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HEALTH IN AN AGE OF GLOBALIZATION

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ABSTRACT

Disease has traveled with goods and people since the earliest times. Armed globalization spread disease, to the extent of eliminating entire populations. The geography of disease shaped patterns of colonization and industrialization throughout the now poor world. Many see related threats to public health from current globalization. Multilateral and bilateral trade agreements do not always adequately represent the interests of poor countries, the General Agreement on Trade in Services may restrict the freedom of signatories to shape their own health delivery systems, and it remains unclear whether current arrangements for intellectual property rights are in the interests of citizens of poor countries with HIV/AIDS. However, to the extent that globalization promotes economic growth, population health may benefit, and there has been substantial reductions in poverty and in international inequalities in life-expectancy over the last 50 years. Although there is a strong inverse relationship between the poverty and life-expectancy in levels, gains in life expectancy have been only weakly correlated with growth rates and, in the last decade, the HIV/AIDS epidemic has widened international inequalities in life expectancy. The rapid transmission of health knowledge and therapies from one rich country to another has led to a swift convergence of adult mortality rates among the rich of the world, particularly men. Globalization would do much for global health if transmission from rich to poor countries could be accelerated.

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0. Introduction

When economists write about globalization, they focus on the movement of goods, people, information, and ideas, and they look at the effects on economic growth, poverty and inequality. Health is not a primary focus of their attention. By contrast, much of the literature in public health sees globalization as a threat to international health. On the relatively few occasions where economists have addressed health, they focus on the indirect effects, arguing that the economic benefits of globalization are good for health—because poverty is the major determinant of health in poor countries—and that, if there are unwelcome side-effects on health, they can best be dealt with by suitable public health measures, not by policies that slow the globalization process. Both sides of this (mostly non-) argument have substance, and one aim of this paper is to present some of the arguments from the public health literature as seen through the eyes of at least one economist. There is also much to be learned from looking at previous episodes of globalization, and at the history of trade and health, and it is with this that I begin.

If it is true that income is the primary determinant of health, at least in poor countries, then the consequences of globalization for public health depend on its well-researched (although still disputed) consequences for economic growth, particularly for the poorest countries. Although the income to health mechanism is undoubtedly present—everything is easier with money, and some improvements are impossible without it—I argue that the transmission of health related knowledge is ultimately more important. Social forces, including not only income, but also education and politics, are central because they govern they way in which new knowledge is transformed into population health. The health and life-expectancy of the vast majority of mankind, whether they live in rich countries or poor countries, depends on ideas, techniques, and

therapies developed elsewhere, so that it is the spread of knowledge that is the fundamental determinant of population health. The trade-borne transmission of infectious disease has been the focus of international health authorities since seventeenth century Italy and remains important today. But, at least since the middle of the last century, a more important influence has been the international transmission of ideas, techniques, and technologies. It is plausible that the recent acceleration of the pace of globalization has been accompanied by faster transmission of health in rich countries, although it is probably too soon to be sure. But the current lack of treatment of HIV/AIDS in subSaharan Africa, as well as the annual deaths of 10.5 million children in poor countries that would not have taken place had they been born in rich countries, are major failures of globalization to date.

1. Health and globalization in history

Disease has been an unwelcome companion of trade at least since the plague of Athens in 430 BC killed perhaps as much as one third of the population. The black rats, which carried bubonic and pneumonic plague to Europe in 1347, were most likely carried by trading ships. More than three hundred years later, the city states of northern Italy developed the first systems of national and international public health in their attempts to control recurrent episodes of the disease, Carlo Cippola (1981, 1992). Merchants wanted quarantine restrictions to be internationally coordinated in order to minimize the disruption to their business, yet even at this early date, health concerns tended to run second to the needs of trade. In 1630–31, when Pistoia (near Florence) had locked its gates to quarantine itself against the encroaching plague, and had expelled all foreigners, mountebanks, and Jews, the city was temporarily opened up to all comers to facilitate the export

of its wine, Cipolla (1981, pp53–4.). And in the trade and health dispute between Florence and Genoa in 1652, quarantines were used to favor domestic over foreign traders as much as to protect public health. At the same time, the fundamentally mistaken notions of the how the plague was spread, particularly the overstatement of the risks of person to person contagion, and the lack of understanding of the role of rats and fleas, led to the imposition of quarantines that did little to hamper the spread of the plague but which sometimes destroyed the livelihood of a trade-dependent city, as in Verona in 1575, Cipolla (1992, p. 78). This story of policy-making in the face of a mistaken understanding and of bitterly contested quarantines was to be repeated into the 20th Century, see for example Margaret Humphreys on yellow fever in the southern US in the late 19th century.

The Pan-American Sanitary Bureau (now PAHO) was founded in 1902, and was the first of the international public health agencies. Like the public health magistrates in seventeenth century Italy, the original function was to deal with merchants' dissatisfaction with the lack of international coordination of health measures. Fifty years earlier, in 1851, the first international sanitary conference was held in Europe, as the rising volume of international trade, driven by reductions in costs from better ships and railways, came into conflict with national health measures. Not only had national quarantine measures failed to halt the spread of cholera during the epidemics of the first half of the century, but the measures were costly to merchants who sought international co-ordination, David Fidler (2001). But these concerns did not lead to international health control until the setting up of the World Health Organization in 1948. International public health has always been as much concerned with facilitating trade as with protecting health and, as many writers have noted, when the two come into conflict, as with

Pistoia's wine in 1630, or in the dispute between Florence and Genoa in 1652, trade tends to trump health. In perhaps the most extreme example, Britain went to war with China in 1839–42 to open Chinese markets to the import of British opium from India.

Disease followed the movement of people as well as of goods. The decimation and even eradication of the peoples of central America and Oceania by European germs are well-known, Jared Diamond (1997). In the slave trade between west Africa and the Americas around a sixth of the victims died during the middle passage, and enough bodies were thrown overboard for sharks to learn to follow the ships, Encyclopedia Brittanica (2004). Daron Acemoglu, Simon Johnson and James Robinson (2001, 2002) argue that patterns of colonization were shaped by the mortality of white imperialists, so that in places where it was unhealthy for colonists to settle, the imperial powers set up extractive (plantation and mining) regimes for whom the health of the native population was of little direct concern. These regimes permanently compromised the development prospects of the countries which were affected. The Bengal famine of 1770, in which a third of the population died, did not inspire the East India company to suspend its tax collection, and Emma Rothschild has argued that this example was very much in the minds of American colonists in the years leading up to the revolution; taxation without representation was a recipe for impoverishment and famine.

Quarantine is used to control the movement of people, as well as of goods. And as was the case for goods, health policy for immigrants and travelers is always affected by other factors. The National Institutes of Health in the United States was set up to research yellow fever and cholera after the first Federal Quarantine Act of 1878. Only federal (or international) agencies can hope to solve the coordination and verification problems that arise when local (or national) authorities

have unfettered authority to restrict the movement of goods and people. The US Immigration Act of 1891 excluded those with "loathsome and contagious diseases," but through a process of labeling immigrants and ethnic groups as inherently diseased, the quarantine measures became methods of discrimination and exclusion, even in the absence of threats to public health, Howard Markel and Alexandra Stern (2002). While it makes obvious sense for a harbor master to refuse admission to a ship signaling the cholera on board by flying the yellow jack, it is much less clear that US immigration policies that preclude the entry of those with specified diseases (trachoma a century ago, AIDS, TB, and syphilis now) has had any positive effect on public health. Indeed, the US Congress, led by Senator Jesse Helms, made AIDS an excludable disease for immigrants in 1987 against the opposition of the then Secretary of Health and Human Services. Once again, the public health was subservient to domestic political needs.

2. Globalization and health: arguments from economics and public health

Although several economists have addressed the health consequences of globalization, health is most notable by its absence from even critical discussions of globalizations in the economics literature. Michael Bordo, Alan Taylor, and Jeffrey Williamson's (2003) edited volume on the history of globalization has no chapter on health, nor does health appear in the index, an absence shared by the terms "colonialism" and "slavery," as noted by Branco Milanovic (2003). The recent (2004) report of the World Commission on the Social Dimensions of Globalization, whose membership included globalization critic Joseph Stiglitz, gives only cursory mention to international health, confining its references to HIV/AIDS and TRIPS (trade-related aspects of intellectual property rights). Health is evidently not one of the discontents of globalization. The

World Bank's 2002 flagship publication on globalization, *Globalization, growth and poverty*, written by Paul Collier and David Dollar, lists good health and good healthcare provision, along with education, as essential preconditions for successful globalization, a view that is shared by many of those who are more critical of globalization, such as Andrea Cornia (2001). Indeed, since the conditions are not met in much of the world, including most of Africa, this argument is consistent with the critics' view that globalization is often harmful to health in the poorest countries of the world.

For economists who are broadly in favor of globalization, the story about health runs something as follows. Stanley Fischer (2003) notes that much of the current disagreement is *factual*, whether or not human wellbeing has improved over the past two or three decades. And as he points out, both life expectancy and child mortality have improved dramatically since 1970, with the notable exceptions, particularly after 1990, of subSaharan Africa, and to a somewhat lesser extent, the countries of the former Soviet Union and Eastern Europe. That globalization might have had something to do with these improvements comes from the idea that higher incomes promote better health. In the 1980s and 1990s, there was a broad increase in world incomes, and a reduction in poverty, both as a fraction of the world's population, and in absolute numbers. What happened to income inequality is disputed, but the most favorable view, associated with David Dollar and Aart Kraay (2001), is that there was no relationship between growth and changes in income inequality so that, on average over countries, the growth in incomes of the poor was the same as growth at the mean, so that growth was a powerful engine of poverty reduction. Although this argument has many problems—the data on inequality are not very good, GDP growth may be overstated and many of the items that are growing more rapidly

neither reach the poor nor are covered in the inequality statistics, Angus Deaton (2004)—there is little doubt that there has been real poverty reduction in the world as a whole. The link between income and health in poor countries is typically thought to be strong, Samuel Preston (1975, 1980), Lawrence Summers and Lant Pritchett (1998), so that it is entirely plausible that globalization-induced poverty reduction has improved population health.

Even the strongest defenders of globalization note qualifications. Cheaper and faster travel enhances the dangers of the spread of infectious diseases. When travel was by sea, most infectious diseases would pass through the incubation period during the voyage and the ship could be prevented from landing. But a traveler could go six times round the world during the incubation period of SARS, Sir George Alleyne (2004). The spread of HIV/AIDS was certainly accelerated by the ease and volume of modern travel. Yet it is surely not the case that reversing or slowing globalization, even if it were possible, is the appropriate policy response, Dollar (2001). Indeed it can been argued that the same speeding up of communications makes the response to the disease faster and more effective, see in particular the WHO's description of its response to SARS, WHO (2004). Dollar also notes that the international architecture, particularly the WTO and TRIPS agreements, needs to be set up in a way that ensures that the health of the poor is not threatened, for example by undermining occupational or environmental health.

The literature in the health sciences takes a more negative view of globalization. Some of the difference is that non-economists take a broad definition of globalization, encompassing not only the international transfer of goods, information, and ideas, but also such policies as privatization, user fees, and structural adjustment programs. In much of this literature, globalization is seen, not as a voluntary expansion of exchange, but as the forced adoption of American models of social

and economic arrangements. Even when such models would not be freely chosen, developing countries have little choice in the matter because they have little effective power in the international organizations, such as the World Bank, the IMF, and the World Trade Organization, which are dominated by western, and particularly American interests. Poor countries lack both the financial and human resources that would allow them to be equal participants in the international bodies in which decisions are taken that affect them and, beyond that, in setting the rules under which the international system operates. Globalization is seen as completing the unfinished business of colonization, Ronald Labonte (2003).

One particular source of (widely shared) concern is the 1995 General Agreement on Trade in Services (GATS), whose (not very clearly defined) provisions can be read as requiring governments to open national health services to international commercial suppliers of health services and health insurance; indeed, only "service provided in the exercise of government authority" are clearly excluded, not those supplied "on a commercial basis, nor in competition with one or more service suppliers," Aaditya Mattoo (2003). Such provisions may limit the ability of governments to design and operate their own health systems, and are seen by many as a threat to public health. Privatization of health services, even if incomes are growing rapidly (and perhaps *especially* if income are growing rapidly), is seen as a threat to the health of the poor, who are typically served (if at all) by public provision. That there are grounds for such concern is illustrated by the much slower improvement in population health in China that accompanied the rapid economic growth after the reforms, Jean Drèze and Amartya Sen (2002, Chapter 4.) The assessment of the GATS by Leah Belsky et al (2004) suggests that the worst fears may be exaggerated, but the authors acknowledge that there is a great deal of uncertainty about how the

agreement will operate. There are also concerns about *bilateral* trade agreements, particularly between the US and other countries, in which the interests of the US pharmaceutical companies are strongly represented. Press reports indicate that countries, in exchange for access to American markets, are pressed to impose high local prices for drugs, threatening the health of their own citizens, as well as to restrict re-exportation of drugs to the US, threatening the health of Americans.

The multinational (especially American) pharmaceutical industry is under attack by the opponents of globalization for putting profits ahead of lives. Defenders accuse their critics of wilfully misunderstanding the trade-offs involved between funding research and selling drugs, although it is not always clear how much of the basic research was funded by the companies as opposed to US taxpayers through NIH. US trade policy is seen as serving corporate interests, particularly those of the pharmaceutical industry. One acrimonious debate has been over the $15 billion promised by the Bush administration for fighting AIDS, and whether these funds may be spent on the cheaper (and likely more effective) anti-retroviral drugs manufactured in India. Even so, it is far from clear that the unavailability of patented drugs is the main barrier to population health in poor countries, many of whom have weak health delivery systems that already fail to deliver many essential drugs that are not under patent. Other multinational corporations, particularly in tobacco and food, are also seen as a threat to public health. Smoking began as a luxury for the rich in rich countries, but as the health risks became apparent, it became a habit of the poor in rich countries. Even that is now under threat, as public health legislation, law suits, and taxation make it more and more difficult to sell tobacco in the west. Consumers in poor countries may be the next safe haven for tobacco, and while WTO rules allow governments to

control tobacco sales, provided they do not discriminate between domestic and foreign brands, some countries worry that their ability to regulate is no match for well-funded international corporations. Food companies are also seen as a threat, and the WHO and other health writers emphasize the growing "epidemic" of obesity in poor countries, noting that Africa is now the only continent in which the majority of deaths are from infectious diseases, rather from heart disease and cancer, World Health Report (2004). Of course, the rise in non-communicable disease is in large part the result of reductions in infectious disease child mortality, both of which are entirely positive developments. And some of the increase in obesity comes from the fact that fewer people in poor countries now engage in manual labor; and even in the US, there is far from general agreement on the causes of recent increases in obesity, and what role, if any, has been played by fast food companies, see for example David Cutler, Edward Glaeser, and Jesse Shapiro (2003.)

Anti-globalizers also challenge the economists on their own ground. They question whether globalization has promoted economic growth in general, and argue that it has widened income inequalities, both within countries, and between them. Contrary to the standard economic model in which more open trade reduces the return to labor in the labor-scarce north, while increasing it in the labor-rich south, thus narrowing the difference between them, they argue that globalization has benefitted the rich and hurt the poor in both the north and the south, while leaving behind (or making worse off) whole countries that are unable to participate in globalization, because they lack geographical access, or an educated and healthy population. Such arguments receive some support from a recent economic literature that investigates trade in intermediate goods, or outsourcing, which replaces high cost but relatively low-skill western workers with highly-

trained but much cheaper workers in developing countries, particularly India, Robert Feenstra and Gordon Hanson (2001), Susan Zhu and Daniel Trefler (2001). It is argued that increases in income inequality undermine social cohesion, and are bad for population health, not just for those who lose out, but also for everyone who lives in a less equal society, Richard Wilkinson (1996, 2002), Ichiro Kawachi, Wilkinson, and Bruce Kennedy (1999). The critics note that, overall, health in the south has not improved as rapidly in the 90s as it did in the 80s; for example, infant mortality rates in India fell by 30 percent in the 1980s but only by 12.5 percent in the 1990s, Deaton and Drèze (2002), and indeed the rate of decline in child mortality in the 1990s was lower than in the 1980s in all of the WHO's regions except the Western Pacific, Omar Ahmad, Alan Lopez, and Mie Inoue (2000).

That the income distribution has widened between countries is correct, and many countries have indeed seen widening domestic income inequality. Yet it is also true that, because the economies of India and China have grown so rapidly in the 90s, income distribution among the citizens of the world has become more equal. In any case, there is no evidence that income inequality by itself is a risk to population health, Deaton (2003); the early (and immensely influential) cross-country correlations between life-expectancy and income inequality, Wilkinson (1992), were driven by flawed measures of inequality and cannot be reproduced with credible data.

3. Life-expectancy, incomes, and the gifts of globalization

The starting point for any discussion about incomes, health, and knowledge, is Samuel Preston's (1975) investigation into the changing relationship between life-expectancy and GDP. The

millennium version of the Preston curve is shown in Figure 1, which plots country life-expectancy (using circles whose size is proportional to population) against per capita GDP in purchasing power parity dollars. The curve is a non-parametrically fitted regression function, weighted by population. For the current argument, the main feature of this curve is that the slope of life-expectancy with respect to income is steep among the poorest countries. While no one would argue that the slope of a regression function is the same as the effect of income on life-expectancy, many writers have found it plausible that, at low incomes, income itself is an important (perhaps the most important) determinant of health. Preston himself argued that technical change in private and public health knowledge was more important overall (or about equally important, Preston, 1980) than changes in income, but noted that the poorest countries had benefitted little from new knowledge, presumably because the implementation and adoption of even inexpensive techniques cannot be done without money. Adequate nutrition is also an important determinant of health in poor countries, and the link between income, food, and nutrition is a direct and obvious one. The same can be said for the construction of clean-water supplies and for waste disposal. Such arguments are central to the economists' case that globalization is *indirectly* good for health, at least in those countries where globalization has increased per capita income.

Figure 2 shows the changes on changes version of Figure 1, plotting changes in life-expectancy from 1960 to 2000 against the corresponding average annual rate of growth of GDP in real PPP dollars. The relationship here is much weaker and the positive slope depends almost entirely on China (an unweighted regression has an insignificant slope that is only one fifth of the size), whose increase in life-expectancy since 1960 reflects not only genuine new progress, but

also that 1960 was a year of crisis mortality during the "Great Leap Forward." Between 1970 and 2000, when life-expectancy in China increased, not by 34 years, but by 8.5 years, the worldwide correlation between the growth rate of GDP and the change in life-expectancy is only 0.18, and the population weighted regression corresponding to Figure 2 has a slope of 0.2 with a *t*-value of only 1.9. Both the slope and its significance increase somewhat among the initially poorest countries; for the 26 (58) countries whose logarithm of real per capita GDP in 1970 was less than 7 (8), the slope is 0.49 (0.32), with a *t*-values of 2.1 (2.2). The connection between income and life-expectancy at low incomes may be plausible but, even among the initially poorest countries, differences in income growth explain less than a sixth of the variance in improvements in life-expectancy, and even an increase in the 30-year growth rate by 2 percent a year would add only 1 year to life-expectancy. Even if it were accepted that globalization increases growth rates under suitable conditions, then this is a weak channel through which globalization might improve health. Of course, the argument works the other way too. If globalization has indeed impoverished some countries, the effect on their population health has also likely been modest.

The weak relationship between growth and gains in life-expectancy calls for discussion. It simply defies belief that the low levels of life-expectancy on the left of the Preston curve in Figure 1 have *nothing* to do with poverty. In which case we would expect those countries that have done the most to eliminate poverty over the last forty years to be those showing the greatest gains in life-expectancy. Among many economists, including those who believe in the indirect health benefits of globalization, that this relationship holds is taken as proven fact, and the citation most frequently given is Pritchett and Summers' aptly-titled paper "Wealthier is healthier." Yet Pritchett and Summers, although they use a different selection of data and a

shorter time period, find exactly the same result as here, that changes in life-expectancy are insignificantly related to changes in real income. The finding of their title comes from the relationship between income and infant (or child mortality) not life expectancy. As they point out, estimates of life-expectancy for a good number of countries are derived from measures of infant and child mortality (though this is less so now, given the importance of HIV/AIDS), which makes it surprising that the relationships with income would be so different. The tracking down of these discrepancies is an important task, but is beyond the scope of this paper.

The literature on mortality decline in poor countries provides many clues towards resolving the conflict between the strong effects of income in Figure 1, and the weak or absent effects in Figure 2. While income makes many things possible in the long run, the more important proximate determinants of mortality decline are clean water, health systems, a demand for adequate and adequately operated health systems, and basic sanitary knowledge. The provision of the last two has much to do with education, particularly the education of women, and all seem to depend on active participation in health matters of people and, see in particular Jack Caldwell (1978, 1981) and Drèze and Sen (2002). To this "integrated" route to mortality decline, many would add the "vertical" and externally-driven (by WHO and other international agencies) disease eradication campaigns against malaria, smallpox, river blindness, and polio, as well as the later campaigns for immunization, breast-feeding, growth monitoring, and oral-rehydration therapy. All of these routes to mortality decline have been effective, and sometimes have been so in the absence of economic growth. In some cases, as in China after the economic reforms, growth may actually hinder progress, at least for a time. Yet it is hard to imagine many of these programs being sustained in the long-run in the absence of growth if only because education and

health are themselves the foundations of higher incomes in the future. Indeed, Drèze and Sen argue that it is unlikely that post-reform growth in China could have taken place without the health and literacy achievements that provided it. More broadly, the WHO's (2001) Commission on Macroeconomics and Health has recently emphasized the economic benefits that are to be expected from improvements in health. While the statistical analysis to support this picture largely remains to be done, it is consistent with both Figures 1 and 2.

I now turn to the distributions of growth and increases in life-expectancy over countries. The first panel of Table 1 shows the changes in life expectancy by decade, starting in 1960. Even if we exclude China between 1960 and 1970, the rate of improvement of life-expectancy was declining throughout the period. To some extent, this is a consequence of the population health reversals during the last decade in subSaharan Africa and in Eastern Europe and the countries of the former Soviet Union. But life-expectancy rose less rapidly in the 1990s than in the 1980s, even though per capita growth rates were typically higher. In poor countries not affected by HIV/AIDS, this slowdown comes from a virtually worldwide reduction in the rate of decline in child mortality rates.

The second panel presents the data on growth rates of GDP. World growth rates were higher in the 1990s than in the 1980s, a result that is driven by Asia, by the Middle East and North Africa, and by Latin America, which partially recovered from negative growth in the 1980s. Notable exceptions to the pattern are subSaharan Africa and Eastern Europe. One simple way of looking at both health and income together is to multiply income per capita by the number of years which a newborn can expect to receive it, and growth rates of this product are presented in the final panel. The behavior of this more comprehensive measure is similar to that of real

income. SubSaharan Africa does much better in the 1960s and 1970s, because there were substantial reductions in child mortality in spite of weak or non-existent economic growth, and much worse in the 1980s and 1990s, because of HIV/AIDS. In Asia, strong economic growth has been accompanied by substantial reductions in mortality and the growth of the compound measure has been consistently high.

The relationship between income and health is further explored in Figures 3 and 4. As is often the case with international comparisons, results depend on whether countries are treated as single points, with each country treated as a unit, as is appropriate when we are looking at the effects of policies of which there is one per country, or whether countries are weighted by population, as is required for welfare calculations where we care about people, not countries. Figure 3 shows that the improvement in life-expectancy between 1970 and 2000 was greater for people living in countries with lower GDP in 1960, the weighted line, but was lower for countries with lower GDP in 1960, the unweighted line. In Figure 4, we see that for both countries and people, the gain in life-expectancy from 1970 to 2000 was greater for those whose life-expectancy was lower in 1960. The countries in the bottom left of both figures which show a *fall* in life-expectancy are mostly in subSaharan Africa, and without them and the effects of HIV/AIDS, both relationships would have been stronger. I have drawn these graphs with 1960 on the *x*-axis, in order to avoid a spurious negative slope from measurement error (or white noise) in life-expectancy estimates. Another way to do the same thing is to regress the change in life expectancy from 1970 to 2000 on life-expectancy in 1970, using life expectancy in 1960 as an instrument. It is also possible to look at the joint effect of base ln(GDP) and life-expectancy simultaneously, but both become individually (although not jointly) significant. The data cannot

support estimates of their separate effects.

That the least healthy countries have seen the largest increases in life-expectancy does not necessarily imply that international inequality in life-expectancy is decreasing. However, Table 2 shows that inequality has in fact fallen. Between 1960 and 2000, when the population weighted average of life-expectancy at birth rose from 49 (heavily affected by China) to 67, the standard deviation of life-expectancy across countries fell from 12.8 to 11.1 years in 1990, rising to 12.0 in 2000 in consequence of HIV/AIDS in Africa. Across people, the decline in inequality is even more dramatic, from 12.9 to 8.1 in 1990, rising only to 8.7 years in 2000. Both sets of numbers ignore the within-country component of dispersion in life-expectancy at birth, and the population weighted numbers are heavily affected by India and China, and downplay the African experience. As the next two columns show, the behavior of the cross-country dispersion of per capita GDP is quite different from that of life-expectancy. Convergence, if it takes place at all, is much weaker. With each country as a unit, the variance of logs of GDP has been increasing and there is no convergence in GDP per capita, even in logarithms. This is the "increasing inequality between countries" that is emphasized in the public health literature. By contrast, once we weight by population, the standard deviation of log GDP declined from 1980 to 2000. Because I am ignoring inequality within countries, which has been increasing in many countries, including India and China, these figures overstate the decline in interpersonal inequality. But because the between country component contributed more to overall inequality than does the within country component, overall inequality in the world has been improving, see for example François Bourguignon and Christian Morrisson (2002). As has been widely recognized, rapid progress in India and China since 1980 is driving much of this result.

In a recent paper, Gary Becker, Tomas Philipson, and Rodrigo Soares (2002) have argued that changes in income should be combined with the changes in life-expectancy to give a more comprehensive ("full income") measure of well-being, and that once this is done, the divergence in per capita incomes across countries turns into convergence in full income. Becker and Philpson's calculations use values of additional life years from Kip Viscusi and Joseph Aldy's (2003) international compendium of market based estimates, and also include a calculation of the utility gain from the increased opportunities for intertemporal substitution associated with longer life. A cruder (albeit simpler) calculation comes from ignoring the value of intertemporal substitution and looking at the measure presented in the last panel of Table 1, the product of life-expectancy and per capita GDP. The final columns of Table 1 show what has happened to the dispersion of this approximation to full income. As is the case for income per capita, dispersion in the logarithm of full income has been increasing, while dispersion over people has been decreasing. Because the gain in life-expectancy adds more to the growth in full income in the poorest countries, the reduction in dispersion over people of (log) full income is a good deal more marked than that in per capita income.

The increase in health and in full income in the poorest countries, in Latin America and Africa in the 1970s and 1980s, and in Asia since 1960, represents a large increase in well-being. And these gains followed even faster gains in many poor countries in the decade immediately after the Second World War, Davidson Gwatkin (1980), an issue to which I shall return. While it is unlikely that much of the health gains came from growth in income, let alone from globalization induced growth in income, globalization in the broader sense has much to do with them. A substantial fraction of health gains in poor countries are generated by the transfer of

knowledge from rich countries, about vaccines, about antibiotics, and ultimately about the germ theory of disease, all of which was originally discovered or formulated in the (now) rich countries. In this sense, the first world has been responsible for producing the global public goods of medical and health-related research and development, from which everyone has benefitted, in poor and now rich countries alike. Of course, not all of the gains are pure gifts from North to South; many cannot be implemented without substantial investments in education and in physical infrastructure, nor without a sometimes lengthy process by which new information and ways of doing things are absorbed into the population as a whole.

There is also a serious questions whether "full income" or life-expectancy does not overstate, or at least seriously mismeasure the true welfare gains in poor countries. The estimates of the value of life are computed from a conceptual experiment in which adults reveal their willingness to pay for a reduction in the risk of dying. Even if we accept that such measures of the value of risk reduction can be legitimately converted, using expected utility theory, into the value of extending life, then it does not necessarily follow that we can use these measures to assess the value of reductions in infant and child mortality which, until the advent of HIV/AIDS, was the main force driving changes in life-expectancy in poor countries.

To illustrate, suppose that in the initial situation, a half of all children die at, or immediately after, birth, while those who do not die live until they are 60, so that life-expectancy is 30. We then introduce immunization, oral rehydration therapy, and antibiotics, and clean up the water supply, after which only one quarter of children die, so that life expectancy rises by 15 years to 45. By the Becker et al calculation, everyone gets an additional 15 years, each of which is valued at per capita annual GDP. But this is hardly the end of the story. In the initial situation, women

had many children, knowing that many would die. In a healthier world, they will have fewer. Suppose, after a possibly long transition, the total fertility rate is reduced from 6 to 4, so that each woman has exactly the same number of children (3) who survive beyond birth. Once this new equilibrium has been established, both the size and the age-structure of the population are exactly the same as they were before the health innovations.

It is clear that, in this situation, the increase in welfare is not correctly assessed by valuing the additional life-expectancy at per capita GDP or any other income-based number. Indeed, given that there are exactly the same number of people as before, enjoying (by assumption) the same level of lifetime income, it would be tempting to conclude that welfare has not changed. But that would miss the gain to the mothers, who now bear fewer children in order to have the same number of surviving offspring, whose own health is improved, who have wider opportunities to do other things, and who are (at least in part) spared the agony of watching their children die. But there is no reason to suppose that these gains to the mothers are related to the increased life expectancy at birth of their infants. (Although the mothers themselves are likely to live longer.) What about the value of the lives of the children who are saved? One possibility is to count, as a welfare gain, the 60 years of life for the quarter of children who would have died, but who now survive. This would be one additional 60-year lifespan for each mother. But if we count these lives, we must also subtract the value of the equal number of lives that would have been, but which are now not lived, because their mothers choose not to give birth to those who would have lived them, John Broome (2003). There are two babies per mother who would not have been born, one of whom would have survived, and whose lost lifespan needs to be offset against that of the born child who survives. Either way, we reach the same result, which is that the only gain,

and certainly the most important one, is the better lives lived by the mothers.

4. Globalization and the determinants of health

It is hard to think about the relationship between globalization and health without taking some view of the determinants of the long term worldwide decline in mortality rates. If income is the primary determinant of mortality decline, then the globalization and health question depends on the familiar argument about the effects of globalization on income, on which I have nothing new to say. But as I argued above, growth in income is not strongly predictive of declines in mortality, and the finding here is consistent with other evidence, both econometric, Dean Jamison, Martin Sandbu and Jia Wang (2001), and historical, Richard Easterlin (1996, 1999), Preston (1975, 1980, 1996), Joel Mokyr (2004), that the transmission of health knowledge and technology is at least as important as changes in income.

Another possible argument, following Richard Wilkinson, is that mortality in rich countries is primarily determined not by income, but by income inequality, so that the effect of globalization on rich country health depends on the effects of globalization on rich country income inequality. Like the effects on income, the effects of globalization on income inequality are well-debated. But even if we were to accept the argument that, at least in *some* rich countries, *some* of the increase in income inequality has come from globalization, there is no good evidence that national mortality rates are affected by national income inequality, see Deaton (2003). The possible exception is infant mortality rates, where low income still has an effect, even in rich countries so that, at a given level of income per head, more income inequality means more poverty, and higher infant mortality, see also Kenneth Judge and Michaela Benzeval (1997).

Perhaps the most promising line of enquiry is one that considers the effects of globalization on the transmission of health knowledge and health technology. Lowering the costs of trade will speed the rate at which new therapies are installed in one country, having been proved effective in another, and this might be important for health for such items as neonatal intensive care units (NICUs), kidney dialysis equipment, screening equipment, and cardiac units, for example, as well as with earlier and lower technology interventions in poor countries, all of which have been connected with declining mortality. Similarly, cheaper and more rapid transmission of information, through international television transmission and the internet, will speed up the transmission of ideas, for example about the health consequences of smoking, exercise, or the use of salt, as well as inexpensive medical procedures, such as the use of beta-blockers or aspirin in the treatment of heart attacks. While these ideas do not change health without being incorporated into behavior, institutions, and access, processes that sometimes take time, there remains a presumption that cheaper and faster information flows will enhance the speed at which health knowledge is transmitted.

These transmission effects, if they are important, will generate two effects that we can look for in the data. First, international movements in health indicators, particularly mortality rates, should be more closely coordinated than once was the case, particularly for causes of death where health technology and knowledge are important. Second, as emphasized by Easterlin (1996), there will be pressure for mortality rates to converge across countries. In the simplest case, a new technique is introduced in one place so that the relevant mortality rate falls, followed by similar falls elsewhere. If the transmission of delayed or prevented, mortality rates can diverge, and initially similar mortality rates may become widely dispersed, at least for a while. And if there is

a stream of new therapies, with some places adopting more rapidly than others, there will be a variable gap between leaders and followers, albeit with mortality rates falling everywhere. Matters are complicated further if disease depends in part on cumulative exposure, as in the link between smoking and cancer.

That transmission of technology is important was previously argued in Deaton and Christina Paxson (2004), who compared the time-series evidence on age-specific mortality rates for males and females between the US and the UK. Although mortality rates are higher in the US until about age 60, their evidence showed that changes in mortality trends for infants and for middle-aged men and women tended to show up in the US about four years prior to similar appearance in the UK. Although techniques are not necessarily invented in the US, the competitive and for-profit healthcare system allows their speedier introduction than in the government-controlled and less well-funded British system, see e.g. Henry Aaron and William Schwartz (1984). Hence, if new technologies such as neonatal intensive care units, cardiac bypass grafts, beta-blockers, and catheterization do actually save lives, we would observe this pattern of lags in mortality rates. Of course, none of this rules out alternative explanations, such as the spread of infectious disease (AIDS mortality shows a similar pattern of the US leading the UK in mortality increase), or health-related behaviors, particularly smoking.

Figure 5 refines the all-cause mortality plots in Deaton and Paxson (2004) by focusing on cardiovascular disease for males and females aged 50 to 64 from 1950 to 2000 for the US and Britain; this is the cause of death where technical progress has arguably had the greatest impact. For males, the patterns are the same in both countries, with mortality relatively flat or rising in the early years, and then declining thereafter, by a half or more in both countries. However, the

decline in mortality in the US starts around 1970, which appears to be *before* the new techniques were available, but not until a decade later in Britain, a substantially longer lag than the four years in all-cause mortality. The pattern for women, if it exists at all, is much less pronounced. For both men and women, these mortality rates are essentially the same by te end of the century. While the acceleration in mortality decline in Britain after 1980 is apparent, there is no obvious sustained change in the US. Of course, there are other factors affecting mortality, of which likely the most important is smoking. However, patterns of tobacco use were similar in the two countries over the two periods. In the 1950s, both American and British men were much more likely to be smokers than women, While the prevalence of smoking among men declined throughout the period, that among women increased until the mid-1970s, achieving parity with men in Britain, and close to it in the US. Thereafter, the prevalence of smoking declines in parallel for both men and women. Smoking is a risk factor for heart disease though, unlike lung cancer, the risk is thought to be reduced or eliminated immediately after quitting. In consequence, these patterns of smoking do little to explain the differences in male-female mortality from CVD, nor do they offer an alternative to the technology story for the increase in the rate of mortality decline.

Figure 6 shows all-cause mortality for the countries in the OECD. Once again, we see the characteristic patterns of health transmission among males, but not among females. The patterns of mortality decline are strongly correlated across countries, and beyond that, for males but not females, there is increasing convergence of rates. In 1950, mortality rates for men in this age group ranged from 1 percent to more than 2 percent. By 2000, and with the exception of late-comer Korea, the rates cluster between 0.8 and 1.3 percent. Figure 7 shows the same plots, but

for mortality from cardiovascular disease alone. Because this is such a large share of total mortality, it shows that much of the convergence in mortality rates is driven by what has been happening to cardiovascular mortality. Unlike the case of all-cause mortality, there is evidence of convergence and of some acceleration in the rate of mortality decline among women as well as among men.

These patterns can be reconciled with reference to international patterns of smoking. Figure 8, taken from the International Mortality and Smoking Statistics data base, Barbara Forey, John Hamling, Peter Lee, and Nicholas Wald (2002), show survey based estimates of prevalence rates of smoking (of manufactured cigarettes) for five year periods from 1951–55. These figures are age-adjusted by applying five-year age-specific prevalence to a standard European population. It is clear that different countries have responded very differently to the common knowledge about the health risks of smoking. Almost everywhere at the beginning of the period, men were more likely than women to smoke, and almost everywhere the differential narrowed between 1950 and 2000. In most OECD countries, although not all, there has been a consistent, long-term decline in the prevalence of smoking among men. In some countries, particularly the English speaking countries, the US, Canada, Britain, New Zealand, Australia, and Ireland, prevalence of cigarette smoking was falling for both men and women well before the end of the century. However, for much of the rest of Europe, the fraction of women smoking is still rising in the latest surveys, and there are some countries, particularly in Eastern Europe, where prevalence continues to rise for both men and women. Overall, smoking prevalence is generally declining for men, and there is some international narrowing in the dispersion of rates. For women, by contrast, there is no general decline in prevalence, and little convergence.

These smoking patterns have clear counterparts in international patterns of mortality from lung-cancer, which are shown in Figure 9. For men, lung-cancer mortality rates rose for most of the period, and international rates diverged, along with international smoking patterns, but by the late 1980s, mortality rates were declining in many countries, and beginning to converge. Lung cancer mortality among women, like prevalence of smoking among women, started from much lower levels than for men, but is still rising and diverging in most countries, although the beginnings of a decline can be seen in some. These lung-cancer mortality rates are only a fraction of the mortality rates from cardiovascular disease, only a fifth for men and less for women, and cigarettes are likely responsible for more deaths through heart than lung disease. But taking both together, it is clear that, at least after the mid-1970s, therapeutic improvements have been working together with changes in behavior for men, but largely against one another for women. (Note that there has been little or no progress in the treatment of lung-cancer.) And because the smoking behavior of women differs so much from country to country, and there is no convergence, we do not see the convergence in mortality among women that is so clear among men. Note too that an “all smoking” explanation is insufficient, if only because of the (albeit limited) progress and convergence in female mortality, in spite of the lack of a general decline in smoking and a divergence in the prevalence of smoking. Nor is there any sharp decline in the prevalence of smoking among men around 1970–80, which would explain the marked acceleration in the rate of mortality decline, in general, and for cardiovascular disease in particular.

5. Summary and conclusions

The health of nations is as globally interdependent now as it has been in the past. In the first wave of globalization, or rather colonization, the transmission of disease to populations with no immunity played a central role, not only in the decimation of peoples, but in the conquest of the New World by the Old. Later in the era of colonization, patterns of settlement and exploitation, including who colonized whom, and what mode of colonization and exploitation resulted, depended on the ability of potential settlers and colonizers to deal with the burden of local disease. The movement of people propagated, and was conditioned by, the patterns of disease. Today, the health of most people in the world, in rich as well as poor countries, depends on their ability to adopt locally health knowledge and health technologies that have been discovered and developed elsewhere.

In the middle of the 20th Century, child mortality rates, and with them life-expectancy, improved throughout poor countries. Gwatkin (1980) labels this as the third of three great waves of mortality decline. The first, starting at the end of the 19th century, began in North and Western Europe, and was quickly transmitted to the United States. The second wave, beginning in the 1920s, was in South and Eastern Europe, and the rate of gain of life-expectancy was even more rapid than in the first, with some countries showing increases in life-expectancy of more than half a year per year over a decade or more. Because this second wave had the experience and knowledge of the first to draw on, it could be more rapid, and by the middle of the 20th Century, life expectancies in the south and east of Europe were close to those in the north and west. Gwatkin's third great wave was in the poor countries, and began in earnest after the Second World War, greatly aided by international public health efforts, particularly by the WHO and by

UNICEF. In some countries, the increase in life expectancy was greater than a year per year, and in a few cases, such as Mauritius and Sri Lanka, faster than two years per year.

Again, much of the progress came from applying the knowledge gained in the earlier waves. As Preston (1960) writes: “With the exception of water and sewerage improvements and smallpox vaccination, the techniques of preventative and curative healthcare that have been widely deployed in LDCs are twentieth century products. Virtually all were facilitated by the ultimate acceptance of the revelatory germ theory of disease at the turn of the century” (p 304). Yet there were new tools too, and much of the most rapid progress in the 1940s and 1950s came from vector control, particularly DDT spraying against malaria, and from the use of newly developed antibiotics against tuberculosis. Although some of the progress was subsequently reversed, new treatments became available, particularly oral rehydration therapy after 1979, and there was continued in coverage of immunization. And while gains in income were undoubtedly important, for improving nutrition, and for funding for better water and sanitation schemes, some countries made progress in reducing child mortality even in the absence of economic growth, recapitulating the history of health improvements in Europe 50 to 75 years before. This wave of health improvement ultimately came from the globalization of knowledge, facilitated by local political, economic, and educational conditions.

More recently, mortality decline among the rich countries of the world has depended on transmission of new knowledge and technology, and in particular, as I have tried to demonstrate above, by the diffusion of knowledge about the risks of cigarette smoking, and by the diffusion of new techniques for saving the lives of those with cardiovascular disease. The medical changes, although in some cases expensive, diffuse more rapidly than do changes in behavior, which

respond slowly and unevenly to changes in knowledge about risks. Indeed, there are important parallels between the slow changes in cigarette habits and the slow adoption of the germ-theory of disease into individual behavior almost a century earlier, Nancy Tomes (2000).

Among countries that are not in the richest group, the convergence of health slowed towards the end of the 20th century. When we look at the 50-64 year old group outside of the OECD, and redraw the figures on all-cause and cardiovascular mortality rates, the picture is very different. Mortality rates in Eastern Europe and the countries of the former soviet union show mortality increases and mortality divergence, not mortality decreases and mortality convergence. And in Latin America and the Caribbean, the other area that is covered by the WHO mortality statistics, the decline of mortality is much slower, and there is only very limited evidence of convergence. There is clearly a long way to go before the habits and technology of the rich countries are fully adopted even in middle-income countries.

Among the poorest countries, the gifts of global health have been diminishing or otherwise limited in the 1990s. Declines in child mortality have been less rapid in the 1990s than they were in the 1980s, perhaps because the easy gains were made earlier. By 2000, the HIV/AIDS epidemic had widened the gap in life-expectancy between Europe and North America on the one hand and sub-Saharan Africa to more than its level in 1950. If we accept the argument that health is largely determined by the transfer of technology and knowledge, the current state of mortality from the epidemic in Africa is evidence of the failure of globalization to transfer effective anti-retroviral drug-based technology and treatment from the rich countries to sub-Saharan Africa. More broadly, there are 10.5 million child deaths each year that are preventable in the sense that those children would not have died had they been born in rich countries, Lopez (2000). The

model in which global public health goods are produced by the rich countries and made available to all has yet to work in this case.

While AIDS is arguably unique, and indeed antiretrovirals are the only important case where drugs listed as "essential medicines" by the WHO are still on patent, Amir Attaran (2004), it is hardly an exception that can be ignored. There are between 25 to 28 million people in sub-Saharan Africa who are infected with HIV/AIDS, of which 2.2 to 2.4 million are dying each year. Many of these deaths are preventable and would be prevented with adequate resources. People who live in rich countries have full access to the technology that prevents, or at least long postpones, death from AIDS. People who live in poor countries do not. And it is this *inequality* in outcomes, not only from AIDS, but also from measles, from diarrhea, and from pneumonia, that fuels much of the anger that is so characteristic of the literature in health. As illustrated in Section 3, the last half century has seen enormous advances in knowledge that have generated unprecedented declines in mortality among the citizens of the rich countries. These advances will eventually reach the poor of the world so that, in the long run, they too will benefit, but in the meantime we are living with appalling inequalities, in which the poor of the world die of AIDS and, more broadly, where poor people around the world die of diseases that are readily preventable elsewhere, including in the first-world hospitals and clinics that serve the rich in poor countries. What is required is not less globalization, but more, or at least more globalization of a different kind. Deaths that can be prevented should be prevented, and they will be prevented if we can find faster ways of diffusing first-world health technologies, including the creation of the economic, educational, and political conditions that would permit their more rapid diffusion.

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Table 1
Changes in life-expectancy and growth rates of GDP per capita and of full income, by region and decade

	All	East Asia & Pacific	South Asia	SubSaharan Africa	Latin America & Caribbean	Middle-East & N. Africa	Eastern Europe and Central Asia	North America & Western Europe
				Change in Life Expectancy (years)				
1960–1970	8.4	18.0	5.0	4.0	4.1	5.3	2.1	1.5
1970–1980	3.9	5.1	4.7	3.4	4.1	5.8	–0.9	2.5
1980–1990	2.7	2.8	4.9	2.4	3.3	6.1	1.4	2.1
1990–2000	1.2	1.8	3.9	–3.5	2.4	3.5	–1.5	1.9
				Growth rate of real GDP per head (percent per year)				
1960–1970	3.1	4.9	2.2	1.8	2.8	4.7	..	3.4
1970–1980	2.0	2.9	0.7	0.4	3.0	1.1	..	2.5
1980–1990	1.7	3.4	3.6	–0.5	–0.8	0.5	..	2.1
1990–2000	2.2	3.9	3.5	–0.3	1.9	2.4	–1.8	2.0
				Growth rate of real GDP per head x Life Expectancy (percent per year)				
1960–1970	4.8	8.6	5.0	3.9	3.5	5.7	..	1.6
1970–1980	2.6	3.7	4.8	3.4	3.7	2.0	..	2.5
1980–1990	2.1	3.8	4.9	2.4	–0.2	1.5	..	2.0
1990–2000	2.5	4.2	4.0	–4.0	2.2	3.0	–2.1	1.8

Notes: Life-Expectancy from World Development Indicators, (separately) population weighted for all countries available in 1960, 1970, 1980, 1990, and 2000, and changes calculated on a regional basis. GDP is real chain weighted gross domestic product per capita from the Penn World Table, and is also population weighted. The last two panels are calculated only for those countries with non-missing values for both life-expectancy and PWT GDP. There are 106 such countries in 1960, 110 in 1970, 115 in 1980, and 131 in 1990 and 2000. The life-expectancy data in the first panel use data from 161 countries in 1960, 162 in 1970, 173 in 1980, 188 in 1990, and 191 in 2000.

Table 2
Convergence and divergence in life-expectancy and GDP per capita

	Life Expectancy			ln(GDP per capita)		ln(GDP per capita * LE)	
	Mean	Standard Deviation		Standard deviation		Standard Deviation	
	weighted	weighted	unweighted	weighted	unweighted	weighted	unweighted
1960	49.0	12.9	12.8	1.03	0.90	1.26	1.11
1970	58.3	9.4	12.0	1.09	0.98	1.20	1.17
1980	62.2	8.9	11.5	1.10	1.03	1.20	1.20
1990	65.2	8.1	11.1	1.02	1.10	1.12	1.26
2000	66.9	8.7	12.0	0.95	1.11	1.07	1.29

Notes: Calculated for countries with both life expectancy in *World Development Indicators 2003*, and real PPP chain-weighted per capita GDP in the *Penn World Table*. There are 106 countries in 1960, 110 in 1970, 115 in 1980, and 131 in 1990 and 2000. All weighted statistics are weighted by population in the relevant year, including life expectancy at birth.

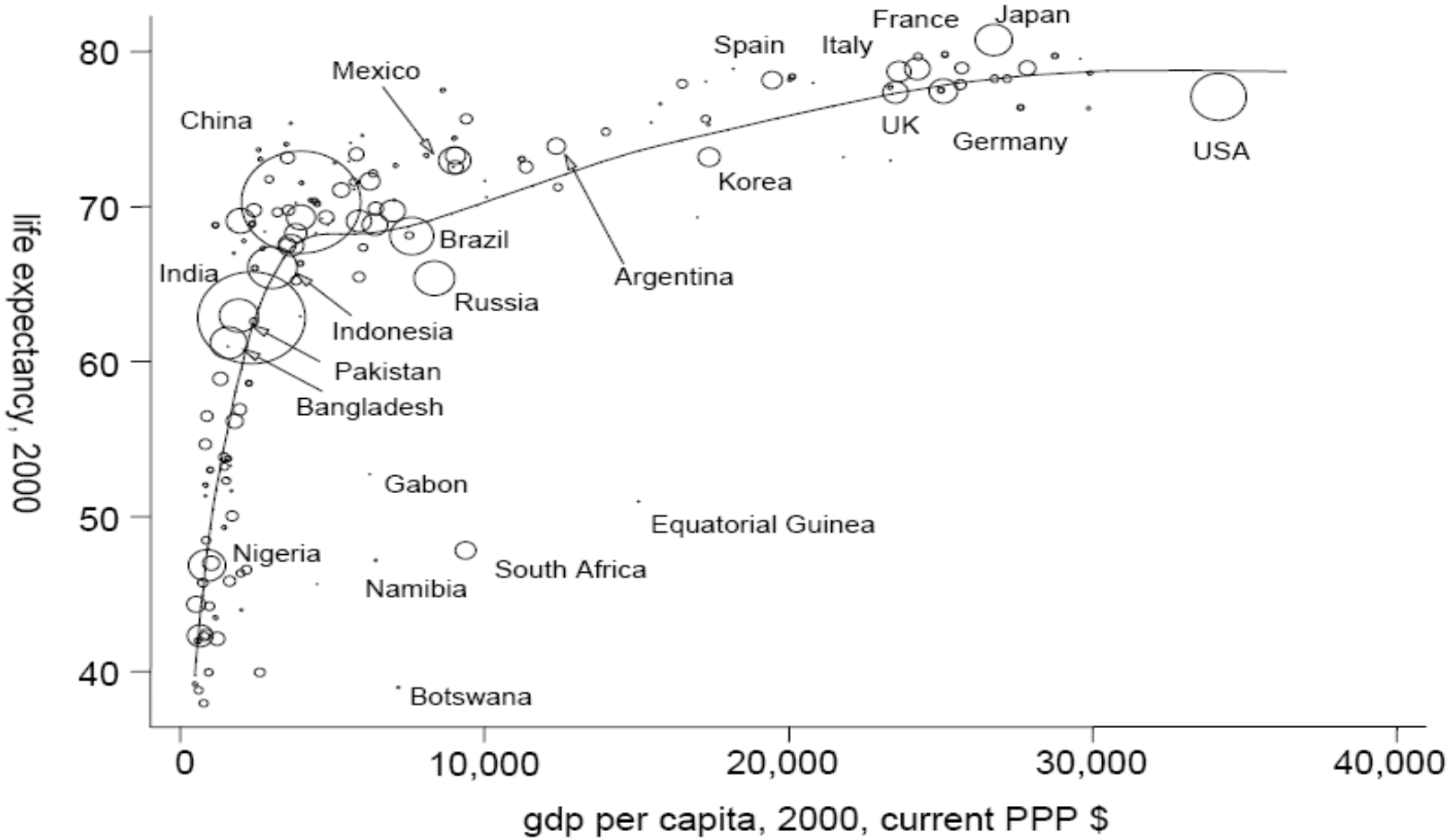

Figure 1: The Millennium Preston curve
Source: Author's calculations based on World Development Indicators 2003 (life expectancy and Penn World Table (GDP.)
Note: Circles have diameter proportional to population size

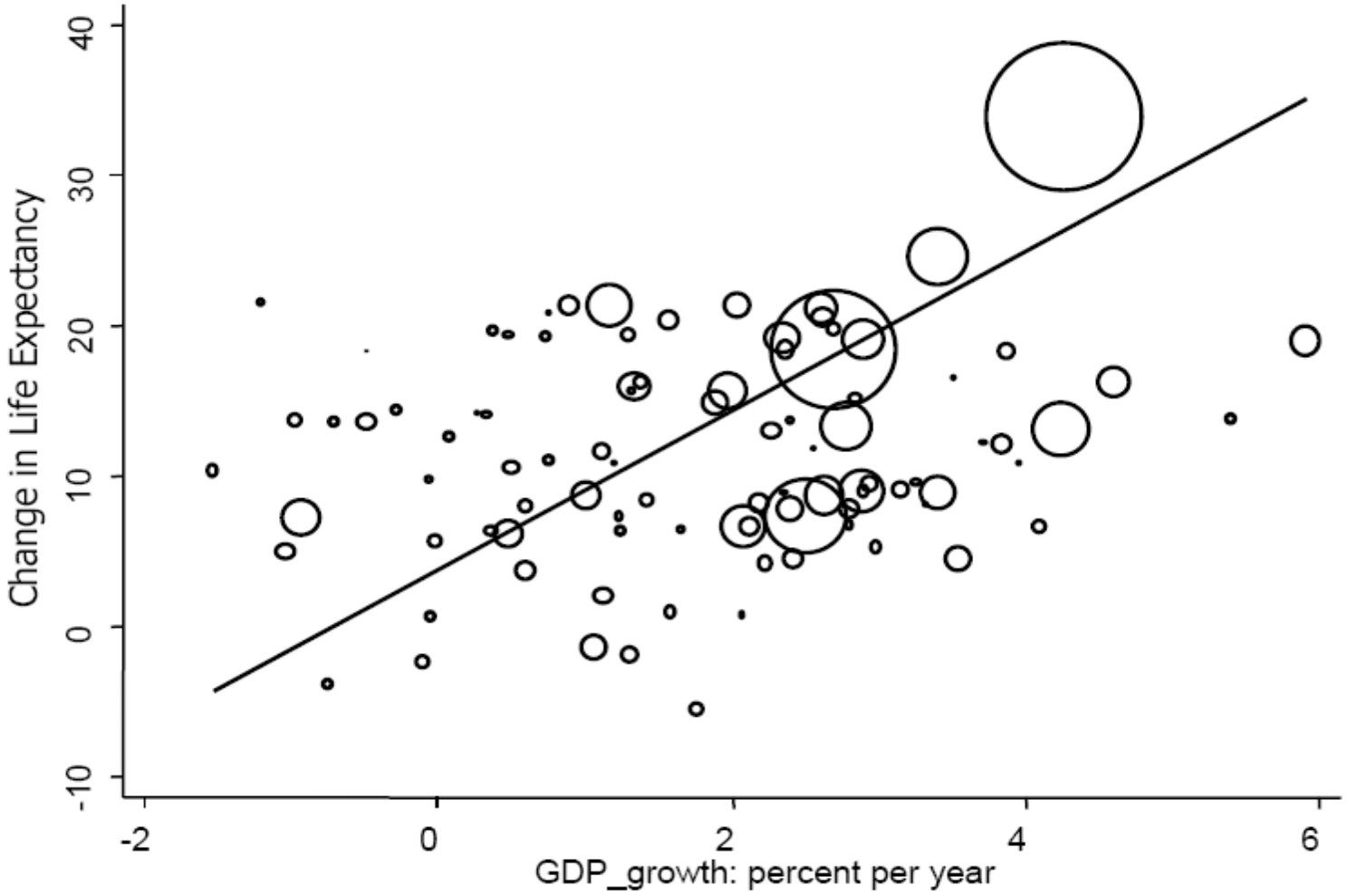

Figure 2: Change in life expectancy and GDP growth, 1960–2000
Source: See Figure 1. Note: Circles have diameter proportional to population size. The life-expectancy gain in China, which is the largest circle, is artificially by the famine conditions in 1960.

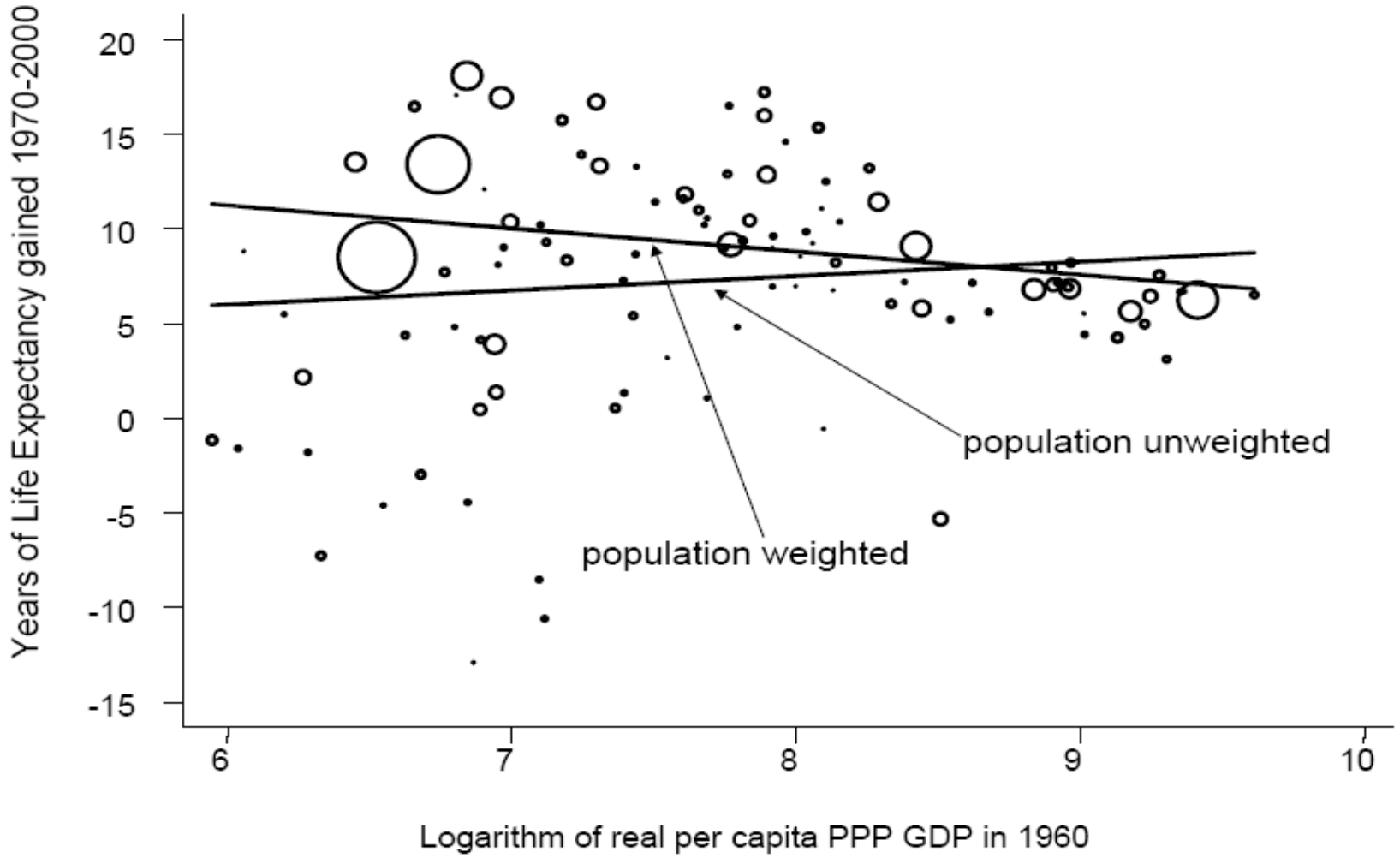

Figure 3: Change in life expectancy 1970–2000 versus per capita GDP
Source: See Figure 1

Figure 4: Change in life expectancy 1970–2000 and life expectancy in 1960
Source: See Figure 1.

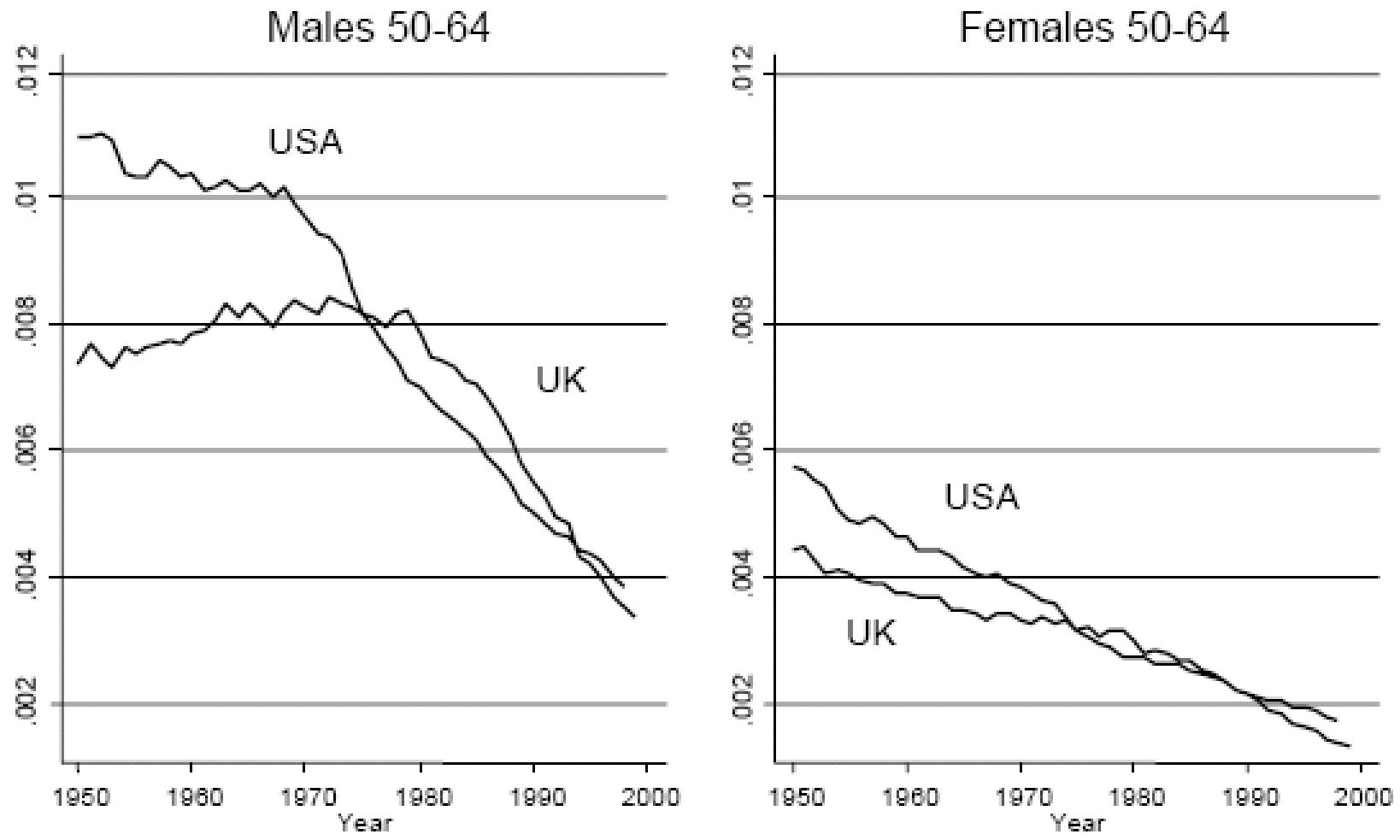

Figure 5: Age-adjusted mortality rates from cardiovascular disease, US and UK, 1950–2000
Source: Author's calculations based on WHO mortality database.

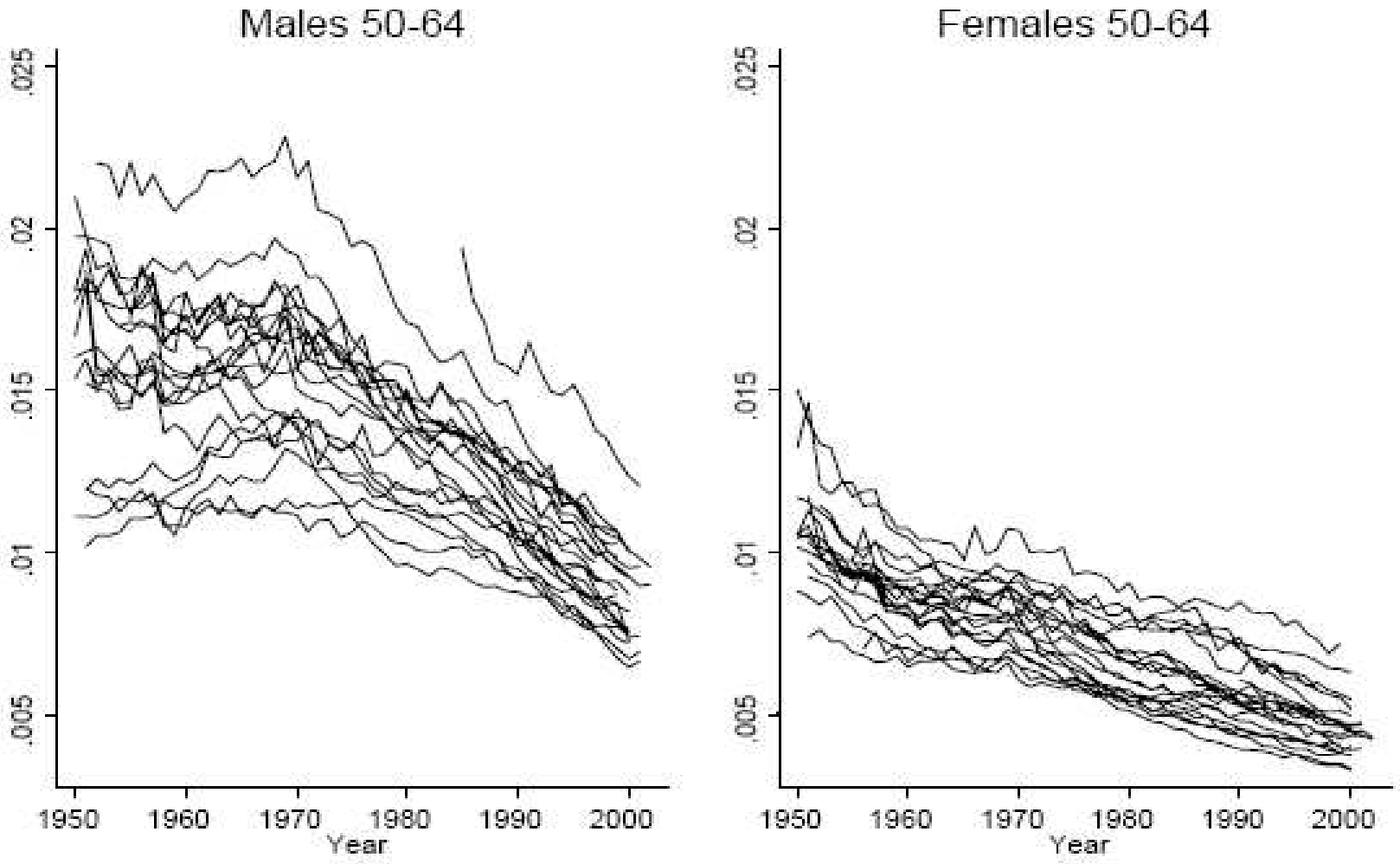

Figure 6: OECD all-cause age-adjusted mortality rates, 1950–2000
Source: See Figure 5

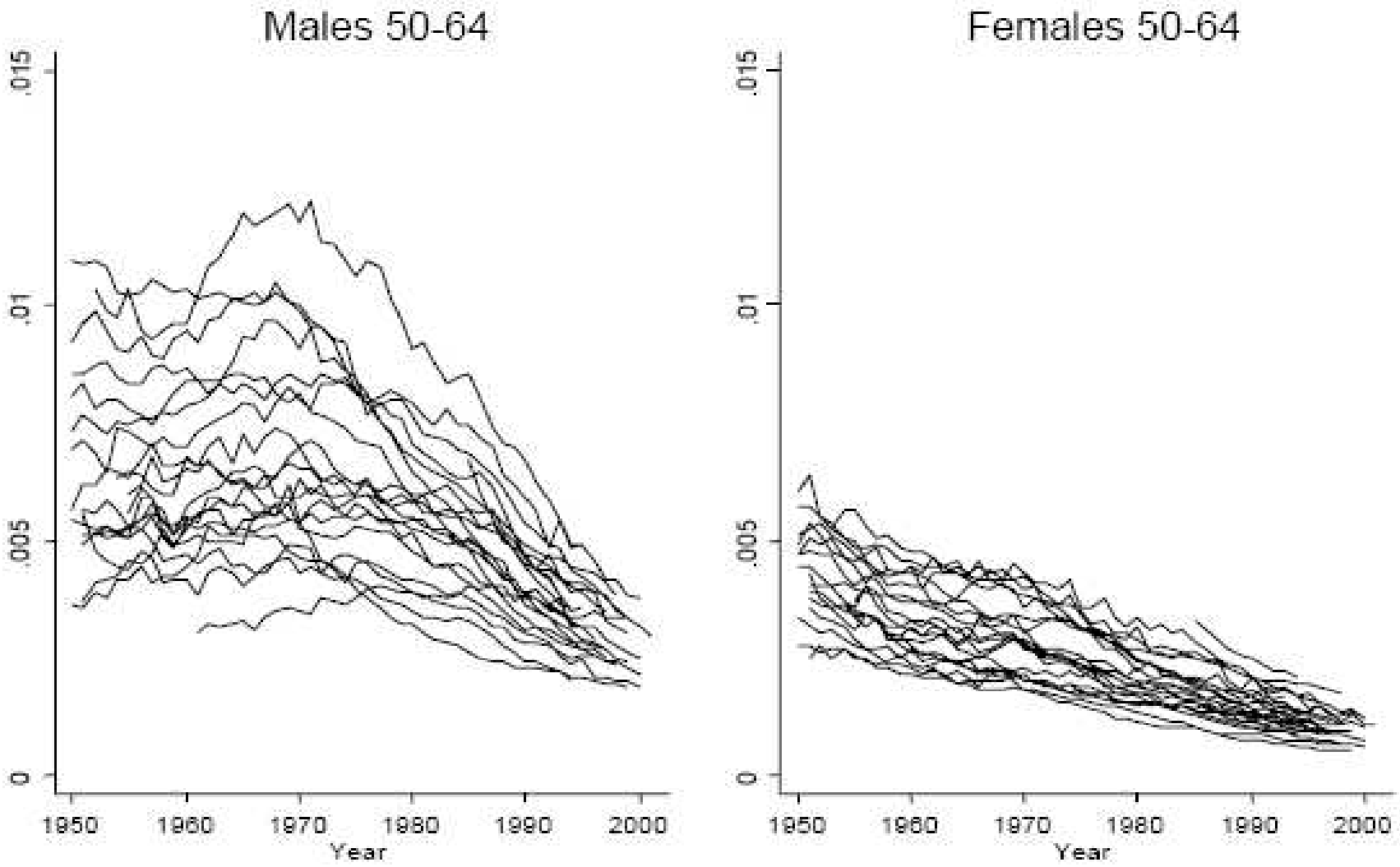

Figure 7: OECD mortality rates from cardiovascular disease
Source: See Figure 5

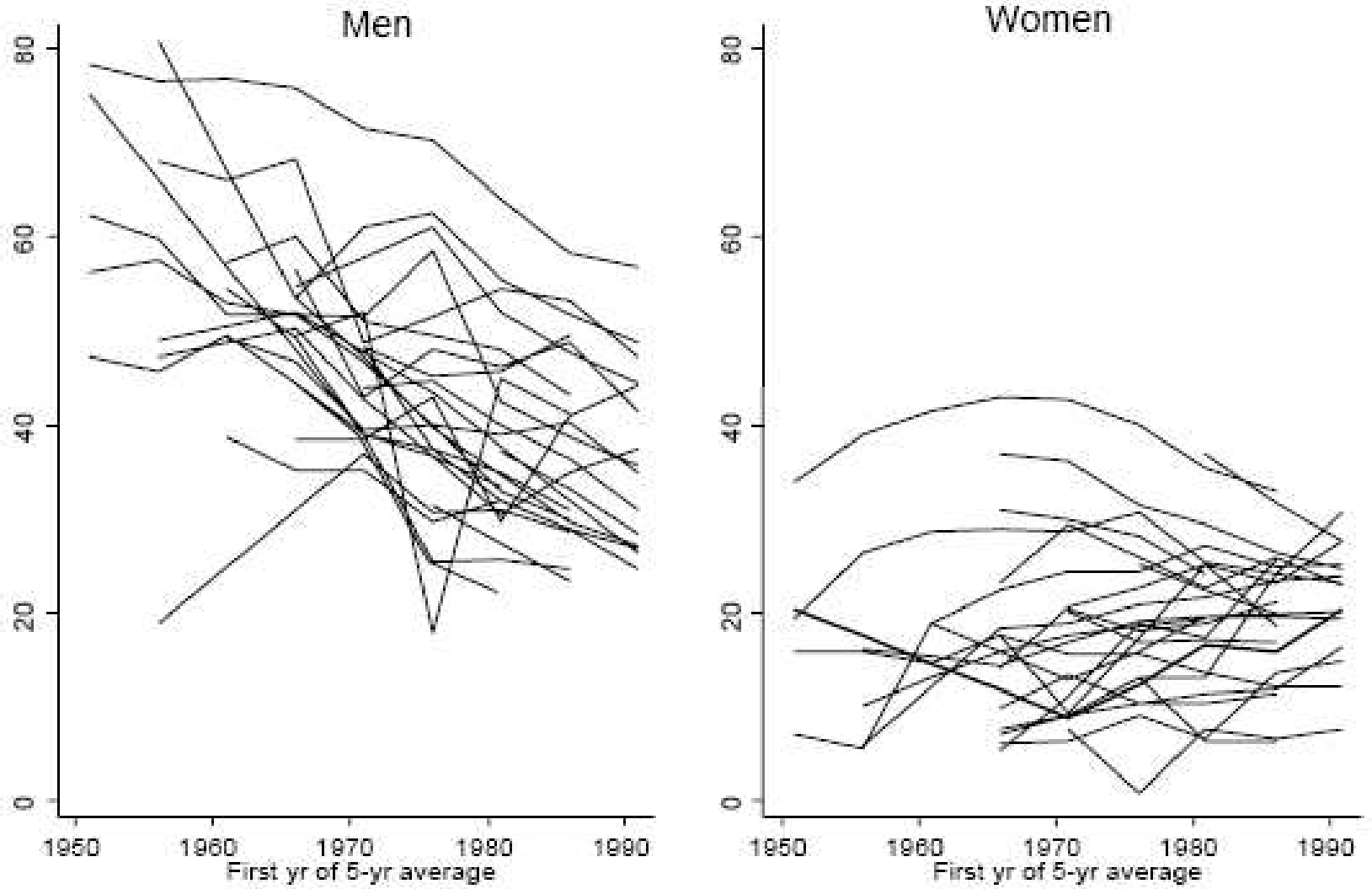

Figure 8: OECD smoking prevalence rates
Source: International Mortality and Smoking Statistical Database.

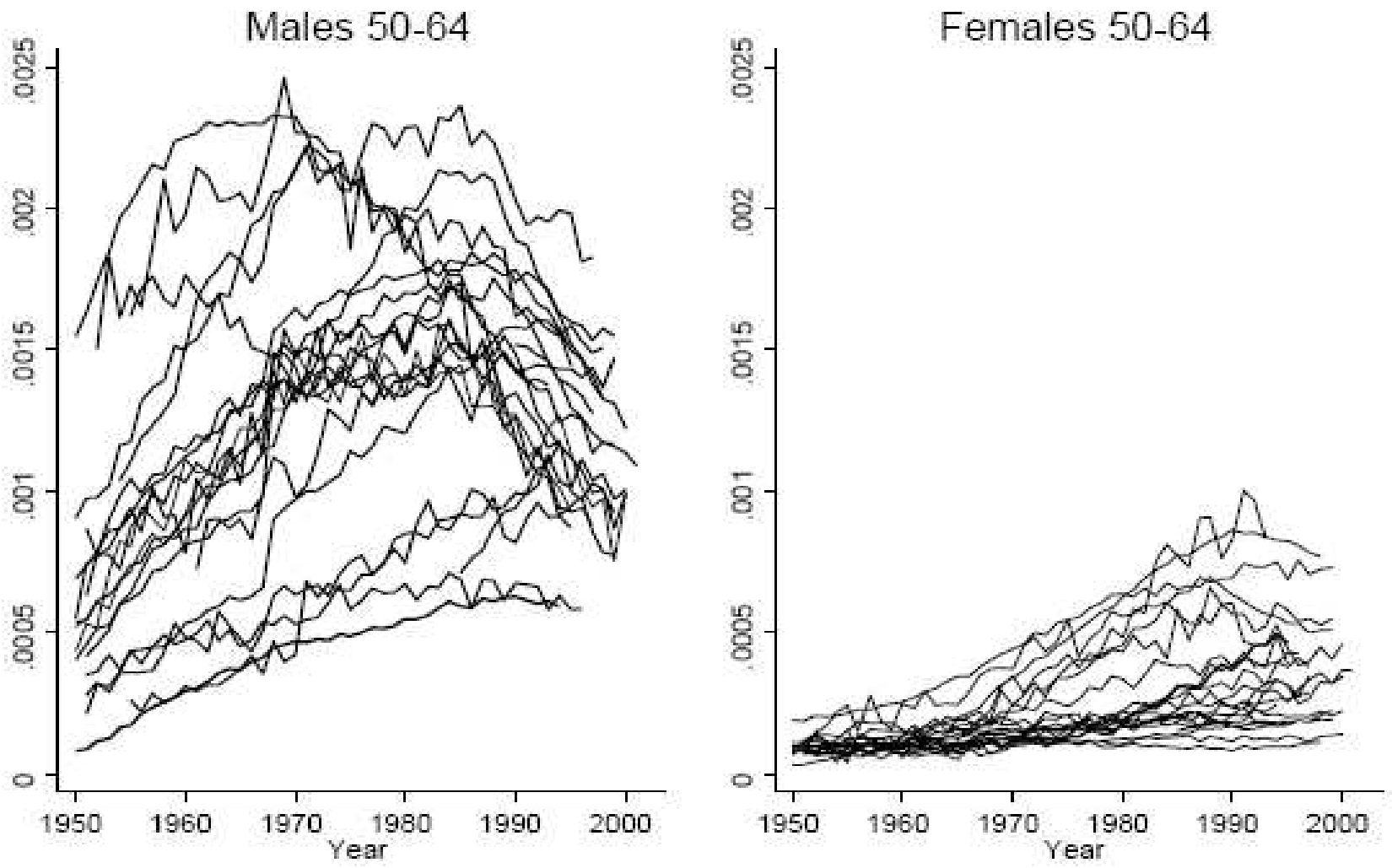

Figure 9: OECD lung-cancer mortality rates, age-adjusted
Source: See Figure 5.