Unhealthy People are Poor People
...and vice versa.

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First Draft, July 7th 2002
Revised September 6th, 2002

(*) Keynote address at the European Conference on Health Economics of the International Health Economics Organization, Paris, July 7th, 2002. I thank the Centre de Recerca en Economia de la Salut at Universitat Pompeu Fabra and Spain's Ministerio de Ciencia y Tecnología throught grant SEC2001-0674 for financial support.

As an economist that has devoted a substantial part of his life to do research in the field of economic growth, I think it is a great opportunity for me to address this audience of health economists because we, growth and health economists, face very similar problems and deal with very similar questions.

In the declaration of independence of the United States, Thomas Jefferson, wrote one of the most widely quoted statements in history: "*We hold these Truths to be self-evident, that all Men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the Pursuit of Happiness*". Life, Liberty and the Pursue of Happiness.

Both Health and Economic Growth are fundamental determinants of the human right to "life": Poor health obviously shortens human life, but so does economic poverty.

Both Health and Economic Growth are fundamental determinants of the human right to "liberty": unhealthy citizens do not have the freedom to move, work and make free decisions, and neither do poor citizens.

Both Health and Economic Growth are fundamental determinants of the possibility to pursue happiness: Poor health directly reduces psychological well being by generating pain and suffering. Surveys consistently show that good health is the number one desire of men and women worldwide. Material well-being is the second cause of human concern.

In sum, both Health and Economic Development are key factors when it comes to achieving the three basic human rights highlighted by Thomas Jefferson: life, liberty and the pursuit of happiness.

In this address I will try to argue that, not only health and growth are key

determinants of human welfare, but that they so interrelated that it is impossible to generate economic growth in the developing world without solving the central health problems faced by these countries, and we will not be able to improve health without generating economic growth[1]: Unhealthy People are Poor People...and vice versa.

(1) Poverty Affects Health

Poverty has adverse consequences on health through many different channels. First, and most obviously, poor people (and poor countries) do not have the material resources, the money necessary to buy health care: they cannot afford prevention before the disease appears and they cannot afford doctors and medicines once the disease has appeared. Thus, poor people are more likely to be unhealthy than rich people. The fact that poor people cannot afford medicines has important consequences as it reduces the incentives for pharmaceutical corporations to devote R&D resources to poor men's diseases as they estimate that the profits that such products would generate will turn out to be insufficient to cover the large R&D outlays. Hence, they devote most of their effort to rich man's problems such as colon cancer, baldness, obesity or…, yes, erectile dysfunction: only about 1 out of every 100 products patented by the pharmaceutical industry are related to tropical diseases (and tropical countries tend to be the poorest countries in the world). The sad result is that, before inventing a cure or a vaccine for malaria, humanity invents Viagra.

Second, poor people are more likely to be malnourished, are more likely to have an insufficient caloric and protein intake and, as a result, are more likely to be immunodeficient and vulnerable to infectious diseases. Thus, what would be a small epidemic outbreak in a relative rich town or country ends up being a large pandemic in a poor society. Third, poor people are more likely to live in massively overcrowded

areas without clean water and sanitation or in distant rural areas, also without clean water and sanitation. Hence, they have a larger propensity to have diarrhea, cholera or typhoid fever. According to the UN's children's fund, diarrhea is one of the three main causes of child mortality (the other two are malnutrition and respiratory infections).

Fourth, poor people are more likely to live far away from doctors and hospitals, making it very expensive to seek help when problems arise. Thus, poor people are more likely to go untreated and, as a result, to suffer from worse health. Last week I was watching a special on Nepal on the National Geographic channel. A woman was shown on a truck going back to her own town up in the mountains of the Himalaya Range. With tears in her eyes, she mentioned that her son had been sick for months but that she could not take him to the doctor in the city of Bhaktapur because the roads to that town had been frozen during the whole winter.

Fifth, poor people are more likely to have less education and to understand the need to seek doctors or other kinds of help. It has been widely documented that one of the key determinants of child mortality is the literacy of mothers. Educated mothers, for example, understand the need for hand washing, for the use of soap, for the need to drink of clean water. One important cause of neonatal tetanus in Sub-Saharian Africa (another important cause of child mortality in the third world) for example, is the use of rusty scissors or knives when cutting the umbilical cord. Very simple education, therefore, can prevent neonatal tetanus substantially.

Sixth, poor (and uneducated) young girls are more likely to be unable to refuse sex with rich-powerful men, which makes them vulnerable to the spread of venereal diseases or AIDS. Speaking of AIDS, what started as an "American" disease in 1981 is now mainly concentrated in the poorest continent: 75% of the world's infected by the HIV virus live in Sub-Saharian Africa, especially Southern Africa. UNAIDS 2000

reports that Botswana 35%, Swaziland 25%, Lesotho 24%, South Africa 20% and Namibia 20%. For the same countries, the fraction of HIV-positive pregnant females are 43%, 30%, 30%, 19% and 26% so millions of babies are likely to be infected at birth.

In sum, there is a variety of mechanisms that explain how poverty and economic underdevelopment cause poor health. But the causation also goes in the other direction. And we, growth economists, increasingly incorporate health into our analysis because we find that health affects economic growth in a variety of ways.

(2) Health Affects Poverty.

In one of my recent research projects[2], I investigate empirically the determinants of aggregate economic growth. Many possible factors have been proposed by economists, politicians and observers worldwide as candidates to be determinants of growth: from technology to openness, to macroeconomic stability, to the rule of law to democracy. Some of these aspects, although intuitive at first, turn out not to be robustly correlated with growth. One of the factors that seem to matter robustly is human capital. Human capital is the input associated with the human body: strength, brainpower and native ability are certainly factors that suggest a direct link between the human body and productivity. Education is also a factor that can help improve human skills and, therefore, productivity and economic growth. But the fathers of the concept of human capital, Theodore W. Schultz and Gary S. Becker, already recognized that a central component of human capital was health. The interesting empirical result is that, in fact, health is the most important component of human capital when it comes to affecting aggregate economic growth. For example, we find that life expectancy at birth to be one of the robust determinants of growth: countries

that had a larger life expectancy in the 1960s are countries that grew the fastest over the following four decades. We also find that malaria prevalence is an important (negative) determinant of growth: countries with a larger fraction of population affected by malaria tend to grow less and this is true, even after taking into account that these countries are likely to be in Africa (with all the negative growth implications that this tends to have). Thus, empirical evidence suggests that good health is an important determinant of aggregate economic growth.

What are the mechanisms that explain how poor health causes poverty and underdevelopment? We can view them by way of a simple production function:

$$Y = AF(K, hL), \qquad \textbf{Equation 1}$$

where Y is output or product, A is an efficiency parameter, *F()* is a production function, *K* is physical capital, *L* is labor and *h* is the "quality of labor" or human capital.

Effects on Human Capital

The obvious relation is that unhealthy citizens are less productive "bodies" so the same amount hours of work deliver less product. In other words, health has a direct effect on the quality of labor factor h: sick kids weigh less, are shorter, have lower brain capacity. Deficits in iron and vitamin A are found to be associated with deficits in brainpower, and all of this tends to lower future productivity and wages. An immediate implication of this is that unhealthy individuals are more likely to be poor and their incomes are more likely to experience low growth rates. This effect is compounded by shorter life expectancy: poor individuals work fewer years and,

therefore, are likely to earn even lower lifetime wages. This magnifies the existing flow differences in earnings.

This direct mechanism is important, but it is not the only one. Another channel through which health affects the productivity and growth of a family's, a society's or a nation's income is through its effects on education, which is another component of *h,* human capital. Here, too, there are various operating channels. First, sick kids tend to miss school more often so they get less education, which again, tends to make them poorer in the future. Edward Miguel and Michael Kremer's[3] recent studies of schools in Kenya report interesting effects. He randomly selected schools for treatment with deworming drugs -drugs against hookworm, roundworm, whipworm, and schistosomiasis. The results show that kids in treated schools reduced absenteeism by one quarter (with gains being especially large among the youngest children). The paper also shows untreated kids in treated schools tended to show lower absenteeism, which as thought to be an externality through social norms: absenteeism is seen as socially bad if few people miss class. To be honest, however, we have to mention that the Miguel-Kremer study fails to find any relation between deworming and academic test scores, which might be more a sign of the poor quality of education than of the small effects of health improvements on human capital.

A second effect operates through the Beckerian quality/quantity of children trade off. Parents that know that their children are very likely to die early will tend to have many kids in order to end up with some adult descendants. The problem is that the budget constraint ends up binding and the amount of resources they can devote to each child is lower so each child ends up with lower education and human capital. Parents, therefore, substitute quality of children for quantity of children.

A third effect of health on education operates through incentives: obviously, the

rate of return to education is the larger present discounted value of all future wages that an educated person gets. Low life expectancy tends to reduce the rate of return and, as a result, the incentives to educate and accumulate human capital. For example, imagine that one more year of schooling gives a 15% higher initial wage (a number aligned with the labor literature that estimates the rate of return to schooling). Imagine also that, following the endogenous growth literature, education also allows for a higher growth of wages, say 2% rather than 1%. Finally, consider a real interest rate is 1% (we need to discount future incomes). If the working life expectancy is 20 years, then the overall rate of return to one year of schooling would be 32%. That is, the present discounted value of lifetime income of a person with one more year of education would be 1.32 times that of a person with one less year. If the working life expectancy were 50 years instead, the rate of return would be 55%. Of course, if the educated person happens to enjoy a life expectancy of 50 years whereas the poor tend to have a 20 year expectancy (that is, if poverty and low life expectancy tend to be associated), then the rate of return to education is 387%.

This kind of complementarity between health and incentives to schooling exists also between different kinds of health investments. In a paper with Will Dow and Thomas Phillipson[4] argue that, since an individual cannot die twice, competing risks imply that individuals will not waste resources on causes that are not the most immediate, but will make health investments so as to equalize cause-specific mortality. Analyzing data from one of the most important public health programs ever introduced, the Expanded Program on Immunization (EPI) of the United Nations in Malawi, Tanzania, Zambia, and Zimbabwe, we find evidence for the existence of such complementarities, involving causes that are not biomedically, but behaviorally, linked. In particular, we find that if the tetanus vaccine simply avoided death, then it

should decrease mortality by 1%. However, we estimate declines significantly larger. We also estimate larger birthweights and lower mortality rates six months down the road, phenomena for which there is no direct medical pathway. Our conclusion is that when mothers observe lower probability of infant death due to neonatal tetanus vaccination, their reaction is a superior investment in other kinds of health. This is the same kind of incentive that I mentioned for education.

Finally, health has effects on the education of children through the death of parents. It is no secret that parental (and especially maternal) guidance is an important input in the process of education. But it is calculated that the recent AIDS pandemic has left more than 14 million orphans in Africa alone. This children have to wonder around without the guidance and without the financial protection and moral support supplied by parents. Notice that these kids live in countries with very weak governments and without welfare state. Among their feasible alternatives (which include child prostitution and enrollment as soldiers in some absurd war), work is the most attractive. Of course, for these kids, schooling is out of the question.

Effects on Physical Capital

The second set of channels through which health affects output, income, productivity and, ultimately, growth operates through the accumulation of physical capital, K. Citizens who expect to live long after retirement tend to have strong incentives to save and invest (this is what we call "life cycle savings" as opposed to "precautionary savings"). If life expectancy happens to be close to 60 years of age, people do not expect to live many years in retirement and, as a result, their incentives to save are greatly reduced. Thus, through its adverse effect on life expectancy, poor health will tend to reduce national savings and investment.

A second effect on physical capital comes from the complementarities across inputs. If human capital is complementary to physical capital, then there is little incentive to invest in physical capital when human capital is low. In other words, firms do not want to invest in countries where the labor force is unhealthy, uneducated, or untrained (and we have already argued that unhealthy citizens will tend to have less education and training.) For example, multinational corporations are pulling out of Botswana, even though this has been one of the most successful countries in Africa over the last four decades. The reason? The spread of AIDS. Firms find that they now need to train two workers for every position because it is very likely that one of the workers will become infected and firms cannot afford not to have a trained person in every position. This, of course, increases the training costs substantially and reduces profitability. The result is that firms find it unprofitable to remain in Botswana so they decide to leave. Absenteeism related to AIDS is also reaching unbearable proportions for other reasons, one of them being "funeral attendance". The problem has become so large that many firms have been force to disallow workers to attend funerals of people who are not direct relatives because this kind of absenteeism was becoming extraordinarily expensive.

The effect of health on physical capital can also be found through public investment: governments of countries with widespread epidemics see their budgets so stressed by health outlays that they have to stop investing in physical infrastructures. Public capital slowly deteriorates and this reduces the rate of return of complamentary private physical capital (the rate of return to a truck depends on the quality of the road). This in turn, lowers the incentives to invest in both human and physical capital.

A third channel is found in what can very well be called a “poverty trap” caused by some initial illness. When I was working in Bolivia, I met woman named Patricia,

who had once been the wife of a middle class landowner from Cochabamba. The couple had four young children who attended a good private school. The second child was especially bright and loved math and natural sciences. His parents had great hopes of him once becoming an engineer. Everything seemed to go well with the family until, all of a sudden, the husband fell ill. He turned out to have some strange form of cancer, which, according to Patricia, required very expensive treatment. To pay for it, they had to sell all their land and properties. After two years of expensive treatment, he died, leaving Patricia and their children with no assets, no land, and no money. They moved to La Paz (where I met her) and she unsuccessfully tried to find a job as a housemaid. As she failed to find enough money to eat, her four kids left school and now wonder around La Paz as shoe-shiners, earning a couple of dollars a day, barely get enough to eat. A man's unfortunate illness turned a middle-class Bolivian family into an unhappy group living under extreme poverty. It turned a bright kid with great hopes of becoming an engineer into a hopeless uneducated boy with a dark and gloomy future. The financial stress that illnesses cause on poor or even middle income families can have disastrous consequences that spilled over to the next generation. And the worst is that the next member of the family to become ill will have to go untreated because now they really have no money.

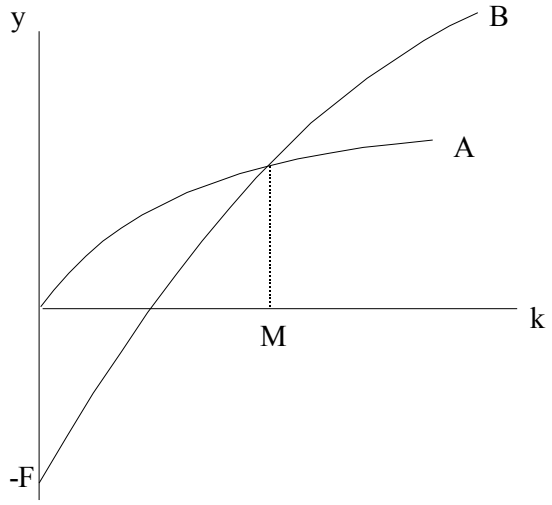
The terrifying experience of this Bolivian family is not rare in the developing world: the cost of curing an illness is some times so large that its financial consequences are felt by the family long after the illness is gone. Patricia was especially unlucky because her husband eventually died. But even if Gonzalo had beaten cancer, the family would have fallen into poverty because they would have lost all assets and would even be deeply indebted to some heartless usurer charging them interest of 50% or higher.

Effects on Aggregate Efficiency

Finally, health has a direct on efficiency, the term that I labeled *A* in the production function above. One example of this effect can be found in Ethiopia, where there are many wealthy regions irrigated by lakes. People can choose to live in these fertile areas but there is a problem: mosquitoes. Mosquitoes tend to live near lakes and, in a tropical weather such as Ethiopia's this often means malaria. The alternative is to move to a drier and less fertile land where there are no mosquitoes and there is no malaria, but where productivity is much lower. It can be shown that this choice also tends to lead to another kind of poverty trap. The consequences of this can be analyzed with a very simple economic growth model. Imagine that a nation has access to two production functions. One is depicted in equation 1, where the productivity level, *A*, is very low. The other production function is given by

$$Y = BK \,, \qquad \textbf{Equation 2}$$

where $B>A$. The problem is that, in order to use the productive production function, a fixed cost has to be paid (this could be identified with the eradication of malaria, for example) In per capita terms, these two production functions look like



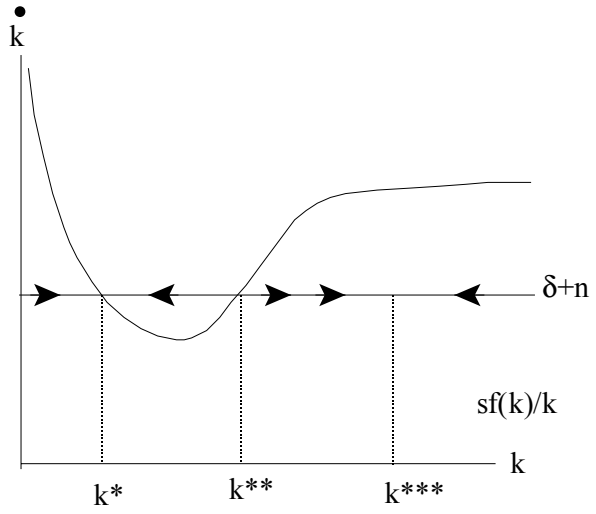
The effective production function will be given by the outer envelope. That is, economies with less capital than M will choose the production function B whereas economies with more than M will choose A.

The fundamental equation of Solow-Swan, which describes the growth rate of capital for economies with constant savings rates is

$$\gamma = sf(k)/k - (\partial + n), \qquad \text{Equation 3}$$

where s is the savings rate, n is the population growth rate and δ is the depreciation rate. The second term in Equation (3) is not a function of *k* so it can be depicted as a horizontal line. The first term is the constant savings rate times the average product of capital. This average product first declines, then increases and finally stays horizontal, as depicted in Figure 2. The growth rate is the vertical distance between the two lines. Notice that ALL economies to the left of *k*** will end up with a capital stock equal to *k** , stagnated forever with zero growth. All economies to the right of *k*** will end up with perpetual growth. The level of capital *k** is known as a *poverty trap*: poor

countries do not have enough initial wealth prefer to use the "bad technology" because they cannot afford to pay the fixed cost. This leaves them with a small productivity, small output and small ability to grow. They end up not generating enough saving and investment to escape the trap.



This little model shows that health problems that lead to the choice of the unproductive production function can end up condemning the country to a poverty trap. In a recent paper, Acemoglu, Johnson and Robinson (2002)[5] even argue that this phenomenon not only leads to a bad choice of production functions but that it once led to the wrong choice of institutions by colonial powers, a choice that is still suffered by today's poor countries. Indeed, they argue that when colonial powers found that the land they were about to colonize was inhospitable (which is measured today by high mortality rates by priests and military posts), they chose to set up extractive institutions, institutions that were inherited by the independent countries once the colonial powers left. On the other hand, they chose to set up wealth creating institutions (with rule of law, property rights, etc) wherever they found the land to be

hospitable enough so that some of its citizens were willing to move there.

Finally, another effect of health on efficiency can appear through social unrest. Empirical evidence suggests that Health inequality leads to less social cohesion and probability of revolution, state collapse and widespread poverty. Also, infant mortality is highly correlated with the probability of social instability.

(3) Solutions

The fact that health and economic development are so closely related and mutually "caused" suggests that we cannot solve one problem without simultaneously solving the other. If the mutual causality between health and education incentives is true, introducing a good education system will not have any effect unless we increase health and life expectancy because kids will have no incentives to attend school. And the reverse is also true: solving a particular problem health will not help much if the people who receive the intervention remain under the poverty thresholds, because this will keep the chances of them becoming ill with some other disease. Hence, our actions need to simultaneously attack the problems of poor health and poor economic conditions. How?

(a) To Promote Health

To promote health, we need to work on two main fronts: micro actions and macro actions. At the microeconomic level, we need widespread vaccination programs (we have eradicated smallpox, nearly eradicated polio and making progress in measles; we need to continue in this direction), we need to invest in hospitals, doctors and general care. We also need to keep making progress in making clean water and sanitation more widely available.

At the macroeconomic front, we need to provide the incentives to invest in pharmaceutical R&D. In this we confront the usual time-inconsistency dilemma. On one hand, we need to guarantee intellectual property rights to inventors in order to induce them to spend good money in research. The patent system that we have has worked well and we need to keep it, and its main engine is the profits that pharmaceutical firms expect to get from their research and development investments. On the other hand, we need to provide the pills, vaccines and drugs that have already been invented to the poor at affordable prices. Notice that these two goals appear to be mutually exclusive and self destructive: if we sell the drugs at marginal costs, there will be no profits and, therefore, no research. If we sell at monopoly prices, poor citizens will not be able to afford the drugs. We need to find ways to make the two goals compatible. And the kind of intellectual expropriation that occurred in the 2001 South Africa vs. Pharmaceutical firms episode is not the solution. At least not for AIDS. The reason is that the antirretroviral pills that were "expropriated" are not the final cure for AIDS. In fact, it is possible that their effectiveness is limited in time as the virus mutates. Thus, we need to rely on the pharmaceutical firms to invent the vaccine that will end up being the final solution. And expropriating the current formulae does not seem to be the best way to induce them to invest obscene amounts of dollars in the project. We, therefore, need to come up with solutions that both guarantee property rights and profits for researchers and low prices for poor consumers. One proposal on the table involves dual pricing (marginal cost in poor countries and monopoly-patent pricing in rich countries). In general, dual pricing is very dangerous because they will induce widespread black markets. I am more inclined to support Michael Kremer's[6] idea of an R&D fund financed by rich countries, a fund that will be used to purchase vaccines at monopoly prices from

whoever pharmaceutical firm that happens to invent a useful vaccine.

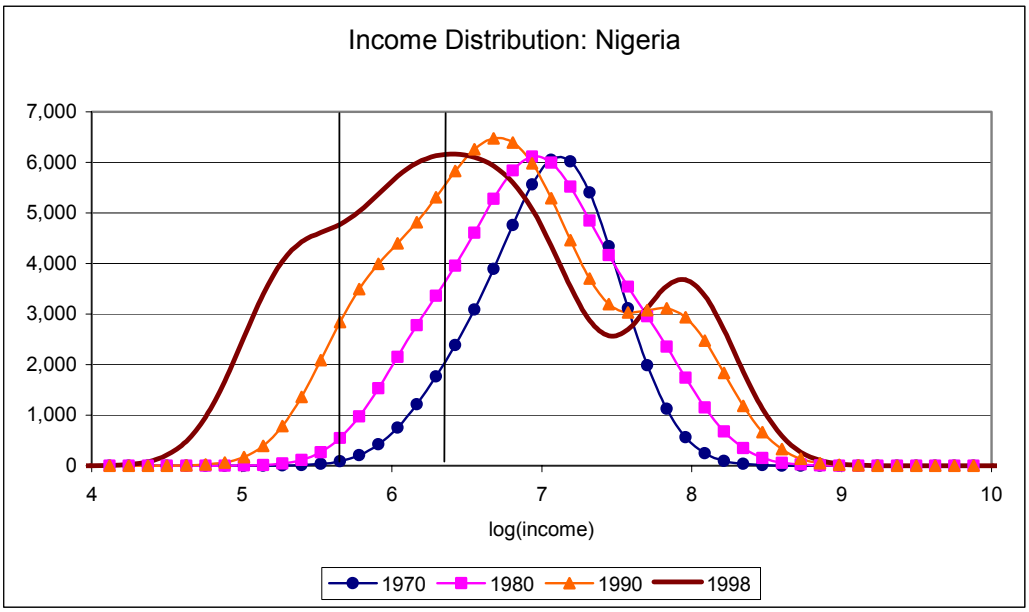
(a) Promoting Growth and Poverty Reduction.

Many things need to be done in this area. It is important that poor countries set up the "right" institutions that promote a reasonable economic environment, with guaranteed property rights, justice, and peace. Their governments need to be less corrupt, more transparent and more accountable. We need to invest in education and we need to create the environment where individuals have the incentives to get educated (that is, where they get a good return for their schooling). We need to promote free markets all over the world, especially in Europe and the United States, where agricultural protectionism is one of the leading causes of poverty in the third world. We need to keep promoting foreign direct investment, which is the ultimate source of technological diffusion. And all of this, needs to be done by keeping in mind that poverty reduction is crucial: if the poor do not participate of the process of welfare improvement, all programs are likely to collapse.

Obviously, some of this process will require international help from rich countries (reduction of protectionist policies, money for the vaccine research fund, etc). Some of this effort needs to be better directed than in the past, and we need to look at the perverse incentives that we create with the international help. For example, recent proposals for debt reduction and debt forgiveness for countries that have low investment in health only induces reductions on health investment on the part of poor and highly indebted economies.

But most of the effort will have to be undertaken by the political and economic leaders of the poor countries themselves. In this regard, I should finish this address expressing some doubts on the desire that the political elites of the poor countries. If

we look at the evolution of the distribution of income of African countries we will see something very surprising: whereas the poor are becoming poorer, the rich are becoming richer. Figure 3, for example, shows the evolution of the distribution of income in Nigeria between 1970 and 1998.



The problem is that the decisions need to be made by the political and economic elites. And as, you know from the experience of smokers, the doctor can tell you that you need to quit smoking. The government may finance programs for you to quit smoking. But at the end of the day, if you don't want to quit, you will be unable to quit smoking. Similarly, (and forgive me this one last parallelism between health and economic development), if the leaders of poor countries do not want to introduce reforms, reforms will never be introduced.

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Footnotes.

[1] See also Sachs (2002).
[2] See Sala-i-Martin, Doppelhofer, and Miller (2002).
[3] Kremer and Miguel (2001).
[4] Dow, Phillipson and Sala-i-Martin (1999).
[5] See also Easterly and Levine (2002)
[6] See Kremer (1999)