapid and thorough European domination. "Health conditions" thus affected the institutions that Europeans were able to impose in the Americas.

4.2 European Colonization Meets Malaria and Yellow Fever

The other side of the colonization story is the diseases that Europeans encountered in many of the areas they colonized. As we argued in Acemoglu, Johnson, and Robinson (2001), a crucial determinant of colonization strategy and colonial institutions was whether Europeans settled or not. Starting in the seventeenth century, large numbers of Europeans emigrated to and settled in certain areas. Settlement colonies survived and prospered only where the disease environment was favorable for Europeans. For example, Australia and New Zealand had less prevalent tuberculosis, pneumonia, and smallpox, making them healthier for Europeans than their home countries before 1900.

In other areas, hostile disease environments made it practically impossible for Europeans to settle. In particular, disease environments with malaria and yellow fever were highly fatal to Europeans. When they attempted to settle or organize expeditions to areas with prevalent yellow fever and malaria, European mortality rates were staggeringly high (see the references and discussion in Acemoglu, Johnson, and Robinson 2001).

As a result, disease environments had a major effect on whether Europeans could settle, and via this channel, on the institutions that they set up in the colonies. European colonists were much more likely to develop institutions of private property, encouraging economic and social development, in places where they settled. In contrast, in places where they did not settle, they were more likely to opt for extractive institutions, designed to extract resources without investing in institutional development. In these places, institutions were highly centralized, with political power concentrated in the hands of a small elite and with almost no checks on this elite. The property rights and more general rights of the majority of the population were not protected.

These colonial institutions, at least to some degree, persisted to the present. In Acemoglu, Johnson, and Robinson (2001), we argue that they had a first-order effect on economic development of these areas. For example, the lowest quarter of the former colonies in terms of European settler mortality are today approximately five times as rich as countries that were in the highest quarter of the distribution for European settler mortality. The evidence in Acemoglu, Johnson, and Robinson (2001, 2002a) suggests that this difference is due to the differential path of institutional development in these colonies.

5. Conclusion

A recent influential view sees health conditions and disease environments as first-order direct determinants of economic development. Scholars, commentators, and international organizations are now arguing that we should invest in the health of less-developed populations in part because of the economic benefits that these investments will create.

Such investments are highly desirable on humanitarian and social grounds, but the evidence that these investments will lead to rapid economic development is weak. Micro estimates of health conditions on economic outcomes typically suggest small effects relative to the very large cross-country differences in income per capita. Furthermore, episodes of large exogenous declines in mortality have not generally been followed by fast growth.

Health surely matters for economic outcomes, but differences in health conditions and life expectancy are unlikely to be a major reason for the extreme poverty suffered by many nations today. Instead, institutional differences between countries, specifically, the economic, political and social organizations that societies have chosen or ended up with, are likely to be the main factor behind these income differences.

Diseases and health conditions have nonetheless played an important role in the history of economic development. At a number of critical junctures in history, disease environments had a first-order effect on economic development by affecting the path of institutional and social development. We discussed two important episodes of the past 500 years when diseases had a profound effect on institutions, shaping the future course of economic development.

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