

Health as Human Capital and its Impact on Economic Performance

by David Bloom and David Canning*

1. Introduction

Health is a key component of an individual's welfare and standard of living. Sickness and ill health, and the risk of death, are central issues in shaping human capabilities and behavior. There is therefore a strong argument for health spending on the grounds that it has a direct effect on human wellbeing and happiness.

The market for health is special and the provision of health often requires a large element of involvement by government. Infectious diseases have obvious externalities that create a large public interest in their control. In addition, the uncertainty of the occurrence of ill health, and the large medical bills that it may lead to, creates a need for insurance or borrowing to finance health expenditures. However, market failure is common in health, insurance and credit markets, often due to differences in information between the market provider and the customer. Government regulation and intervention in health, in an effort to overcome these market failures, is widespread.

When individuals purchase goods they make a trade-off between the benefits they receive and the cost of the good. One drawback of government provision is that it must decide on the right level of spending on health, though it often lacks direct knowledge of health benefits.

In developing countries the most effective methods of improving health require public sector involvement. In developing countries the main cause of ill health and premature mortality are infectious diseases. These can be tackled effectively through the provision of clean water and sanitation systems and wide scale vaccination programs. Such preventative public health measures can have a very large impact on the transmission of infectious disease, in many cases leading to the eradication of the disease.

However, developing countries have limited budgets and there are many sectors in which there is a need for government spending. In particular, there is a strong case that poorer countries should concentrate their government spending on investment that leads to economic growth; spending on current consumption may lead to welfare gains today but does nothing to cure the long-term problems of poverty. Government spending on education, transport and communication infrastructure, and on legal institutions that ensure personal security and property rights can be shown to have a positive impact on economic growth. It can be argued that spending on health delays such investments and so hampers economic growth.

* David Bloom is Clarence James Gamble Professor of Economics and Demography, Harvard School of Public Health and David Canning is Professor of Economics and International Health, Harvard School of Public Health. This paper is based on a keynote address given to the WHO Conference on Health and Disability, Trieste, Italy, April 2002. The authors are grateful to the participants in the conference for their comments and subsequent discussions. We would also like to thank Larry Rosenberg for his comments.

In this paper we argue that health is not only a consumption good that adds to wellbeing, but also an investment good that increases the future productive power of individuals and the economy. Health has a direct effect on the productivity of workers. Together with the moral argument, worker productivity is the main mechanism put forward by the World Health Organization (2001, 2002) to justify increased transfers to developing countries for health spending. However, there are also more indirect mechanisms through which health can influence productivity. These indirect mechanisms, while less obvious, may be more important in practice.

One indirect mechanism is that health can be a complementary input to other forms of human capital. There is a great deal of empirical evidence that productivity and wages rise with education levels and worker job experience. These returns may be higher for healthy workers so that the gains from education and work experience accrue mainly to healthy workers who are working. In addition, these higher returns may induce greater investment in education and on-the-job training when workers are healthy. Ill health and premature death essentially lead to wasted investment in human capital and reduce the incentive to invest in people.

Another indirect benefit of improvements in health is that the prospective lifespan of healthier workers is longer. Long lifespans increase the need for retirement income. In countries with low life expectancy the prospect of retiring is remote. Once longer lifespans become common, retirement becomes a real possibility and workers have to consider saving for their retirement. In developed countries savings for retirement is the main source of investment funds. Increasing longevity can generate the need for retirement income and set off a savings and investment boom.

Finally, reductions in mortality rates change the age structure of the population. Initially, health improvements tend to reduce the mortality rates of infants and children who are particularly susceptible to disease. This causes a “baby boom” cohort. The reduction in child mortality often leads to a subsequent reduction in the birth rate as families adjust their fertility behavior to the new low mortality regime. This fall in birth rates means that the large baby boom cohort is unique, with much smaller cohorts before and following on. This large cohort can have profound effects on the economy as it enters education, works as young adults, works and saves as older adults and finally enters retirement.

Taken together, we argue that these mechanisms mean that investments in health can have a large impact on economic performance. This makes investment in health in developing countries, where the costs of tackling the problem of infectious disease can be low, very appealing. The investment argument for increased health spending in developed countries is much less obvious. In developed countries the gains from improved health mainly accrue to the elderly and tend to prolong retirement with little effect on the productivity of workers. In addition, the cost of treating non-infectious diseases, such as heart disease and cancer that require intensive interventions by health workers, is relatively high.

The argument that health is an investment good means that the economic prospects of countries with high rates of HIV/AIDS are poor. Many current projections actually conclude that HIV/AIDS will increase income *per capita*. This is because deaths tend to reduce both total income and the number of people this income must be divided between. The resultant smaller population tends to mean that there is more capital per worker for those that remain leading to increased income *per capita*.

This argument is essentially the same as that used by Cantor (1991) who argues that the Black Death (Bubonic Plague) in England in 1450 led to a rise in living standards for the survivors who had higher levels of land for cultivation *per capita*. However, the two are not the same. The Black Death was a very short-term epidemic that burnt itself out in about three

years. Its effect was a one-off reduction in the size of the population. HIV/AIDS persists. It kills but also affects the lives of survivors. Young people in high HIV/AIDS countries have a high risk of illness and death. We argue that this will have large negative effects on the economy by reducing their investment in education and savings for old age. HIV/AIDS may not just be a medical disaster but also an economic disaster.

In section 2 we set out the macroeconomic evidence for a link between health and economic growth. In section 3 we investigate the mechanisms that lie behind this link. In section 4 we discuss some of the issues that require further research. Finally, in section 5 we argue that health not only generates income but that higher income improves health outcomes. We outline the dynamic process of cumulative causality that health improvements can initiate.

2. Health and national income

There is a clear correlation between income and health. Figure 1 plots life expectancy and average income levels across the world in 1990. While high incomes and good health tend to go together, a central issue is the direction of causality. The traditional view (e.g., Preston, 1975; World Bank, 1993; Pritchett and Summers, 1996) is that high income leads to good health through its effects on nutrition and the purchase of healthcare.

The empirical evidence from cross-country growth regressions challenges this view. A great deal of effort has been expended trying to explain why economic growth in some countries has been so much higher than in others. Many factors have been identified, for example, the initial level of income *per capita* (low income countries tend to catch up with

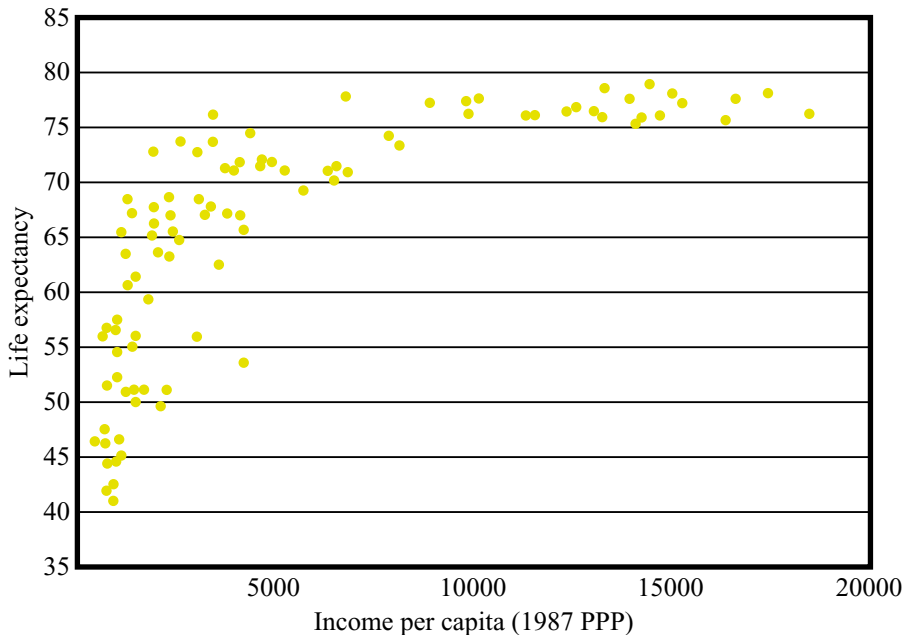


Figure 1: Life expectancy and income in 1990

high income countries), geographical location, the institutional environment and economic policy, and investments in education. To this list we can now add health. Even when we allow for these other factors, health, as measured by life expectancy at the beginning of the period, has a significant effect on subsequent economic growth. Estimates suggest that the health effect on GDP is large: one extra year of life expectancy raises steady state GDP by about 4 per cent.

This health effect has been found consistently in many studies (e.g., Barro, 1996, 1997; Barro and Lee, 1994; Barro and Sala-i-Martin, 1995; Bhargava *et al.*, 2001; Bloom, Canning and Sevilla, 2001; and Hamoudi and Sachs, 2000). In a study comparing many possible factors that have been put forward as explaining economic development Sala-i-Martin (1997a, b) found health to be one of the most robust predictors of future growth.

3. Healthier is wealthier: mechanisms

If health leads to economic growth, Bloom and Canning (2000) argue we need to understand the mechanisms through which it operates. The most obvious mechanism is through the effect of health on the productivity of workers. If health improves productivity we would expect to see a relationship between health measures and wages since the extra productivity of healthy workers should be reflected in their remuneration.

Many micro-economic studies use height as a measure of long-term health. Height is a good proxy for health because it is linked to health and nutrition *in utero* and in childhood. In particular, bouts of sickness when young tend to arrest physical growth, leaving height as an indicator of the frequency and duration of childhood illness. Height is a significant indicator of adult health: tall people have better health and live longer (Fogel, 1994, 1997; Sohn, 2000). However, other factors also affect height. In particular, a component of height clearly inherited from one's parents. To estimate the health effect, studies use only height variations due to environmental health differences.

This is, of course, difficult to do. It involves using not actual height but the portion of height explained by health when young. In practice this involves regressing height on a range of health indicators and using the resultant fitted value, which now only depends on health factors, to explain wages.

Table 1 shows the effect of height on wages using this methodology found by Schultz (1999a, b), Schultz and Tansel (1992), and Ribero and Nunez (2000).

*Table 1:
Effect of 1cm extra height on wages*

| Country | Males | Females |
|----------|-------|---------|
| Brazil | 4% | 6% |
| Ghana | 6% | 8% |
| Colombia | 6% | 7% |

These effects are very large. One centimeter of height due to health inputs when young adds about 6 per cent to wages. This is about the same effect on wages as an extra year of education since the consensus is that a year of education adds about 9 per cent to wages (Psacharopoulos, 1994). Estimates of the height effect in developed countries are much

smaller, about 1 to 2 per cent extra on wages per centimeter of height (Strauss and Thomas, 1998). This may be because work in developing countries is more physical and the productivity declines that result from ill health are consequently larger.

This wage rate gap reflects the increased productivity of healthy workers when all workers are actually in work. There is the additional effect that ill health may prevent workers from going to work, leading to an ever larger gap in earnings.

Increased health and labor market participation can also increase the return to education. Unless workers are employed, their education, viewed as a productive asset, goes to waste. In addition, reduced mortality rates also increase the return to education by lengthening the lifespan over which the education can be employed. These increased returns to education can induce greater demand for education in countries with good health and low mortality rates. Bils and Klenow (2000) estimate that an extra year of life expectancy leads schooling levels to increase by 0.25 years. This means that the high levels of life expectancy in developed countries may help explain why education levels are so high compared with developing countries.

As workers gain experience, their productivity and wages tend to rise. This source of productivity may be large; estimates of the total returns to work experience in the United States are of roughly the same magnitude as the returns to education. Increases in life expectancy and labor force participation tend to increase average experience levels in the workforce. However, this effect is offset to some extent by the extra schooling that more long-lived workers acquire. This extra schooling reduces labor market experience so that while workers in countries with high life expectancies are older on average, they have about the same level of work experience as those in high mortality countries.

One of the clearest requirements for economic growth is a high rate of investment in physical capital. Young (1994, 1995) makes the point that the “economic miracle” countries in East Asia that had sustained high rates of economic growth did so largely due to high rates of growth of factor inputs rather than increases in total factor productivity. One key element in these economic success stories was their exceptionally high rates of savings and investment, often in excess of 30 per cent of income being saved.

Bloom, Canning and Graham (2002) analyse national savings rates across countries and explain the savings boom in East Asia by the rapid increase in life expectancy in the region over the period. Increases in longevity increase the need for retirement income.

With high life expectancy, young people save more for retirement, but in a stable population this saving is offset by the dis-saving of the old as they run down and consume their wealth. In Europe and the United States these effects just about cancel out so that net national savings and investment rates are low. However, in East Asia the rise in life expectancy has been so sudden that there is a “baby boom” cohort that is saving for retirement, but a substantially smaller old cohort that is dis-saving. This gives an exceptionally high rate of national savings. This effect will last until the population age structure reaches equilibrium when the dis-saving of the old offsets the saving of the young. It follows that it is not so much longevity that increases national savings rates but *increases* in longevity that raise national savings rates for a time until equilibrium is established again.

This effect is clearly dependent on the working population being able to foresee their retirement and engaging in saving to pay for it. The savings boom would have been much less pronounced if workers relied on a pay-as-you-go pension scheme that would pay their pensions out of taxes on the subsequent cohorts of workers. However, in East Asia workers have had to rely on their private savings or on government schemes that are funded by forced saving and asset accumulation rather than taxes on future workers. This system of pension

funding has not only produced the East Asia saving boom but has also led to the hope that the eventual ageing of the baby boom cohort will not put a strain on public spending.

Finally, health improvements have a large impact via their effect on the population age structure. Declining mortality rates result in large cohorts of young people as infant mortality falls. This is eventually counterbalanced by a reduction in fertility due to increased child survival rates. However, the consequence of this is to create a large “baby boom” cohort that works its way through the population age structure. Figure 2 shows how the population age structure in East Asia has changed since 1950 and projects it into the future. The higher diagonal “ridge” in the figure is the baby boom cohort that ages by five years in each five-year period. As can be seen from the figure this large baby boom cohort dominates the age structure.

The result is a high level of youth dependency initially. This large cohort of children puts pressure on education systems and tends to lower income *per capita* since it does not add to production but does increase the population size. However, eventually this cohort enters working age and the result is a high proportion of working-age people to total population. In East Asia between 1960 and 2000 the ratio of working age (15–64) to dependent population (0–14 and 65-plus) rose from about 1.3 to over 2. This means a much higher input of workers *per capita* into production and a higher level of income *per capita*. In addition, household savings rates peak when workers are aged between 40 and 65 and preparing for retirement, giving a savings boom when the baby boom cohort enters this age range. Bloom and Williamson (1998) and Bloom, Canning and Malaney (2000) investigate the economic impact of these demographic changes in East Asia in detail.

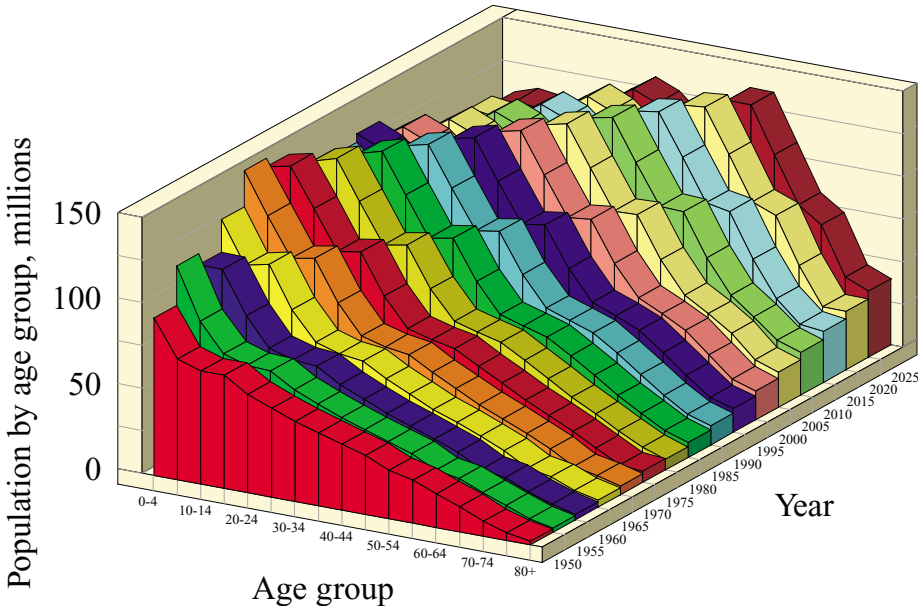


Figure 2: Changing Age Distribution East Asia

Source: The Sex and Age Distributions of Population. The 1992 Revision of the United Nations' Global Population Estimates and Projections

Eventually, as the baby boom cohort ages, the high old-age dependency rate puts a brake on economic growth. The demographic transition thus gives a significant but “temporary”, 50 years say, boost to economic growth. This positive picture can be contrasted with the situation in Africa shown in Figure 3. Improvements in health, and in particular reductions in infant mortality are increasing the number of children dramatically. However, this has not yet been matched by a reduction in fertility and youth dependency rates remain high and appear set to persist for the foreseeable future, making the growth prospect for Africa bleak (see also Bloom and Sachs, 1998; Easterly and Levine, 1997).

4. Mutual reinforcement: virtuous spirals and vicious circles

Fundamental health improvements can be achieved, even in very poor countries by the introduction of antibiotics, vaccines, and public health measures (clean drinking water, better sanitation), along with improved primary healthcare. We have argued that these health improvements promote economic growth. However, there is no doubt that economic growth also leads to health improvements implying that causality runs in both directions.

This two-way causality can give rise to a process of cumulative causality with health improvements leading to economic growth which feeds back into further health improvements and so on. The East Asian growth miracle is compelling evidence for a process of cumulative causality. Such rapid rates of economic growth can only be sustained if there are positive feedback effects. Bloom and Canning (2001) look in detail at the linkages between health, fertility, and economic growth and find evidence of such positive feedbacks.

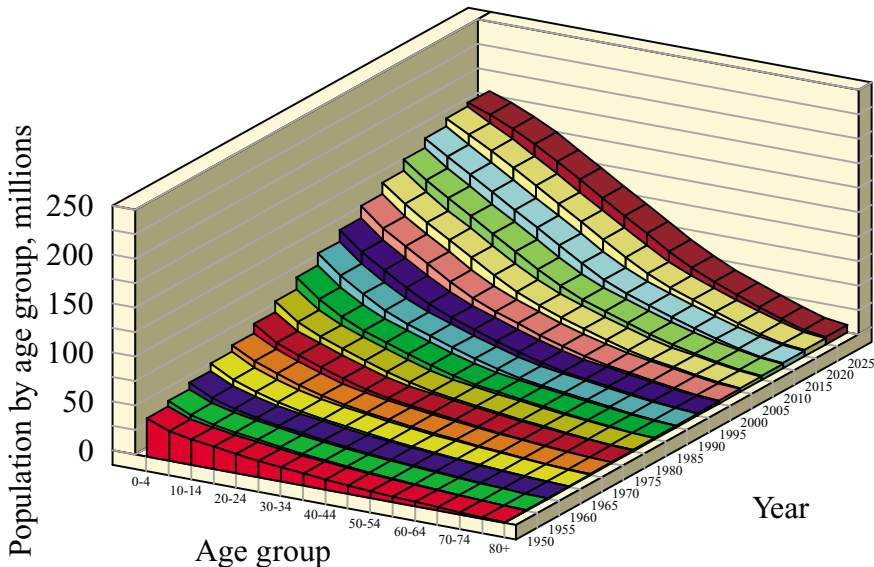


Figure 3: Changing Age Distribution Africa

Source: The Sex and Age Distributions of Population. The 1996 Revision of the United Nations' Global Population Estimates and Projections

There is also, unfortunately, scope for vicious circles, with health declines setting off a process of impoverishment and further ill health. This is particularly worrying for Russia (see Bloom and Malaney, 1998), where male life expectancy has declined sharply, and for sub-Saharan Africa, where HIV infection is high and there is the prospect of AIDS having a massive impact on mortality rates in the near future.

Figure 4 shows a schematic representation of the traditional view in which economic growth is caused by a process of factor accumulation and in which health is seen as a by-product. In contrast, Figure 5 shows a new paradigm in which health interacts both with income directly through worker productivity and indirectly through its effects on investments in human and physical capital. This paradigm has multiple interactions and causal pathways, together with many points of entry where policy interventions can influence the system.

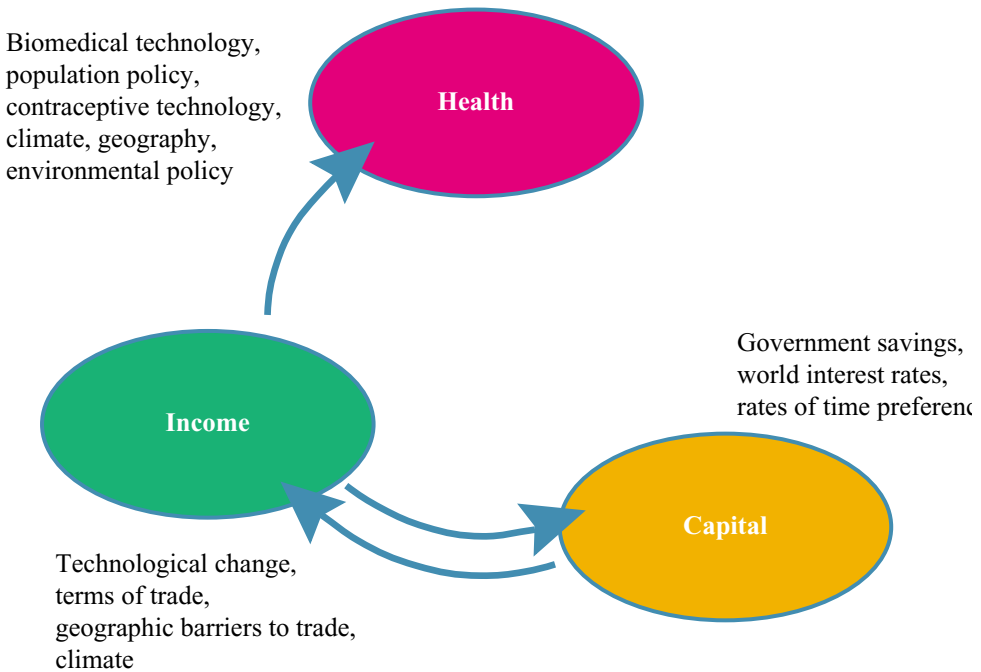


Figure 4: Health and income: the traditional view

Health, like education, is a form of human capital and is a fundamental requirement for economic development. The paradigm set out in Figure 5 opens the possibility of health-led development, spending on health not just for its direct welfare effects but also to boost economic growth.

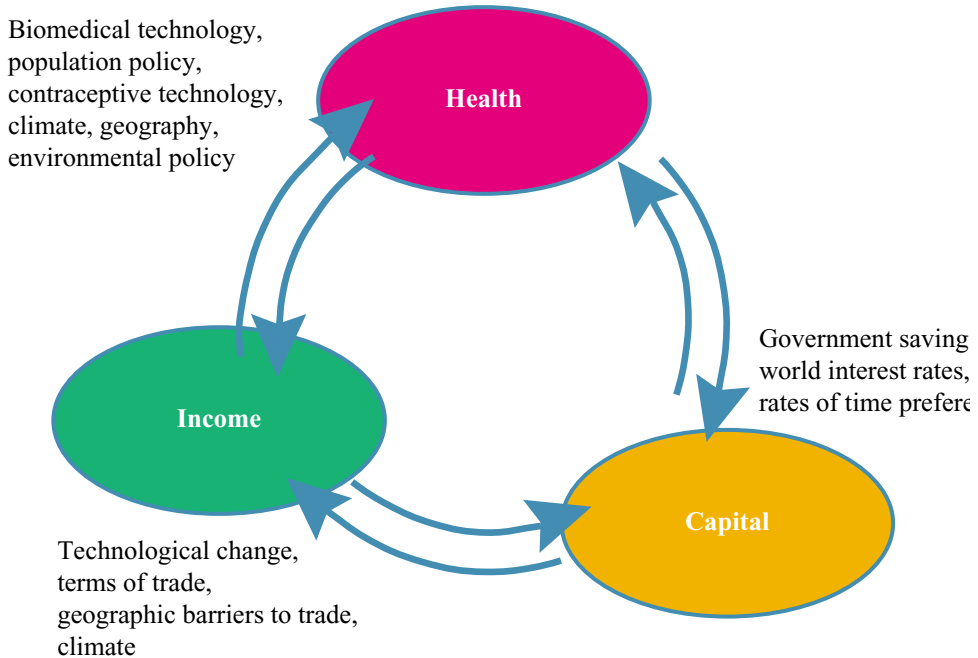


Figure 5: Health and income: a new paradigm

5. Research issues

More research is required in many of the areas touched on in this paper. A major issue is the direction of causality: health and income tend to improve together. In macro studies we often use timing to indicate causality. While health improvements tend to occur prior to rises in income, more needs to be done to establish causality; we need a better understanding of exogenous population health changes to establish that they really occur prior to income increases.

A second problem is that the health measures we use tend to be proxies; it would, for example, be better to use more direct measures of health rather than use height as a proxy. In theory there is also an important distinction between the effect of healthier people (morbidity measures) and effects of increased longevity (mortality measures). Cross-country measures of health usually use life expectancy, a mortality measure, while it is morbidity and disability that matter for worker productivity. This makes it difficult to compare the macro results, based on mortality rates, with the effects of height found in micro studies (though Weil (2001) carries out a calibration exercise that tries to do this).

Our evidence will be substantially improved when we follow people over a substantial period of time to look at short- and long-run effects of ill health on work and wages. Randomized (individual or local) allocation of healthcare measures as a controlled experiment will allow us to determine the direction of causality. This requires longitudinal household studies which combine health and income measures with controlled experiments in health provision. Such data are just now becoming available for developing countries.

6. Conclusion

The WHO report makes a strong argument for large money transfers from the developed world to poorer countries where people are suffering from chronic health conditions. Huge numbers of people in Africa suffer from diseases that are easily preventable. By targeting a small number of infectious diseases, such as tuberculosis, that can be controlled through simple public health measures such as vaccination or clean water and sanitation (or the DOTS treatment regime in the case of TB), we could achieve enormous benefits in terms of saved lives and community health for a relatively small amount of money – the World Health Organization (2001) gives a figure of U.S.\$ 27 billion required in grant assistance to developing countries by 2007. In addition, by spending money on research and development of drugs tailored to particular diseases, particularly malaria, which is a particularly crippling disease in Africa (Gallup and Sachs, 2000) – research that is not commercially viable because these diseases strike mainly poor people in developing countries – even greater health improvements could be achieved.

Despite these potential health benefits, and the relatively low costs of such programs, this argument for directing aid funding towards health has not been decisive. While there is a strong moral case for the large transfer of cash from rich countries to poorer countries, in practice such transfers are currently small and likely to remain fairly small.

The key issue is not that spending on health would be good, it is whether spending on health is better than other uses of the limited funds available in developing countries. In practice every dollar spent on health is a dollar that could be, but is not spent on food, education, or roads.

In assessing the relative benefits of different types of spending a sharp distinction must be made between goods that provide immediate welfare and those that are investment goods that produce sustainable economic development. Traditionally, development aid has focused on education and infrastructure, such as roads, not because aid agencies do not care about ill health, but because these investments are a way of generating sustainable economic growth.

Economic growth alleviates many problems. As countries get rich they gain the resources to feed, clothe, and provide healthcare for their populations. By focusing on economic growth we can hold out the prospect of lifting countries out of poverty, allowing them to develop, eventually removing the need for aid. Aid that focuses on current welfare brings immediate gains, but can also lead to an aid dependency that actually undermines development. Aid of this type can be a bottomless pit, alleviating the current symptoms of the problem without tackling its causes, leading to ever greater needs and further demands for aid.

Another argument for investing rather than consuming is that most aid is not “free” but is made available in the form of loans. Even though interest on these loans may be at concessionary rates, they still have to be repaid. The debt crisis facing developing countries today is largely a crisis of investments that performed poorly. The debt burden in many developing countries is enormous and results in a major diversion of funds from productive and welfare goals to debt repayment. If developing countries are to borrow more we should ensure that this will lead to widening the resource base and will not impose a debt burden, without the means to pay, on future generations.

If we spend on health are we going to undermine economic growth? The answer is no. In fact the real argument for spending on health in developing countries is that health is one of the best investment goods around. It is obvious that health is a productive asset. Healthier people can work harder and have higher productivity. This is particularly true in developing countries where physical labor is the norm. Health therefore is a direct input into labor productivity.

In addition health is closely linked to the returns on education. AIDS deaths in Africa are set to rise to alarming rates, with current HIV infection rates in many countries exceeding 20 per cent. The deaths of young educated workers remove one of the most valuable assets in an economy. These deaths not only waste the huge investments that have been made, in terms both of upbringing and formal education. They also deprive the population of the skilled teachers and caring parents of the next generation.

Although the arguments we have been making here are based on scholarly work, they are far from academic. The change we are talking about – making investments a health a priority for developing countries – has enormous potential to spur development in areas far beyond health itself. Failing to recognize the value of such investments will mean that developing countries will miss out on one of the most effective, and cost-effective, ways to stimulate economic growth and improve living standards.

REFERENCES

- BARRO, R., 1996, "Health and Economic Growth", mimeo, Harvard University.
- BARRO, R., 1997, *Determinants of Economic Growth: A Cross-country Empirical Study*, Lionel Robbins Lectures. Cambridge, MA: MIT Press.
- BARRO, R. and LEE, J., 1994, "Sources of Economic Growth", *Carnegie-Rochester Conference Series on Public Policy*, 40, pp. 1–46.
- BARRO, R. and SALA-I-MARTIN, X., 1995, *Economic Growth*. New York: McGraw-Hill.
- BHARGAVA, A., JAMISON, D., LAU, L. and MURRAY, C., 2001, "Modeling the Effects of Health on Economic Growth", *Journal of Health Economics*, 718, pp. 1–18.
- BILS, M. and KLENOW, P., 2000, "Does Schooling Cause Growth?", *American Economic Review*, 90, pp. 1160–1183.
- BLOOM, D.E. and CANNING, D., 2000, "The Health and Wealth of Nations", *Science*, 287, pp. 1207–1208.
- BLOOM, D.E. and CANNING, D., 2001, "Cumulative Causality, Economic Growth and the Demographic Transition", in N. Birdsall, A.C. Kelly and S.W. Sinding (eds.), *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World*. Oxford U.K.: Oxford University Press.
- BLOOM, D.E., CANNING, D. and GRAHAM, B., 2002, "Longevity and Life Cycle Savings", NBER Working Paper, No. 8808.
- BLOOM, D.E., CANNING, D. and MALANEY, P.N., 2000, "Demographic Change and Economic Growth in Asia", *Population and Development Review*, 26(supp.), pp. 257–290.
- BLOOM, D.E., CANNING, D. and SEVILLA, J., 2001, "The Effect of Health on Economic Growth: Theory and Evidence", NBER Working Paper, No. 8587.
- BLOOM, D. and MALANEY, P., 1998, "Macroeconomic Consequences of the Russian Mortality Crisis", *World Development*, 26, pp. 2073–2085.
- BLOOM, D.E. and SACHS, J., 1998, "Geography, Demography, and Economic Growth in Africa", *Brookings Papers on Economic Activity*, 2, pp. 207–273.
- BLOOM, D.E. and WILLIAMSON, J.G., 1998, "Demographic Transitions and Economic Miracles in Emerging Asia", *World Bank Economic Review*, 12 (3), pp. 419–455.
- CANTOR, N.F., 2001, *In the Wake of the Plague: The Black Death and the World It Made*. New York: The Free Press.
- EASTERLY, W. and LEVINE, R., 1997, "Africa's Growth Tragedy: Policies and Ethnic Divisions", *The Quarterly Journal of Economics*, Vol. 112 (4), pp. 1203–1250.
- FOGEL, R.W., 1994, "Economic Growth, Population Theory and Physiology: The Bearing of Long Term Processes on the Making of Economic Policy", *American Economic Review*, 83(3), pp. 369–395.
- FOGEL, R.W., 1997, "New Findings on Secular Trends in Nutrition and Mortality: Some Implications for Population Theory", in M. Rosenzweig and O. Stark (eds.), *Handbook of Population and Family Economics*, Vol. 1A. New York: Elsevier.
- GALLUP, J. and SACHS, J., 2000, "The Economic Burden of Malaria", Harvard Center for International Development, Working Paper No. 52.
- HAMOUDI, A. and SACHS, J., 1999, "Economic Consequences of Health Status: A Review of the Evidence", Harvard Center for International Development, Working Paper No. 30.
- PRESTON, S., 1975, "The Changing Relation Between Mortality and the Level of Economic Development", *Population Studies*, 29, pp. 231–248.

- PRITCHETT, L. and SUMMERS, L., 1996, "Wealthier is Healthier", *Journal of Human Resources*, 31(4), pp. 844–868.
- PSACHAROPOULOS, G., 1994, "Returns to Investment in Education: A Global Update", *World Development*, 22, pp. 1325–1343.
- RIBERO, R. and NUNEZ, J., 2000, "Adult Morbidity, Height, and Earnings in Columbia", in W.D. Savedoff and T.P. Schultz (eds.), *Wealth from Health*. Washington, D.C.: Inter-American Development Bank.
- SALA-I-MARTIN, X., 1997a, "I Just Ran Four Million Regressions", NBER Working Paper No. 6252.
- SALA-I-MARTIN, X., 1997b, "I Just Ran Two Million Regressions", *American Economic Review, Papers and Proceedings*, 87, pp. 178–183.
- SCHULTZ, P., 1999a, "Health and Schooling Investments in Africa", *Journal of Economic Perspectives*, 13(3), pp. 67–88.
- SCHULTZ, P., 1999b, "Productive Benefits of Improving Health: Evidence from Low Income Countries", mimeo, Yale University.
- SCHULTZ, P. and TANSEL, A., 1992, "Measurement of Returns to Adult Health: Morbidity Effects on Wage Rates in Cote d'Ivoire and Ghana", Yale Economic Growth Center Discussion Paper No. 663.
- SOHN, B., 2000, "How Much Has Health Improvement Contributed to the Korean Economic Growth?" mimeo, Brown University.
- STRAUSS, J. and THOMAS, D., 1998, "Health, Nutrition and Economic Development", *Journal of Economic Literature*, 36(2), pp. 766–817.
- WEIL, D., 2001, "Accounting for the Effect of Health on Economic Growth", mimeo, Brown University.
- WORLD BANK, 1993, World Development Report 1993: Investing in Health. Washington, D.C.
- WORLD HEALTH ORGANIZATION, 2001, Report of the Commission on Macroeconomics and Health, *Macroeconomics and Health: Investing in Health for Economic Development*. Geneva: WHO.
- WORLD HEALTH ORGANIZATION, 2002, Report of Working Group 1 of the Commission on Macroeconomics and Health, *Health, Economic Growth and Poverty Reduction*. Geneva: WHO.
- YOUNG, A., 1994, "Lessons from the East Asian NIC's: A Contrarian View", *European Economic Review*, 38, pp. 964–973.
- YOUNG, A., 1995, "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience", *Quarterly Journal of Economics*, 110, pp. 641–680.