

HIV/AIDS and Cross-National Convergence in Life Expectancy

ERIC NEUMAYER

FOR MOST OF the twentieth century cross-national convergence occurred in life expectancy and infant and child survival rates. Life expectancy and survival rates have increased faster over time in countries with low survival rates and low life expectancy than in countries with high survival rates and high life expectancy.¹ While this achievement has not gone undisputed (see, for example, Hobijn and Franses 2001; Mazumdar 2003), most analysts of convergence in the quality of life have hailed this development as a great success (Ram and Schultz 1979; Ram 1982, 1998, 2003; Ingram 1994; Easterlin 2000; Sab and Smith 2001; Neumayer 2003; Kenny 2003; Becker, Philipson, and Soares 2003).

What has been relatively neglected is that the convergence in life expectancy came to a halt at the end of the twentieth century, even, according to some estimations, turning into divergence. Wilson (2001), Neumayer (2003), Ram (2003), and Goesling and Firebaugh (2004) are exceptions to this neglect. Wilson (2001: 167) merely notes that “between 1975–80 and 2000 several countries in southern Africa saw life expectancy decline substantially following the spread of HIV/AIDS” in an analysis otherwise devoted to global demographic convergence. Neumayer (2003: 294) demonstrates the divergence and speculates that it might be explained by “social upheaval in many countries of transition particularly in what used to be the former Soviet Union, together with the spread of AIDS and urban violence in many developing countries.” Goesling and Firebaugh (2004) also demonstrate divergence in the 1990s, attributing it largely to the effect of HIV/AIDS. Ram (2003) goes further and tests whether the results pointing to convergence change if the 12 countries most highly affected by HIV/AIDS are removed from the sample.² He weights observations by population size and finds that the exclusion of these countries has a significant effect. First,

whereas there is no evidence for convergence in life expectancy over the period 1980 to 2000 in the full sample, convergence is seen in the restricted sample. Looking at the decade of the 1990s only, he finds divergence in life expectancy in the full sample, but neither convergence nor divergence in the restricted sample.

This article explores in greater detail the impact of HIV/AIDS on convergence in fundamental aspects of the quality of life. First, in addition to life expectancy I also address infant and child survival, that is, survival beyond age one and age five years, respectively. Second, in addition to analyzing the past record, I also look at the predicted future trend of convergence. Third, I examine the impact of the epidemic more comprehensively in analyzing and comparing convergence trends in three scenarios: a "Historical and Expected AIDS scenario," a "High AIDS scenario," and a "No AIDS scenario." The first scenario is one of estimated historical and future best-guess survival rates and life expectancies. The High AIDS scenario assumes that the epidemic has far worse consequences than expected in high-prevalence countries. The counterfactual No AIDS scenario is based on survival rates and life expectancies after eliminating the estimated best-guess mortality caused by the epidemic. I show that HIV/AIDS has caused divergence in life expectancies that will persist for another decade or so in the Historical and Expected AIDS scenario and until the end of our period of analysis (2050) in the High AIDS scenario. The epidemic has, however, not led to divergence in infant and child survival rates and will not do so in the future in any of the scenarios, but it has slightly slowed convergence in these indicators of the quality of life.

The next section provides background information on the impact that HIV/AIDS has had on mortality in the most severely affected countries. This is followed by an explanation of the three scenarios and descriptions of the sources of data and of the analysis of convergence. Results are reported and the final section draws conclusions from the evidence presented.

HIV/AIDS and the mortality crisis in the most severely affected countries

HIV/AIDS has become the "deadliest epidemic in contemporary history" (United Nations 2003b: 2). By the end of 2003, between 34 million and 46 million people were estimated to be living with HIV/AIDS, 4.2 to 5.8 million of whom were newly infected in that year; between 2.5 and 3.5 million AIDS deaths occurred during 2003 (UNAIDS and WHO 2003: 3), bringing the total number of deaths caused by AIDS since 1981 to approximately 20 million (UNAIDS and WHO 2004: 5). AIDS now represents the fourth most important cause of death worldwide and the leading cause in sub-Saharan Africa, the region most severely affected with about 70 percent of all infected persons. Within sub-Saharan Africa, the seven most affected

countries are Botswana, Lesotho, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe (United Nations 2003b). Philipson and Posner (1995) and Caldwell (2000) discuss the many reasons why the region has been particularly hard hit by the epidemic.

While most countries severely affected by the epidemic seem to have reached the peak of HIV incidence, it is estimated that prevalence will peak only in this decade or the next, given that many HIV-infected persons survive for a number of years before eventually suffering from and dying of AIDS (United Nations 2003b: Table 3). Incidence, which is complicated and expensive to estimate, measures the number of new infections among the noninfected population during a period of time. Prevalence measures the percent of the population living with HIV and is typically based on HIV tests on anonymous blood samples from women in antenatal clinics (UNAIDS and WHO 2003).

There are manifold demographic impacts of the epidemic. In this article I concentrate on mortality and life expectancy rather than population size, population growth, and population age structure. In the absence of a cure, the most direct effect of the epidemic is to raise mortality. It is estimated that during the period 2000 to 2005 up to 20 million more people will have died than would have in the absence of AIDS (United Nations 2003b: Table 6). Sub-Saharan Africa is again the region most severely hit, accounting for around 75 percent of these excess deaths. The maximum number of excess deaths will be reached after prevalence has peaked, which implies that the number can be expected to rise in most countries for another ten to 15 years (United Nations 2003b: 7).

The large regional and country differences in excess mortality result in large differences in life expectancy. During the period 2010 to 2015, when the impact of HIV/AIDS on life expectancy is projected to be strongest, life expectancy at birth in the most severely affected sub-Saharan African countries is estimated to be lowered from 58.3 years to 47.1 years (or by 19.3 percent), whereas the corresponding average figures for Asian countries are from 71 years to 68.9 years (or 2.9 percent) and for Latin American and Caribbean countries from 71.6 years to 69.7 years (or 2.6 percent) (United Nations 2003b: Table 6). For the seven sub-Saharan African countries with prevalence rates above 20 percent of the population aged 15 to 49 years, the impact on life expectancy is even more severe, with a reduction from 67 years to 37.6 years (or 30 percent) (United Nations 2003b: Table 7). One of the reasons why the effect on life expectancy is so strong is that most of the excess mortality due to AIDS affects the younger age groups between 25 and 49 years old.

Even infants and children are affected by the disease, not only indirectly by being orphaned if their parents die from AIDS, but also directly through the transmission of the disease from infected mothers. Fortunately, the impact on infant and child mortality is far less pronounced than on

general mortality or life expectancy. One of the reasons is that HIV-infected women have on average a lower fertility rate than noninfected women (United Nations 2003b: 9). Also, not all women transmit the virus to their infants. Even in 38 severely affected countries in sub-Saharan Africa, the estimated infant mortality is raised by no more than about 5 deaths per thousand births (or 5.3 percent) in 2000 to 2005. The effect on mortality of children below age five is somewhat more pronounced at 7 deaths per thousand births (or 7.8 percent) (United Nations 2003b: Table 10). The reason is that almost two-thirds of HIV-infected children are estimated to survive beyond their first birthday (United Nations 2003b: 9). The figures are higher in the group of the seven most affected countries in this region with adult prevalence rates above 20 percent. Their infant mortality is raised by 14 deaths per thousand births (or 27.2 percent) and under-5 mortality is raised by 41 deaths per thousand (or 56.4 percent) (United Nations 2003b: Table 11). Despite these large increases in infant and under-5 mortality caused by the epidemic, the general downward trend in mortality is so strong that even in these most affected countries the impact of HIV/AIDS is not expected to lead to an overall rising trend in mortality during the coming decades.

We now examine the impact that the losses in life expectancy and the increase in infant and child mortality caused by HIV/AIDS have on global convergence in these fundamental aspects of the quality of life.

Three AIDS scenarios

We analyze trends in convergence in life expectancy and survival rates according to three scenarios. The first, the Historical and Expected AIDS scenario, is based on estimates of best-guess observed past and current values of survival rates and life expectancies as well as their extrapolation into the future via best-guess estimates.

The second, the High AIDS scenario, takes account of the fact that the AIDS epidemic might turn out to have much worse effects than expected. There are many possible ways such a scenario could be modeled. One possibility is that countries with currently low HIV/AIDS prevalence could turn into countries with high prevalence. There is great uncertainty about possible increases in infection rates outside the currently severely affected countries. Eberstadt (2002), for example, conjectures that we might see a tremendous increase in HIV/AIDS in Russia, China, India, and other Asian countries. This possibility is highly speculative, however. Instead, I assume here that the list of countries with high prevalence remains the same, but that the effects on life expectancies and survival rates are worse than expected and increasingly so the further in the future the best-guess estimate lies. Specifically, I assume that life expectancies in high-prevalence countries in 2005 are overestimated in the best-guess estimates and are 5 per-

cent below the Historical and Expected AIDS scenario, rising linearly to 25 percent below in 2050. For infant and child mortality rates, I assume that mortality rates are also underestimated in the best-guess estimates, but are only 2.5 percent above the Historical and Expected AIDS scenario in 2000, rising linearly to 12.5 percent in 2050.

Third, the No AIDS scenario is based on estimates of what survival rates and life expectancies would be now and in the future if HIV/AIDS were non-existent. The United Nations Population Division (UNPD) explains how this is done in several steps (United Nations 2001: 104–110). First, UNPD identifies the countries that are most severely affected by the epidemic and for which the disease has a significant effect on mortality. (These 45 countries are listed in the Appendix.³) Countries are included if the estimated prevalence of HIV/AIDS among persons aged 15 to 49 exceeds 1.9 percent. For countries with lower prevalence the epidemic remains largely confined to so-called high-risk groups, implying too much uncertainty about the likely future course of the epidemic to take these countries into account in projections. The only exceptions are Brazil and India, which are included because of their large population size despite prevalence rates below the threshold (United Nations 2003b: 2).⁴ For the 45 countries, the annual number of newly infected persons is estimated for past years. As a second step, the annual probability of acquiring HIV among persons aged 15 and older is estimated. This annual probability is then projected in order to estimate the number of adults living with HIV/AIDS and dying of AIDS in the future. These calculations are based on follow-up studies of HIV-infected persons. By modeling the fertility of HIV-positive mothers and by assuming a fixed rate of transmission from mother to child together with assumptions about the probability of dying from AIDS, the number of deaths of infants and children under the age of five can be calculated. Once the number of adult, infant, and child deaths from AIDS has been estimated, these can be incorporated into the estimates of future life tables to show the most likely values of life expectancy and of infant and child mortality in the absence of AIDS.

Of course, one of the difficulties of estimating the No AIDS scenario is that not all deaths of persons infected with HIV are directly attributable to AIDS. For this reason, UNPD considers only 95 percent of adult deaths of HIV-infected persons as being caused by AIDS. For HIV-positive children the respective shares are region-specific: 96.5 percent in Myanmar and sub-Saharan African countries, 97.7 percent in other countries of Asia, 99.4 percent in Brazil, and 99 percent in other countries of Latin America and the Caribbean (United Nations 2001: 109ff).

I take historical data on life expectancy from the United Nations Population Division and data on mortality of children under the age of five from the United Nations Children Fund (UNICEF). The United Nations Development Programme (UNDP) also provides best-guess estimates until 2050. Both historical data and, even more so, the best-guess future estimates are sub-

ject to measurement error and have to be treated with caution. The data are compiled and made public by the same source I use here, namely the United Nations Common Statistical Database (United Nations 2003a). They form the basis for the Historical and Expected AIDS scenario and, with the modifications stated above, for the High AIDS scenario. For use in the No AIDS scenario, United Nations (2001) provides estimates for the under-5 mortality rate in 2000 and 2020, and United Nations (2003) provides estimates for life expectancies in the years 2005, 2015, and 2050. Because results for infant mortality are very similar to results for under-5 mortality, I report results only for the latter. I convert the mortality rates into survival rates by subtracting them from 1,000.

Analysis of convergence

Countries converge on a variable of interest if the dispersion of the variable is shrinking over time. In the convergence analysis that follows, I test for what is commonly known as β -convergence and σ -convergence. β -convergence implies regressing the rate of change in life expectancy or survival rates on the initial level. This is typically done in a log-transformed model:

$$\ln(x_{it}/x_{i0}) = \alpha + \beta \ln(x_{i0}) + e_i$$

where i stands for each country and t is a count of years after base-year zero. If the estimated β -coefficient is negative and statistically significant, then one can infer that countries have converged on the dependent variable. A statistically significant positive coefficient sign leads to the conclusion that countries have diverged instead. If the coefficient is statistically not significant, whether positive or not, one cannot conclude either way.

By analyzing β -convergence in a log-transformed model, one implicitly assumes that the distance of points within the distribution of the variable of interest is measured in percentage terms. This might be a plausible way of measuring distance, but it can also overstate convergence since the same absolute amount of change in a variable translates into a smaller change in the log of that variable at higher values. Frontrunners will find it increasingly difficult to run ever further away if the variable of interest is analyzed in its logged form. An alternative is therefore to analyze convergence of a variable without log-transformation, that is, in level form. To save space and because the log model is so common in β -convergence analysis, I do not regress rates of change on levels, but instead examine the level form of the life expectancy and survival rate variables in the σ -convergence analysis.

σ -convergence analysis tests whether the spread of the distribution of a variable shrinks over time. β -convergence analysis examines whether past low performers fare better than past high performers and therefore ana-

lyzes intra-distributional movement. As such it is a necessary condition for σ -convergence since the spread of the distribution could not shrink if the low performers did not catch up. It is not a sufficient condition, however, since theoretically the formerly poor performers could overtake the formerly strong performers to an extent that the spread of the distribution increases, which would result in β -convergence with simultaneous σ -divergence (Sala-i-Martin 1996). Below we see that for our variables of interest the analyses of β -convergence and σ -convergence produce very similar results.⁵

One way to test for σ -convergence is to look at the trend in the standard deviation. This works well if the variables are kept in logged form since the test is not sensitive to changes in the mean of the variable. It is more problematic if the variables are held in level form. Because mean life expectancies and infant and child survival rates are increasing over time, the standard deviation will increase if the distributional spread remains the same. Looking at the standard deviation of a mean-increasing variable in level form is therefore slightly biased against finding convergence. In order to avoid this problem, one could look instead at the coefficient of variation (standard deviation divided by mean), but the problem here is that this is approximately equal to the standard deviation of the natural logarithm of the variable (Sala-i-Martin 1995). It would therefore become a pointless exercise. In our case, it makes little difference for the analysis of convergence trends whether variables are held in log or in level form. Hence any potential bias is too small to affect the analysis here, and I report results from trends in the standard deviation of variables held in level form only.

A further question is whether or not observations should be weighted. In the nonweighted case, Luxembourg counts the same as, say, China, even though the latter has a far larger population. To see whether weighting has any influence on the results, I perform all convergence analyses twice, once with and once without weighting by population size.

Results

Table 1 provides a β -convergence analysis of life expectancy in 186 countries in each decade from 1955 onward.⁶ There is clear evidence for convergence in 1955–65, 1965–75, and 1975–85, as indicated by the negative and statistically significant β -coefficients of the log of the initial period value. Convergence then becomes stalled from 1985–95 onward. This remains true if we look at the change in life expectancy up to the current period (i.e., 2005). To explore this issue further, I also look at time spans other than the ten-year period. For the Historical and Expected AIDS scenario, there is actual divergence in life expectancies over the period 1990 to 2005, as indicated by the positive and statistically significant coefficient. If observations are weighted by population size, the picture is somewhat more optimistic. Convergence becomes stalled only in 1995 to 2005 (rather than already a

TABLE 1 Results from OLS regression of the rate of change in life expectancy at birth on initial period logged levels

Years	Historical and Expected AIDS scenario		High AIDS scenario		No AIDS scenario	
	Non-weighted	Population-weighted	Non-weighted	Population-weighted	Non-weighted	Population-weighted
1955–65	-.08*** (8.48)	-.19*** (5.85)				
1965–75	-.12*** (11.58)	-.23*** (3.66)				
1975–85	-.12*** (6.94)	-.15*** (6.84)				
1985–95	-.00 (.06)	-.12*** (2.90)				
1985–2005	.04 (.81)	-.14* (1.87)	.11** (2.14)	-.08 (.98)	-.28*** (6.99)	-.30*** (7.14)
1990–2005	.10** (2.38)	-.02 (.36)	.18*** (3.68)	.04 (.49)	-.16*** (8.80)	-.23*** (6.60)
1995–2005	.02 (.80)	.03 (.61)	.09 (1.11)	.10* (1.70)	-.26*** (4.11)	-.21*** (6.77)

Note: N = 186. Absolute t-statistics in parentheses. Constant included, but coefficient not reported. Standard errors robust to heteroskedasticity. * significant at .10 level ** at .05 level *** at .01 level.

decade before), and over the period 1990 to 2005 there is neither convergence nor divergence (rather than actual divergence as in the nonweighted regression). The reason is that India, China, and a few other very populous developing countries do not currently have very high HIV/AIDS prevalence rates, they do fairly well in terms of life expectancy improvements, and they dominate the weighted regressions owing to their population size.

In the High AIDS scenario, the situation is bleaker than in the first scenario. One sees actual divergence over the periods 1985 to 2005 and 1990 to 2005. As before, the picture is more optimistic if observations are weighted by population size, with divergence setting in only in the period 1995 to 2005.

In the No AIDS scenario, all signs of lack of convergence or even divergence disappear. This follows from the fact that all β -coefficients are negative and statistically significant and holds true for both the nonweighted and the weighted regression analysis. In the absence of AIDS, therefore, those countries with low life expectancies would continue catching up with those that already have high life expectancies. Given the AIDS epidemic, however, there is no more global catching up and in some estimates the gap between the high and the low achievers is widening.

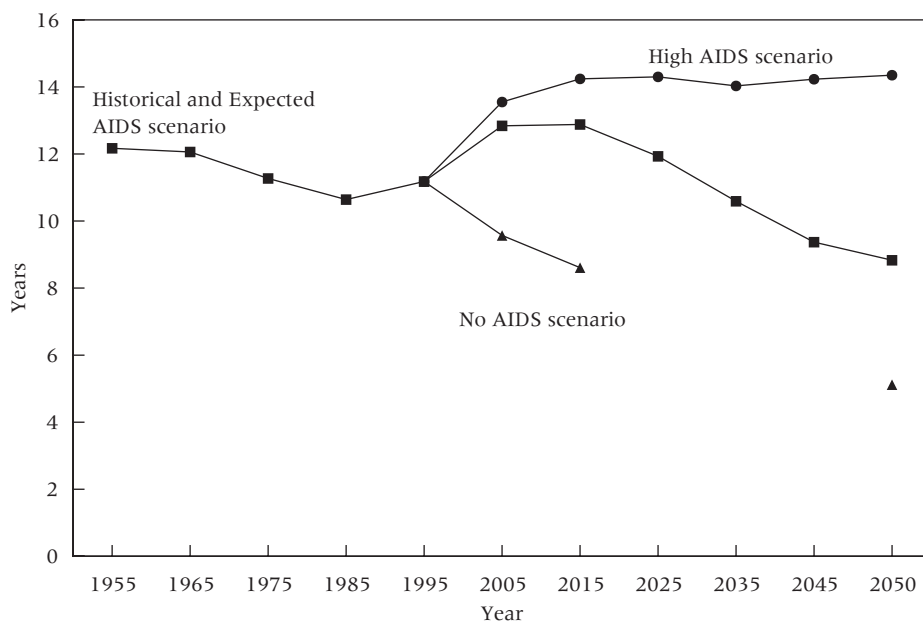
An analysis of σ -convergence, provided in Table 2, leads to results similar to those of the β -convergence analysis. I present results from analyzing σ -convergence in the level values of life expectancies, as the analysis in logs leads to practically identical conclusions. Divergence sets in from 1985 onward in the nonweighted case and from 1995 onward in the population-weighted case, as the respective standard deviations start to rise. Table 2 also lists the standard deviation of projected life expectancies in the future. In the Historical and Expected AIDS scenario, convergence is unlikely to occur in the decade 2005 to 2015 in the nonweighted case. Thereafter, convergence can be expected again. Note, however, that the degree of inequality from 1985—that is, before divergence sets in—will only be achieved again after 2025. Only if we weigh observations by population size can we expect convergence to set in after 2005. The reason is again that the most populous countries currently have relatively low HIV/AIDS prevalence rates.

In the High AIDS scenario, there is divergence over the whole period in the weighted case and divergence with the exception of a brief interlude between 2025 and 2035 in the nonweighted case. Clearly, if the AIDS epidemic turns out to be much worse than expected, this could mean the end of convergence in life expectancies for many decades to come. For the No AIDS scenario, we have data only for three periods of time: 2005, 2015, and 2050. Compared to the Historical and Expected AIDS scenario, the standard deviations are much lower and would continue falling over time instead of rising temporarily. Confirming the results from the β -convergence analysis, all signs of lack of convergence or even divergence disappear in the No AIDS scenario. For clearer illustration, Figure 1 plots the trend in

TABLE 2 Standard deviations (years) of life expectancy at birth

Year	Historical and Expected AIDS scenario		High AIDS scenario		No AIDS scenario	
	Non-weighted	Population-weighted	Non-weighted	Population-weighted	Non-weighted	Population-weighted
1955	12.17	12.46				
1965	12.06	10.95				
1975	11.27	9.54				
1985	10.64	8.69				
1995	11.18	8.24				
2005	12.84	9.28	13.55	9.82	9.57	7.34
2015	12.88	9.21	14.24	10.32	8.61	6.77
2025	11.93	8.57	14.30	10.57		
2035	10.59	7.69	14.03	10.69		
2045	9.37	6.84	14.23	11.27		
2050	8.83	6.46	14.35	11.57	5.12	4.53

NOTE: N = 186.

FIGURE 1 Trend in standard deviation of life expectancy (nonweighted case)

the standard deviation of life expectancy for the three scenarios in the non-weighted case.

I now examine convergence in child survival rates. As mentioned above, the analysis of convergence in infant survival rates leads to very simi-

TABLE 3 Results from OLS regression of the rate of change in child survival rates on initial period logged levels

Years	Historical and Expected AIDS scenario		High AIDS scenario		No AIDS scenario	
	Non-weighted	Population-weighted	Non-weighted	Population-weighted	Non-weighted	Population-weighted
1960–70	–.17*** (6.72)	–.26*** (3.37)				
1970–80	–.19*** (9.10)	–.16*** (4.04)				
1980–90	–.12*** (5.18)	–.21*** (5.26)				
1980–2000	–.23*** (6.40)	–.37*** (6.40)	–.21*** (5.72)	–.36*** (5.94)	–.28*** (7.75)	–.40*** (8.13)
1990–2000	–.10*** (4.16)	–.15*** (4.17)	–.08*** (3.15)	–.14*** (3.44)	–.16*** (6.48)	–.20*** (6.96)

Note: N = 158. Absolute t-statistics in parentheses. Constant included, but coefficient not reported. Standard errors robust to heteroskedasticity. * significant at .10 level ** at .05 level *** at .01 level.

TABLE 4 Standard deviations (per 1,000) of child survival rates

Year	Historical and Expected AIDS scenario		High AIDS scenario		No AIDS scenario	
	Non-weighted	Population-weighted	Non-weighted	Population-weighted	Non-weighted	Population-weighted
1960	104.48	91.52				
1970	93.55	74.80				
1980	80.95	66.77				
1990	74.19	55.52				
2000	69.92	51.23	71.32	52.14	65.12	48.01
2010	62.09	45.32	64.39	46.83		
2020	50.84	38.21	53.61	40.13	45.82	34.89
2030	39.98	31.22	42.87	33.28		
2040	30.51	24.80	33.30	26.81		
2050	22.91	19.18	25.50	21.03		

NOTE: N = 158.

lar results. Table 3 reports results for the β -convergence analysis. HIV/AIDS did not stall the convergence that took place over the second half of the twentieth century in the Historical and Expected AIDS scenario. The regression results from the No AIDS scenario show, however, that convergence would have been stronger between 1995 and 2015 without HIV/AIDS. This follows from the fact that the β -coefficients in the No AIDS scenario are larger than their respective counterparts in the Historical and Expected AIDS scenario. In the High AIDS scenario, convergence is less pronounced than in the Historical and Expected AIDS scenario, but still prevails since the respective coefficients are smaller, but all negatively signed and statistically significantly different from zero.

Results for the σ -convergence analysis in levels are presented in Table 4. Results for the analysis in logs again show a very similar pattern and are therefore not reported. In the Historical and Expected AIDS scenario, convergence is not expected to stall completely or to revert to divergence in the future, whether or not observations are weighted by population size. The same is true for the No AIDS scenario, but here convergence is much more pronounced. For this scenario, estimates are available for only two points in time, namely 2000 and 2020. Even in the High AIDS scenario, convergence does not stall at any time in the future.

Discussion and conclusion

The impact of HIV/AIDS on life expectancies and, though less pronounced, on infant and child survival in the most affected countries is unmistakable. In Botswana and Zimbabwe, for example, the current life expectancy at birth is

already below 40 years and is expected to fall to 31.6 and 33 years, respectively, by 2010–15. These extremely low values put these two and other severely affected countries back to levels of life expectancy prevalent before World War II or even in some cases at the beginning of the twentieth century. Botswana, which had one of the lowest child mortality rates in sub-Saharan Africa, saw its success eroded by the epidemic as mortality rates rose from 63 deaths per thousand live births in 1990–95 to an estimated 104 deaths per thousand during the period 2000–05 (United Nations 2003b: 10).

HIV/AIDS is not the only cause of increased levels of mortality. Indeed, Eastern European countries, in particular those that were part of the former Soviet Union, tended to experience increased mortality in recent decades and especially during the economic and social upheavals following the collapse of communist governments. External and violent causes of death together with diseases of the circulatory system account for the bulk of the mortality increase in those countries (Watson 1995; Gavrilova et al. 2000). In comparison to HIV/AIDS, however, the impact on life expectancy at birth of these factors has been relatively modest. Even in Russia, one of the most severely affected countries, average life expectancy for males and females combined fell from 69.5 years to 66.1 years during the 1990s. True, the average hides the fact that the impact is much stronger on males than on females and it is valid to speak of “the mortality crisis in transitional economies” (Cornia and Panicià 2000). But these losses in life expectancy are simply dwarfed in terms of size by the much larger losses in life expectancy caused by HIV/AIDS in the severely affected countries. It is not the mortality crisis in the former Soviet Union that is “without parallel in modern history,” as Chen, Wittgenstein, and McKeon (1996: 520) suggest, but the HIV/AIDS mortality crisis. Similarly, while mortality from violent crime is rising in many, particularly developing, countries, the effect on life expectancy of the general population rather than that of specific groups such as young black males living in ghettos, slums, or *favelas* is generally negligible. For example, homicide contributes only about 0.6 years or 9.7 percent to the life expectancy difference of six years between whites and blacks in the United States (Potter 2001).

This article has demonstrated that the decline in life expectancy attributable to HIV/AIDS has been the major cause of the recent lack of cross-national convergence and perhaps even divergence. Although the epidemic has not stalled convergence in infant and child survival rates, it has slowed convergence. That the epidemic has stalled cross-national convergence in life expectancy is rendered worse by the fact that convergence in fundamental aspects of the quality of life was cause for optimism among development scholars in the face of the well-established and disappointing lack of convergence or even divergence in average per capita income levels (Pritchett 1996, 1997; Quah 1996, 1997). Worse still, the epidemic is likely

to exacerbate existing divergence in per capita income levels. Earlier estimates predicted negligible effects of the epidemic on per capita incomes in the most severely affected countries owing to lower population growth compensating for the fall in economic output. However, newer estimates taking into account the increased speed and scale of the epidemic and the loss in human and social capital suggest a much larger impact (Bonnell 2000; Gaffeo 2003). Dyson (2003) points to the danger of a reversal of urbanization—a key component of economic development—as a result of death rates exceeding birth rates in urban areas. In addition, the epidemic is likely to exacerbate problems of poor governance in severely affected countries in sub-Saharan Africa (De Waal 2003).

Another cause for concern about the impact of HIV/AIDS on life expectancy at birth is that life expectancy might be linked to other measures of the quality of life. Kenny (2003: 20) suggests that “life expectancy is the best single proxy” for a broad “basket” of quality-of-life indicators. Thus, the lack of convergence in life expectancy might signal lack of convergence in other aspects of well-being.

There are two fundamental reasons why HIV/AIDS is responsible for global divergence or a slowdown in convergence in levels of life expectancy. First, the highest prevalence rates are found in countries faced with widespread poverty, low income levels, and deficient health care systems. This implies higher mortality than would result if economically and socially developed countries experienced similar HIV/AIDS prevalence rates. Second, the epidemic is concentrated in countries that are low performers in life expectancy and infant and child survival rates. It thus prevents them from catching up with the high performers, or at least from catching up as fast as they would otherwise do.

Current projections imply that the lack of convergence or perhaps even the divergence in life expectancy is only a temporary phenomenon, as the results from the Historical and Expected AIDS scenario suggest. Riley (2001) has shown that such temporary reversals have occurred in the past as well—for example, when the rapid increase in urbanization exceeded the ability of cities to cope with urban population growth. If, on the other hand, the epidemic has a much more severe impact on life expectancies and child survival rates than expected, then it could take many decades before convergence in life expectancy resumes. The High AIDS scenario, which by necessity cannot be more than a crude modeling of a far more severe epidemic than expected, suggests that divergence in life expectancies would continue at least over the course of the next 45 years. With respect to infant and child survival rates, the converging trend is so strong, however, that even in this scenario it does not come to a halt.

Which scenario is more likely to resemble the future course of the epidemic is difficult to say. Bongaarts (1996) has demonstrated the uncertainty

involved in predicting the future course of the epidemic over as little as one decade. Future trends in prevention efforts, in access to antiretroviral treatment, and in access to medical care more generally will have substantial effects on the future trend in life expectancies and infant and child survival rates. One would hope that greater and more equal access to medical care and treatment, more successful preventive measures, and perhaps even the discovery of a vaccine will mitigate the loss in human life caused by HIV/AIDS, thus bringing countries back on the road toward convergence in these fundamental aspects of the quality of life more quickly than predicted by the Historical and Expected AIDS scenario.

Appendix: Countries most severely affected by HIV/AIDS

Countries included in United Nations estimations (United Nations 2001): Angola, Bahamas, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Congo (Dem. Rep.), Congo (Rep.), Djibouti, Dominican Republic, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea-Bissau, Guyana, Haiti, Honduras, India, Ivory Coast, Kenya, Lesotho, Liberia, Malawi, Mali, Mozambique, Myanmar, Namibia, Nigeria, Rwanda, Sierra Leone, South Africa, Swaziland, Tanzania, Thailand, Togo, Uganda, Zambia, Zimbabwe.

Notes

I thank Professor Rati Ram for helpful suggestions.

1 Although not the focus of this article, the same is true for many other aspects of the quality of life, for example, convergence in other health and educational indicators and in access to radio and television (Sab and Smith 2001; Neumayer 2003; Kenny 2003).

2 These 12 countries are Botswana, Cameroon, Central African Republic, Kenya, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe.

3 The list of countries included in UNPD estimates rose from 45 to 53 in UNPD's latest assessment of the effects of AIDS on mortality (United Nations 2003b). However, the detailed data from this latest revision had not yet been fully released at the time of writing and could therefore not be used here.

4 For the same reason, China, Russia, and the United States are included among the AIDS-affected countries in United Nations 2003b.

5 In principle, one could apply more sophisticated tools of convergence analysis as well such as Kernel density and Markov transition analysis (see Neumayer 2003). However, such tools are only needed in special cases, for example, if it appears that countries permanently criss-cross from the upper to the lower bounds of a σ -converging distribution (Quah 1996), and this is not the case here.

6 Because the UN provides data as five-year averages, the regressions report results on the rate of change between 1955–60 and 1960–65 against the life expectancy in 1955–60 and so on.

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