CHAPTER 1

HIV/AIDS, Economic Growth, Inequality[1]

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I. Introduction

The evolving HIV epidemic can be considered as the most significant adverse health development in modern history. In many countries, it has reversed gains in life expectancy and related health indicators that had been achieved over many decades. However, the impacts of HIV/AIDS on key macroeconomic indicators, such as economic growth and income per capita, have been modest so far. This chapter reviews the available evidence on the macroeconomic impacts, discussing the interactions between the economic impact of HIV/AIDS and the structure of the economy. In particular, we will argue that a high degree of inequality mitigates the impacts of HIV/AIDS on economic growth and income per capita, while (and because) HIV/AIDS tends to exacerbate inequality.

As a point of reference for our analysis, Section II provides a brief review of the impact of HIV/AIDS on demographic and health indicators, as well as a discussion of the contribution of HIV/AIDS to the burden of disease.

Section III reviews the available evidence on the impacts of HIV/AIDS on economic growth, and contrasts it with the literature on health and growth, as well as the more specific studies analyzing the impacts of HIV/AIDS on growth. Empirical studies typically find a small impact of HIV/AIDS on growth, and this finding is matched by growth analyses in a neoclassical mold in which some adverse impacts of HIV/AIDS (productivity, population growth) are offset by an increase in the capital-labor ratio. We relate these outcomes to the broader growth literature, in which health (usually measured by life expectancy) is frequently used as a proxy for human capital and a determinant of productivity.

Section IV discusses the interactions between the macroeconomic impact of HIV/AIDS and the structure of the economy. Specifically, we will argue that the

structure of many economies with high HIV prevalence (which is associated with high degrees of income inequality) mitigates the macroeconomic impacts of HIV/AIDS, owing to their dual character and—in some countries—the prominent role of resource extraction in the formal sector. We will argue that the increased availability of antiretroviral therapy (ART) has strengthened this link between the structure of the economy and macroeconomic impacts of HIV/AIDS.

Some (but not all) of the mechanisms described in Section IV imply that, while (and because) inequality mitigates the impacts of HIV/AIDS on growth, HIV/AIDS exacerbates inequality through its asymmetric impacts across sectors and households. This issue is developed further in Section V.

Section VI discusses the findings from our analysis. Most generally, our analysis underlines that the impact of HIV/AIDS on growth is not a good measure of its development impacts. This has been observed by other analysts—it does not require rocket science (or growth analysis) to see that the declines in life expectancy associated with HIV/AIDS signify a development catastrophe. Our analysis, however, goes a step further, suggesting that the apparent small impacts of HIV/AIDS on economic growth so far mask distributional effects which are problematic in their own right.

II. Demographic and Health Impact of HIV/AIDS

A full discussion of the demographic and health impact of HIV/AIDS is beyond the scope of this chapter. However, a brief review of some demographic and health aspects of the impact of HIV/AIDS is useful to provide some context for our economic analysis, and because economic studies build on these direct impacts of HIV/AIDS. Specifically, we review the impact of HIV/AIDS on life expectancy in a global context, discuss the impacts of HIV/AIDS on the rate of population growth, illustrate the age profile of HIV/AIDS-related mortality, and address the contribution of HIV/AIDS (and other diseases) to the burden of disease.

Figure 1.1A illustrates the impact of HIV/AIDS on life expectancy, based on estimates by the United Nations Population Division (2009a, 2009b). After life expectancy in sub-Saharan Africa had grown roughly in line with the global average between 1965 and 1985, the growth rate of life expectancy essentially dropped to zero between 1985 and 2005, with an increase of only 0.8 years between the 1985–90 period and the 2000–05 period. Evidently, this decline can be attributed to HIV/AIDS, as the declines are highly correlated with HIV prevalence on the country level (as illustrated by Figure 1.1B, showing developments in life expectancy in countries with high HIV prevalence).[2]

To understand the magnitude of this slowdown, it is important to bear in mind that it took place in the context of otherwise positive trends on the global level;

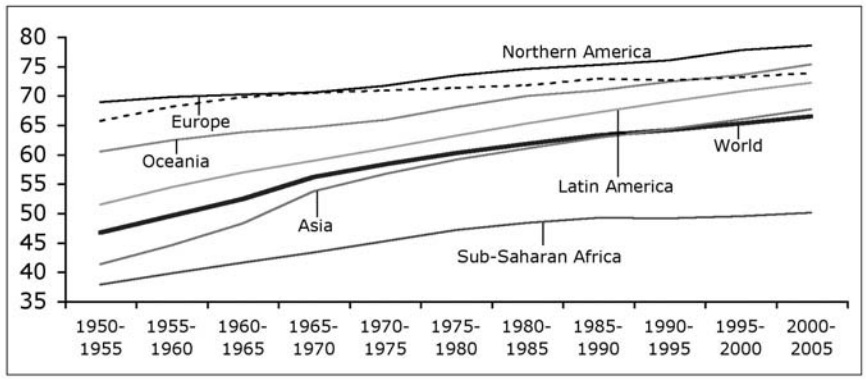

Figure 1.1a Life Expectancy at Birth, by Period and Major World Region (Years)
SOURCE: United Nations Population Division (2009b).

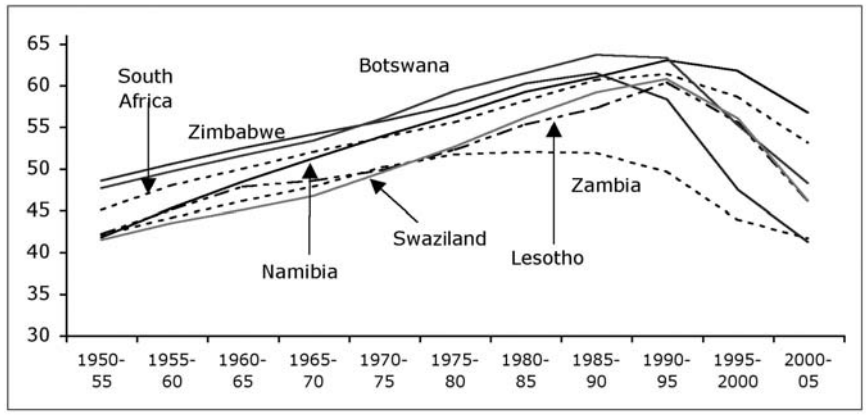

Figure 1.1b. Life Expectancy at Birth, in Seven Countries with High HIV Prevalence (Years)
SOURCE: United Nations Population Division (2009b).

consequently, the gap in life expectancy between sub-Saharan Africa and the global average increased from 13.4 years in 1980–85 to 16.4 years in 2000–05.[3] Another useful point of reference is the estimation of changes in life expectancy that would have occurred in the absence of HIV/AIDS, produced by United Nations Population Division (2009b). These estimates suggest that life expectancy in sub-Saharan Africa would have improved by 5.7 years between 1985–90 and 2000–05 in the absence of HIV/AIDS. This means that the estimated small increase in actual life expectancy of 0.8 years masks an average decline of about five years across sub-Saharan Africa owing to HIV/AIDS, more than offsetting the positive health developments in other areas over this period.

One well-known aspect of HIV/AIDS is the fact that HIV prevalence and mortality are concentrated among the economically most active age groups. This is

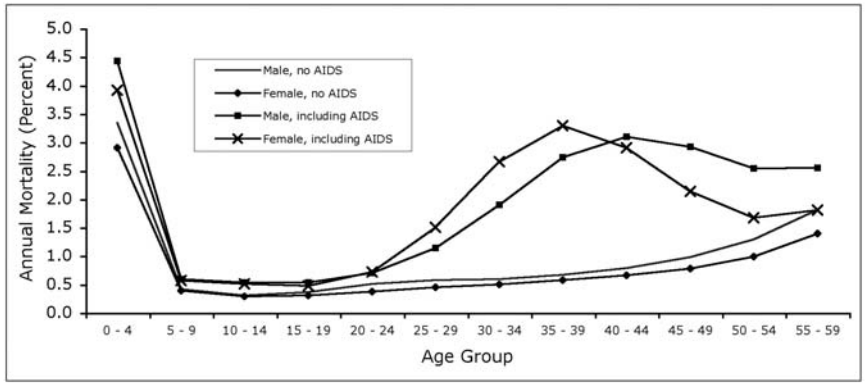

Figure 1.2 Zambia: Mortality by Age and Sex, 2000–05
SOURCE: Author's calculations based on United Nations Population Division (2009b).

illustrated in Figure 1.2 for Zambia, a country with an estimated HIV prevalence of about 15 percent among the population of ages 15–49, which compares to an average of 5 percent for sub-Saharan Africa (UNAIDS 2008a,b).

The estimates by United Nations Population Division (2009b), summarized in Figure 1.2, imply that overall mortality (population weighted) almost doubles from 1.1 percent to 1.9 percent for females, and that it increases from 1.2 percent to 2.0 percent for males. The increase is most pronounced between ages 15 and 49, where annual mortality increases from 0.5 percent to 1.6 percent for females, and from 0.6 percent to 1.4 percent for males. HIV/AIDS-related mortality for women peaks at an earlier age (30–34) and at a higher level than for males, reflecting an earlier average age of infection and somewhat higher HIV prevalence among women.

An immediate consequence of increased mortality is a decrease in the rate of population growth. Additionally, increased morbidity and mortality among women result in a decline in reproduction rates, reinforcing the slowdown in population growth.[4] According to the estimates of the United Nations Population Division (2009b), the slowdown in population growth has been dominated by increased mortality so far. For Malawi, for example, the estimates suggest that population growth in 2000–05 is 0.8 percent lower (3.4 percent rather than 2.6 percent) as a consequence of HIV/AIDS, reflecting an increase in mortality of similar magnitude (from 1.0 percent to 1.8 percent).

One useful point of reference regarding the mortality and health impact of HIV/AIDS are the Global Burden of Disease estimates produced by the WHO (2008b), because they can be used to place HIV/AIDS in the context of other diseases, and as they also include estimates of "disability-adjusted life years" (DALYs) lost owing to various diseases or other reasons. Overall, WHO (2008b) estimates

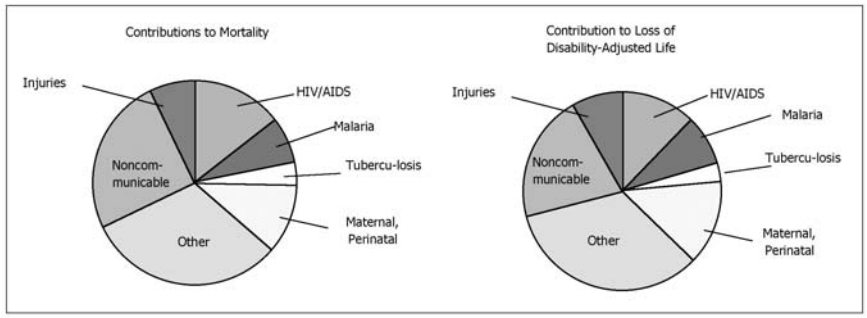

Figure 1.3 Sub-Saharan Africa: Contributions to Burden of Disease, 2004
[a] Contributions to Mortality
[b] Contribution to Loss of Disability-Adjusted Life Years
SOURCE: Data from WHO (2008b).

that the contribution of HIV/AIDS to mortality in sub-Saharan Africa amounted to about 14 percent of the total burden of disease, accounting for 1.7 million out of a total of 11.7 million deaths.[5] In terms of the loss in DALYs, the contribution of HIV/AIDS is less pronounced, at about 12 percent of the total. The less than proportionate role of HIV/AIDS in terms of lost DALYs primarily reflects that infant mortality accounted for only about 14 percent of HIV/AIDS-related deaths, whereas it accounted for 41 percent of deaths overall.

Regarding the age profile of HIV/AIDS-related deaths, the estimates produced by WHO (2008b) broadly match those included in United Nations Population Division (2009b). The role of HIV/AIDS-related mortality is most pronounced in the 30–44 age bracket, where HIV/AIDS-related mortality accounted for 40 percent of mortality among men and 56 percent of mortality among women.

Another important aspect of the health impact of HIV/AIDS regards the distinction between mortality and morbidity (or death and disability, in WHO diction). For HIV/AIDS, the years lost to disability play a subordinate role (9 percent of DALYs lost), similar to malaria and tuberculosis where years lost to disability account for 11 percent and 10 percent, respectively, of the loss in DALYs. These rates are markedly different from those for maternal conditions or noncommunicable diseases where years lost to disability account for about half of the loss in DALYs.

III. Health, HIV/AIDS, and Growth

Our discussion now turns to the available literature on the impact of HIV/AIDS on growth. We proceed in three steps. First, we look at recent trends in economic growth in countries with high HIV prevalence, and check if we can—literally—

see the growth impact of HIV/AIDS. This discussion is complemented by some empirical analysis. Second, we discuss some of the literature on health and growth, which might be directly relevant, but also motivates research focusing on the economic impacts of HIV/AIDS. Finally, we review the literature specifically addressing the impacts of HIV/AIDS on growth.

HIV/AIDS and growth—some data

Figure 1.4 illustrates trends in the growth rates of real GDP (Figure 1.4A) and real GDP per capita (Figure 1.4B) from 1990–2007 for the 10 countries with the highest HIV prevalence rates at the end of 2005 (all in sub-Saharan Africa).[6] We do not

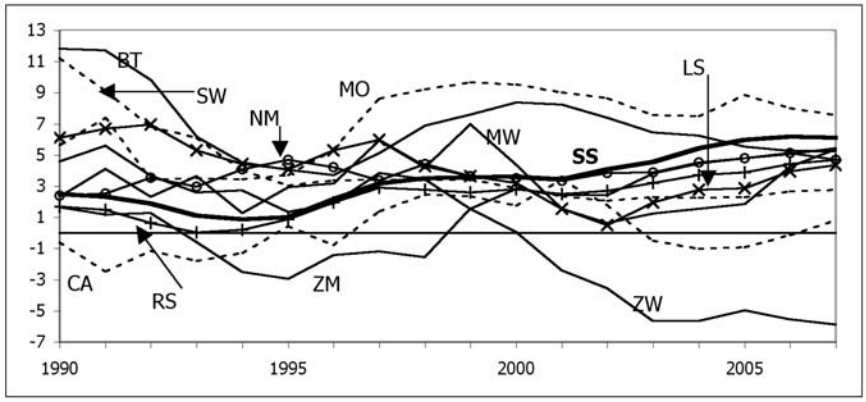

Figure 1.4 Growth Trends in 10 Countries with High HIV Prevalence, 1990–2007
Figure 1.4a Growth of Real GDP (Average annual growth in 5-year period ending in year indicated)

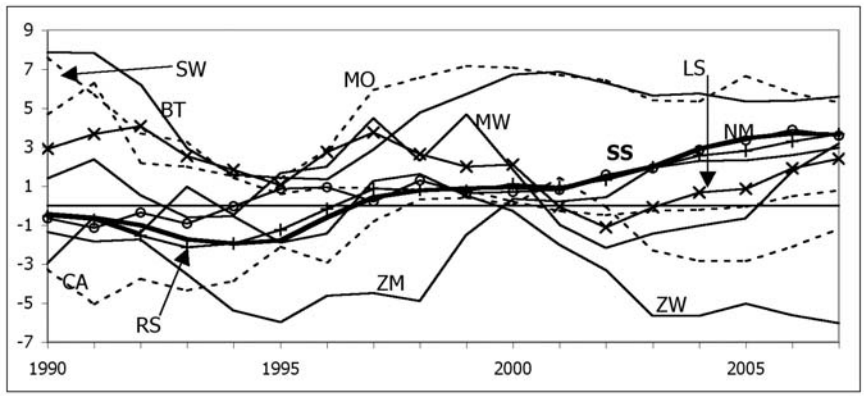

Figure 1.4b Growth of Real GDP per Capita (Average annual growth in 5-year period ending in year indicated)
SOURCE: Data from IMF (2009).

see a dramatic decline in real GDP growth in countries with high HIV prevalence, although the data suggest that growth in these 10 countries may have decelerated somewhat relative to the average for sub-Saharan Africa, where growth has increased during the period shown. Regarding changes in GDP per capita, the picture is similar (Figure 1.4B). This seems counterintuitive at first sight, as HIV/AIDS results in a decline in population growth, so that the growth of GDP per capita in countries with high HIV prevalence should accelerate relative to GDP growth. However, many of the countries with high HIV prevalence are further advanced in the demographic transition, with higher life expectancies (before the arrival of HIV/AIDS) and lower fertility rates than the average for sub-Saharan Africa. For this reason, the rate of population growth, over the 1990–2007 period, declines less in the countries with high HIV prevalence than in the rest of sub-Saharan Africa.

Taking a closer look at the data presented in Figure 1.4, it appears that some of the largest swings in GDP growth shown are arguably not related to HIV/AIDS. Growth in Swaziland is high in the early years shown because it benefited from foreign direct investment serving the South African market until the end of apartheid, but the country has lost this competitive advantage. GDP growth in Botswana is dominated by the diamond sector, the production of which has plateaued for geological reasons (and preceding the escalation of the HIV epidemic in that country); and the collapse in economic growth in Zimbabwe in the later years shown is attributed by most observers to the adverse impact of economic policies.

Health and growth

The study of the impact of health on growth is complicated by an apparent interdependency between health and income.[7] Additionally, the correlation between health and growth (or income) may reflect underlying factors that affect both health and growth (Deaton 2006). While this issue is rarely acknowledged explicitly in the broader growth literature, it is an important issue in some of the recent literature addressing specifically the impacts of health on productivity and growth.

A useful workhorse for conceptualizing the impact of health on growth (and one frequently referred to in the relevant literature) is the framework developed by Mankiw, Romer, and Weil (1992) which augments the classical Solow growth model by allowing for accumulation of *human* as well as physical capital, with an aggregate production function of the form

$$Y_t = K_t^{\alpha} H_t^{\beta} (A_t E L_t)^{1-\alpha-\beta}, \tag{1}$$

where Y, K, H, and L stand for aggregate output, the stock of physical capital, the stock of human capital, and the size of the labor force.[8] One addition to the

Mankiw-Romer-Weil (MRW) framework that we introduce is an efficiency parameter *E*, which stands for the effectiveness of labor inputs, in addition to a productivity parameter *A* capturing technological progress (assumed to grow at rate *g*). Dividing through by effective units of labor *AEL*, the production function becomes

$$y_t = k_t^{\alpha} h_t^{\beta}, \tag{2}$$

where $y_t \equiv \frac{Y}{AEL}$, $k_t \equiv \frac{K}{AEL}$, and $h_t \equiv \frac{H}{AEL}$. The accumulation of *k* and *h* is described by

$$\dot{k}_t = s_k y - (n + g + \delta_k)k, \text{ and} \tag{3}$$

$$\dot{h}_t = s_h y - (n + g + \delta_h)h. \tag{4}$$

This means that the accumulation of physical capital (relative to effective units of labor) depends on investments (= savings, S_k) in physical capital and a term that captures the depreciation of physical capital δ_k and the dilution that occurs through growth *n* in the size of the labor force *L* and technological progress (with *A* growing at rate *g*). The terms in the equation describing the accumulation of human capital are defined correspondingly.

One further extension to the MRW framework is embodied in Eqs. (3) and (4), as we allow the depreciation rates of physical capital (δ_k) and human capital (δ_h) to differ. Specifically, we think of δ_h as the mortality rate among the population, with the following reasoning (abstracting, for a moment, from technological progress *g*): To maintain some capital-labor ratio, it is necessary to make investments to increase the capital stock by the same rate as the population growth rate *n*. However, *human* capital is embodied in people. To retain a constant level in *h*, it is therefore necessary to make investments $s_h y$ to bring new entrants to the labor force "up to speed" with their peers. The rate at which new workers enter the labor force is equal to the (net) growth rate of the labor force *n*, plus the rate at which new entrants replace workers who died, δ_h, which motivates our interpretation of the depreciation rate for human capital.

To link key parameters of the growth model to health indicators, it makes sense to operate in terms of birth rates and mortality rates, rather than the rate of population growth (affected by births and deaths) and mortality. We therefore define the birth rate μ and the mortality rate ω. The parameters of the growth model are linked to these demographic/health variables as $n = \mu - \omega$, and $\delta_h = \omega$. Substituting for *n* and δ_h, in Eqs. (3) and (4) yields

$$\dot{k}_t = s_k y - (\mu - \omega + g + \delta_k)k, \tag{5}$$

$$\dot{h}_t = s_h y - (n + g + \delta_h)h. \text{ and} \tag{6}$$

Solving Eqs. (2), (3), and (4) for the steady state level of output per efficiency unit yields

$$y_t^* = \left(\frac{s_k}{\mu - \omega + g + \delta_k} \right)^{\frac{\alpha}{1-\alpha-\beta}} \left(\frac{s_h}{\mu + g} \right)^{\frac{\beta}{1-\alpha-\beta}}. \tag{7}$$

Additionally, one could be interested in output per capita (Y/L), which—along the steady-state growth path—follows

$$\left(\frac{Y}{L} \right)^* = AEy_t^* = AE \left(\frac{s_k}{\mu - \omega + g + \delta_k} \right)^{\frac{\alpha}{1-\alpha-\beta}} \left(\frac{s_h}{\mu + g} \right)^{\frac{\beta}{1-\alpha-\beta}}. \tag{8}$$

In the framework described by Eqs. (1) – (6), changes in health can affect the steady-state level of output along numerous channels:

1) An increase in mortality rates would increase GDP per capita through its impact on the accumulation of physical capital (Eq. (5)). As more people depart from the labor force, the capital/labor ratio increases.
2) A decline in birth rates would raise GDP per capita through its impact on physical capital accumulation, as the existing capital stock is less diluted by new arrivals (Eq. (5)). At the same time, it would become less expensive to sustain a given level of human capital; alternatively, for given investment rates in human capital, the steady state level of *h* would rise (Eq. (6)).[9]
3) A decrease in the (average) efficiency of labor *E*, as a result of a deteriorating health state among the population, would decrease *Y*/*L*.
4) A decline in the investment rate in physical capital, to accommodate higher health expenditures or reflecting a deteriorating economic outlook, would result in a decline in the steady-state capital stock and output per capita.[10]
5) A decline in the investment rate in human capital would result in a decline in *h*. In addition to the factors noted for physical capital, the decline in human capital could also reflect a more pessimistic outlook regarding the expected returns to human capital (which decline as expected mortality increases).
6) Additionally, a decline in the health outlook may reduce the steady-state growth rate *g*, for example, if there is a feedback effect from human capital to the rate of technological progress.

In the literature on determinants of growth, health is typically discussed in the context of human capital. Barro and Sala-i-Martin (1995) adopt "an empirical framework that relates the real per capita growth rate to . . . the stock of human

capital in the forms of educational attainment and health," proxied by life expectancy at birth (421). Bosworth and Collins (2003) largely equate human capital with educational attainment, but also include life expectancy "as a measure of health." Weil (2004) discusses health as one of the forms of human capital (the other being education), and provides some discussion of the interactions of health and income (with higher income also "buying" better health), and of the links between climate, disease, and productivity.

More recently, Durlauf, Johnson, and Temple (2005) find that life expectancy appears as the most common "health indicator" used in the literature; others include the prevalence of malaria and survival rates (i.e., the probability of reaching some age *y*, starting at age *x*). Caselli (2005, 709), in his discussion of "accounting for cross-country income differences," finds that, "a correction for differences in health status is a first-order requirement in the measurement of human capital," when the adult mortality rate is used as a health proxy. Another health-related variable discussed by Caselli (2005) is "experience," i.e., the average level of work experience among the population, a variable that is influenced by demographic and health variables.

The analysis by Bloom, Canning, and Sevilla (2004) is based on a similar framework as the one outlined above, using a measure of human capital that includes educational attainment (years of schooling, *s*); health (life expectancy, *h*); and "experience" of the workforce. They suggest that "a one-year improvement in a population's life expectancy contributes to an increase of 4 percent in output" (11).[11]

Bhargava and others (2001) focus on the link between growth and the adult survival rate (i.e., the probability of surviving to age 60 after reaching age 15), which arguably is a better measure of health as it relates to productivity since it excludes child mortality. They find a positive effect of adult survival rates on GDP growth only for low-income countries. Lorentzen, McMillan, and Wacziarg (2005) suggest that mortality is an important determinant in explaining growth (the coefficients cannot easily be interpreted, as three different measures of mortality are included in the regressions), and that adult mortality may affect fertility rates, physical capital investment rates, and school enrolment.[12]

Weil (2007) is among the more recent studies adopting approaches that take into account the endogeneity of health outcomes. His approach involves transforming available estimates from microeconomic and historical studies on the link between height and labor productivity into estimates of more commonly used health indicators like adult survival rates.[13] Weil finds that health differences account for about 10 percent of the cross-country variation in income. Acemoglu and Johnson (2006) address the issue of interdependency of health outcomes and income by focusing on declines in mortality that can be attributed to the international epidemiological transition that began in the 1940s (i.e., changes in

mortality that can be arguably attributed to medical innovations rather than economic factors). They find no evidence suggesting that the large exogenous increase in life expectancy led to a significant increase in per capita economic growth in the longer run.

A number of papers have developed a more explicit analytical framework focusing on the impact of changes in mortality on human capital accumulation and growth. Kalemli-Ozcan, Ryder, and Weil (2000) develop a model in which an agent's decisions to invest in human capital depend on the anticipated mortality. They suggest that the negative impact of increased mortality on schooling would double the elasticity of steady-state output with respect to changes in the mortality rate. Kalemli-Ozcan (2002) proposes that an increase in mortality also results in an increase in demand for children and a decline in investment in each child. Another study linking mortality, educational attainment, and fertility, along similar lines, is Soares (2005), although his paper is not primarily geared toward the growth implications.

Health and growth

The adverse health impacts of HIV/AIDS have motivated a body of literature dealing specifically with the growth impacts of HIV/AIDS. The discussion of the links between health and growth already provides many pointers regarding the economic impacts of HIV/AIDS, and indeed motivates much of the applied literature in this area. However, the findings of that literature do not necessarily translate directly to the study of the impacts of HIV/AIDS, as the health consequences of HIV/AIDS are different from health developments underlying the literature on health and growth.

The empirical evidence regarding the effects of HIV/AIDS on economic growth is weak. One early study, Bloom and Mahal (1997), does not find any impact of HIV/AIDS on growth,[14] while Mahal (2004), updating this earlier work, finds a negative (but insignificant) impact. McDonald and Roberts (2006) specify a model in which child mortality enters growth regressions as an explanatory variable, and in turn depends on HIV prevalence. Their estimates imply that an HIV prevalence of 10 percent initially reduces growth by 1.2 percent, and that this effect is highly persistent. Similarly, Dixon, McDonald, and Roberts (2001, 2002) and Bonnel (2000), specify models in which HIV/AIDS negatively affect economic growth through declining life expectancy. Among recent studies, Papageorgiou and Stoytcheva (2009) find a negative (but very small) impact of reported AIDS cases on growth. Lovász and Schipp (2009) report a negative link between HIV/AIDS and HIV prevalence, but caution that it is not robust.

One striking aspect of the empirical literature on the growth impacts of HIV/AIDS is the fact that the most "successful" approaches adopt indirect approaches

(from HIV/AIDS, to life expectancy or mortality, to growth), while the evidence from direct approaches (adding HIV prevalence or mortality to growth regressions) is much weaker. This suggests that misspecification may play a role in the "indirect" approaches, merging one well-established correlation between growth and life expectancy (or mortality) from the cross-country literature with the apparent health impact of HIV/AIDS. Alternatively, the general growth literature may reflect longer-term trends; the discrepancy between the findings from the direct and indirect approaches may, therefore, reflect that the impact of HIV/AIDS has not fully materialized yet.

A number of studies of the impact of HIV/AIDS on the microeconomic level are also relevant for a macroeconomic analysis. Fox and others (2004), and Morris, Burdge, and Cheevers (2001) find evidence regarding the impacts of HIV/AIDS on workers' productivity, although these findings cannot easily be generalized. Regarding access to education, Fortson (2010) finds that areas with a higher level of HIV prevalence experienced a decline in schooling.

The increasing recognition of HIV/AIDS as a serious development issue in the early 1990s has motivated a "first wave" of studies modeling the macroeconomic effects of HIV/AIDS. Two early studies apply a one-sector neoclassical growth model similar to the one outlined above to assess the potential growth impacts of HIV/AIDS in Tanzania (Cuddington 1993a) and Malawi (Cuddington and Hancock 1994). Cuddington (1993b) and Cuddington and Hancock (1995) extend the analysis to a dual economy model; Over (1992) also uses a dual-economy framework and allows for different categories of labor inputs (according to skill level). One common feature of these studies is that the size of the impact of HIV/AIDS on GDP per capita is small, as negative impacts on human capital, savings, or productivity are offset by an increase in the capital-labor ratio brought about by increased mortality and the corresponding fall in the rate of population growth.

Most recent work expands the analysis either by introducing a more differentiated sectoral structure, or by including behavioral relationships with important (and sometimes large) implications for the long-run impact of HIV/AIDS.

Kambou, Devarajan, and Over (1992) apply a "computable general equilibrium" (CGE) model to studying the macroeconomic impacts of HIV/AIDS, distinguishing 11 sectors which differ with respect to the intensity of inputs of rural labor, urban unskilled labor, and skilled labor, with a share of skilled labor that ranges from 0 percent (food crops) to 28 percent (public services). They find that the economy appears most vulnerable to shocks to the supply of skilled labor, as this factor is disproportionally used in sectors accounting for a relatively large share of GDP. Arndt and Lewis (2001) and Arndt (2006) follow similar approaches, also including more detailed assumptions regarding the impact of HIV/AIDS on spending patterns (Arndt and Lewis 2001) or discussing policy interventions to offset an adverse impact of HIV/AIDS on access to education. The studies by

Arndt and Lewis (2001, on South Africa) and Arndt (2006, on Mozambique) find a large impact of HIV/AIDS on GDP growth, reflecting strong assumptions on the impact of AIDS incidence on productivity growth.[15] Thurlow, Gow, and George (2009, focusing on KwaZulu-Natal) complement the analysis with a discussion of the impact of HIV/AIDS across households.

A number of studies (Ellis, Laubscher, and Smit 2006; ING Barings South African Research 2000; and Laubscher, Visagie, and Smit 2001) have adapted large macroeconomic models designed for economic policy analysis to the study of the economic impacts of HIV/AIDS. While the sectoral structure of these models compares to the CGE models described above, they are also designed to capture demand-side effects of HIV/AIDS on GDP (for example, owing to increased demand for health expenditures), but return similar impacts of HIV/AIDS on growth as the CGE models.[16] Ellis, Laubscher, and Smit (2006) is also noteworthy, because it is one of the few studies available that explicitly addresses the economic implications of increasing access to ART.

Several recent studies have explored more complex and indirect effects of HIV/AIDS which arise when economic agents adjust their behavior in response to the macroeconomic and disease environment. Understanding these factors is important especially in order to project the long-term economic consequences of HIV/AIDS. Robalino, Voetberg, and Picazo (2002) argue that increased mortality will result in a decline in the savings rate and investment that exceeds any direct effects arising from higher health expenditures. In Corrigan, Glomm, and Mendez (2005), HIV/AIDS also reduces investments in children's education, as higher mortality risk means that parents are less likely to benefit in old age from investments in their children.[17] Bell, Devarajan, and Gersbach (2006) cover similar ground but provide a more elaborate model of the growth of human capital. In this study, the most significant impacts of HIV/AIDS arise as early mortality disrupts the transmission of knowledge between generations.

A related group of studies focuses on the potential impact of HIV/AIDS on fertility. Young (2005, 2007) focuses on two effects of HIV/AIDS, namely the adverse impact on the human capital accumulation of children, and the reduction in fertility that arises through a reduction in unprotected sex and because HIV/AIDS results in an increase in the of scarcity of labor (as the capital/labor ratio rises) and thus in the value of women's time. Young (2005) argues that the fertility effect, primarily through reduced population growth, translates into increased GDP per capita; Young (2007) provides some empirical analysis in support of this argument. However, these findings run contrary to earlier work on the links between mortality and fertility (e.g., Soares (2005); Juhn, Kalemli-Ozcan, and Turan (2008a); and Fortson (2009)).

In summary, the available evidence suggests that the impact of HIV/AIDS on economic growth (both of real GDP and real GDP per capita) has been small so

far. The literature applying a neoclassical growth framework (and the related CGE and large-scale macroeconomic models) provide some pointers as to why this is the case for GDP per capita, identifying adverse impacts of HIV/AIDS (e.g., reduced savings and productivity), but also an increase in the capital-labor ratio brought about by reduced population growth. If this is true, and the impact of HIV/AIDS on GDP per capita is small, this would mean that the rate of GDP growth, in the long run, would decline roughly in line with reduced population growth.[18] Looking ahead, there is considerable uncertainty regarding the long-term impacts of HIV/AIDS, and concern in particular regarding the large numbers of orphans in countries with high HIV prevalence and the implications for the accumulation and transmission of human capital.

A puzzling aspect of the evidence on the impacts of HIV/AIDS on growth is the fact that the impact appears much lower than predicted by the literature on growth and health (as far as it uses life expectancy or mortality as a meter for health). Within the confines of this chapter, we can only point to some possible explanations. First, HIV/AIDS, unlike other diseases, is a very lethal disease, following a largely asymptomatic period. Its contribution to sickness (as measured by WHO (2008b)) is therefore much smaller than its contribution to mortality, which could mean that the impact of HIV/AIDS on productivity could be smaller than suggested by cross-country evidence conditioning economic variables on mortality or life expectancy.[19] Second, the positive correlation between health outcomes (such as life expectancy) and economic outcomes could reflect factors (such as the quality of institutions) which have an impact on both health and income (as suggested by Deaton (2006)), and which are not directly affected by HIV/AIDS. Relatedly, much of the empirical literature does not adequately capture the endogeneity of health outcomes and may therefore produce biased results. Third, some of the correlation between health indicators and economic variables could reflect longer-term effects (e.g., working through the impacts of impaired health or orphanhood on education) which, in the case of HIV/AIDS, have not fully materialized yet.

IV. HIV/AIDS, Economic Growth, and the Structure of the Economy

In our discussion of the impacts of HIV/AIDS on economic growth, we found that the evidence suggests that HIV/AIDS did not have a large impact on the growth or level of GDP or GDP per capita so far. In this section, we discuss some factors that may contribute to this finding but have played a subordinate role in the literature so far—notably the dual structure of economies and high degrees of inequality found in many economies with high HIV prevalence, and the role of resource extraction in some of these economies.

Data

The extent of inequality in many economies with high HIV prevalence is very high. This is illustrated in Table 1.1, providing summary indicators for the distribution of income for the nine countries with the highest HIV prevalence (at the end of 2007). These data should be interpreted with caution, as some of the data are more than a little outdated.[20] However, more recent country-level data (applying somewhat different methodologies) for Namibia, Lesotho, and Botswana are broadly consistent with the data presented in Table 1.1, suggesting that income inequality has declined moderately in Namibia and Lesotho, although the extent of inequality remains among the highest in sub-Saharan Africa (and globally).

The apparent correlation between high degrees of inequality and high HIV prevalence is sometimes interpreted causally. For example, Piot, Greener, and Russell (2007) discuss links between poor governance, inequality, and HIV prevalence, pointing at the "clear pattern of association between income inequality . . . and HIV prevalence across countries in sub-Saharan Africa" (1571). They find that "inequality is a stronger predictor of HIV prevalence than poor governance," and suggest "that economic growth that is not pro-poor and that leads to greater income inequality may even fuel the HIV epidemic" (1572).

We find that the data do not support these findings regarding the role of inequality. Economic transformation in the context of development can be associated with high degrees of inequality, and it is apparent that the economies with high degrees of inequality in Table 1.1 include some of the most advanced economies in sub-Saharan Africa. Table 1.2 summarizes some regressions exploring the

Table 1.1. Income Distribution in Nine Countries with High HIV Prevalence

	Share in Income or Expenditure (Percent)					
	Survey year	Poorest 10%	Poorest 20%	Richest% 20%	Richest 10%	Gini index
Namibia	1993	0.5	1.4	78.7	64.5	74.3
Lesotho	1995	0.5	1.5	66.5	48.3	63.2
Botswana	1993	1.2	3.2	65.1	51	60.5
South Africa	2000	1.4	3.5	62.2	44.7	57.8
Zambia	2004	1.2	3.6	55.1	38.8	50.8
Swaziland	2000–01	1.6	4.3	56.3	40.7	50.4
Zimbabwe	1995–96	1.8	4.6	55.7	40.3	50.1
Mozambique	2002–03	2.1	5.4	53.6	39.4	47.3
Malawi	2004–05	2.9	7.0	46.6	31.8	39.0
Average, 30 countries[a]		2.0	5.0	53	37	47.5

SOURCE: UNDP (2008)

[a] Unweighted average, thirty sub-Saharan countries for which data were available from UNDP (2008).

Table 1.2 HIV Prevalence, GDP per Capita, and Inequality

	Dependent variable: HIV prevalence (2007)			
Constant	–12.9**	3.5**	–5.8	4.4
	(2.1)	(2.6)	(–1.0)	(0.8)
Gini coefficient	0.43***		0.21	0.007
	(3.3)		(1.66)	(0.06)
GDP per capita (1995)		0.006***	0.005***	–0.001
		(4.6)	(3.2)	(–0.35)
SACU[a] dummy				17.9
				(3.8)
Number of observations	30	30	30	30
R^2	0.28	0.43	0.48	0.67

SOURCE: Author's estimates based on data from IMF (2009), UNDP (2008), and UNAIDS (2008a).
NOTE: One, two, and three stars indicate estimated coefficients significant on a 10-, 5-, and 1-percent level of confidence, respectively.
[a] SACU (South African Customs Union) includes South Africa, Botswana, Lesotho, Namibia, and Swaziland.

correlation between HIV prevalence, the Gini coefficient, and GDP per capita. Clearly, GDP per capita is much more closely correlated with HIV prevalence than the Gini coefficient (which turns—just—insignificant at the 10 percent level if GDP per capita is included in the regression). More problematic for hypotheses regarding economic determinants of HIV is the fact that the coefficients for both the Gini coefficient and GDP per capita are not robust and essentially fall to zero when a dummy for the five South African Customs Union (SACU) countries is included. Thus, apart from the fact that HIV prevalence is high in the five SACU countries (which also happen to feature relatively high levels of GDP per capita and income inequality), the cross-country evidence does not support the hypothesis that HIV prevalence is related to inequality or GDP per capita.

However, inequality is nevertheless relevant for our analysis of the economic impacts of HIV/AIDS. Below, we will argue that economic activity, in terms of value added or incomes, is concentrated in a fairly narrow segment of the economy in many countries facing a severe HIV epidemic. This is captured by the notion of a dual economy which plays a role in some of the studies of the macroeconomic impact of HIV/AIDS discussed above. Alternatively, one may distinguish between manufacturing and services on one hand, and agriculture (characterized by a lower level of value added per head) on the other hand.

From Table 1.3, we see that value added per employee can differ substantially across major sectors, notably between industry and agriculture, where value added per employee differs between the sectors by a factor of up to 20 (for Botswana); the second highest gap (14) occurs for Zambia. It is not a coincidence that these

Table 1.3 Employment and Value Added Across Sectors, Six Countries

		Share of Employment (Percent)			Value Added per Employee (2000 US$)		
Country	Year	Agriculture	Industry	Services	Agriculture	Industry	Services
Botswana	2003	21.2	22.6	56.1	409	8,231	2,909
Lesotho	1997	56.5	15.2	28.2	432	4,452	2,331
Namibia	2000	31.1	12.2	56.0	1,075	7,088	3,305
South Africa	2003	10.3	24.5	65.1	2,356	8,750	6,761
Zambia	1998	70.0	7.0	23.0	188	2,603	1,346
Zimbabwe	1999	60.0	11.8	24.3	311	1,952	2,238

SOURCE: Data from World Bank (2008b), and author's calculations.

are economies which feature a large mining sector. In Botswana (IMF 2008a, 2007), exports of diamonds accounted for about 30 percent of GDP in 2005–07 (and exports of copper nickel for around 4 percent of GDP); in Zambia, exports of metals accounted for 28 percent of GDP in 2006 (IMF 2008b); and in Namibia (also showing high value added in the industrial sector in Table 1.4 below), exports of diamonds and other minerals accounted for 21 percent of GDP in 2006 (IMF 2008c).

The fact that resource extraction is associated with a high degree of concentration in terms of the distribution of value added across the economy is illustrated by data on the value added per employee from Namibia, which specifically account for the mining sector (Table 1.4). We see that employment in the mining sector is miniscule as a percentage of the total labor force. As value added per employee is very high (US$71,500—25 times the level of value added per employee observed in agriculture), the share of mining in GDP is much higher (8.6 percent).[21]

Table 1.4 Namibia: Employment and Value Added Across Sectors, 2004

Labor Force Status	No. of People (Thousands)	No. of People (Percent of Total)	Value Added per Employee
Total employment	385	78.1	$13,300
Mining	8	1.6	$71,500
Agriculture	103	20.9	$2,800
Other employment	275	55.8	$15,500
Public sector	83	16.8	n.a.
Private sector	192	38.9	n.a.
Unemployment	108	21.9	n.a.
Labor force	493	100.0	n.a.

SOURCE: Data from Namibian Labor Force Surveys, as quoted in IMF (2008d).

The Structure of the economy and the macroeconomic impact of HIV/AIDS

The uneven structure of many economies facing severe HIV epidemics does have some implications for the macroeconomic impacts of HIV/AIDS. Very generally, the macroeconomic impact of HIV/AIDS is dominated by its impact in the formal sector. Correspondingly, the impacts in the informal or the agricultural sector carry little weight, even though they account for the livelihoods of a large share of the population. Additionally, considering the relatively low levels of value added for the agricultural sector reported in Table 1.3, the impact of HIV/AIDS in that sector could exacerbate poverty even though aggregate indicators like GDP per capita show a small impact of HIV/AIDS. (We will discuss this issue in some more detail in the next section.)

One of the impacts through which HIV/AIDS may affect growth is the impact on the productivity of sick workers. The most compelling evidence comes from the agricultural or agro-processing sector. For example, Morris, Burdge, and Cheevers (2001) document productivity losses among workers in a sugar mill, while Fox and others (2004) estimate that tea pickers on an estate in Kenya who retired or died from AIDS-related causes earned 16 percent less in their penultimate year at work and 17.7 percent less in their final year. These estimates, however, cannot be transformed into estimates of losses in labor productivity on an aggregate level, as the estimates regard demanding physical labor which is not typical for the economy overall. Indeed, Fox and others provide some indirect evidence suggesting that average productivity losses on the plant level are lower than these direct effects, as workers who cannot do hard physical labor may get shifted to physically less demanding jobs.

Additionally, companies can incur certain expenditures to mitigate the losses associated with increased mortality and morbidity among staff. In addition to just hiring more people,[22] they can invest more in training to compensate for higher turnover or increase the flexibility of staff across tasks. Additionally, they can provide or finance medical services that would mitigate the impacts of HIV/AIDS. (In this context, one of the most significant developments is the expansion in access to ART, which we will return to below.) Additionally, it is important to bear in mind that, according to WHO burden of disease estimates, the extent of morbidity, relative to mortality, is relatively low for HIV/AIDS. Compared to other health conditions, times lost to sickness for HIV/AIDS are relatively small until the last stages of the disease preceding death. Thus, the primary costs associated with HIV/AIDS may be related to increased turnover rather than declining productivity on the job.

These conjectures are consistent with perceptions of the impact of HIV/AIDS in the business community, where companies would typically note an impact of HIV/AIDS on their employees but not regard it as one of the most critical issues

facing the company. For example, according to Ellis and Terwin (2005), only between 0 percent (motor sector) and 16 percent (transport sector) reported a significant impact of HIV/AIDS on businesses, although a much larger proportion of the same businesses—between 22 percent (motor sector) and 52 percent (transport sector)—anticipated a significant impact over a five-year period. In a study focusing on small- and medium-sized enterprises, Connelly and Rosen (2005) report that that HIV/AIDS ranked 9th of 10 major business concerns (although some higher-ranking concerns, such as worker productivity, are related to HIV/AIDS).

One consistent feature of studies of the business response to HIV/AIDS is that the response differs across companies (and sectors) depending on the size of the companies. Ellis and Terwin (2005) report that almost all large companies have implemented an HIV awareness program, while only about one-third of small companies have done so. In this regard, Connelly and Rosen (2005) point at the role of HIV awareness among managers of small and medium enterprises, and at barriers (essentially arising from scale economies) to extending HIV services to small companies.

The points we have made about dual economies and asymmetries in the impact of and the response to HIV/AIDS across companies or sectors applies in particular to resource extraction, which is dominated by large companies. Historically, large mining companies were among the first to address the impact of HIV/AIDS and implement policies to address (and mitigate) the impact of the epidemic.[23] However, there is one aspect that is unique to resource-extracting industries—rents from resource extraction may account for a large proportion of value added.[24] Among other macroeconomic implications (such as the disproportionate role in government revenues), the presence from large rents from resource extraction implies that wages are not a good indicator for the marginal contribution of an employee to a company's output. This is apparent, for example, from the labor market data from Namibia quoted in Table 1.4, estimating the value added per employee at $71,500. In this setting, it is likely that stakeholders in the mining operations find it cost-effective to incur substantial outlays to prevent disruptions to production processes associated with increased morbidity or mortality among employees, and mining output may well remain unchanged, even in the context of a serious epidemic.

Another consequence of the presence of large rents from resource extraction is that the models commonly applied to studying the macroeconomic impacts of HIV/AIDS are misleading.[25] Two studies addressing the macroeconomic impacts of HIV/AIDS in Botswana—a textbook example for an economy built on resource extraction—implicitly acknowledge that the models commonly applied to the study of the macroeconomic impacts of HIV/AIDS are ill-suited to analyze an economy where rents from resource extraction play a dominant role. BIDPA

(2000) assume that mineral rents are unaffected by HIV/AIDS (which would be consistent with our reasoning), while MacFarlan and Sgherri (2001) restrict their analysis to the non-mining sector.

Role of increased access to antiretroviral treatment

The increase in access to access to ART over the last year has also transformed the economic impact of HIV/AIDS, by reducing mortality among people living with HIV/AIDS and extending their life expectancy.[26] To the extent that ART reduces mortality and morbidity among the working-age population, we would also expect to see reduced macroeconomic economic impacts.[27] However, access to ART is far from universal; the distribution of access to treatment across the population has implications for the economic impacts of HIV/AIDS.

Globally, access to ART in low- and middle-income countries has increased from about 400,000 people at the end of 2003 to about 4 million people at the end of 2008, corresponding to a treatment coverage rate of 42 percent (WHO, UNAIDS, and UNICEF 2009). For sub-Saharan Africa, the increase is much more pronounced, from 100,000 people at the end of 2003 (coverage: about 2 percent) to 2,925,000, i.e., a treatment coverage rate of 43 percent. In spite of this large increase, the majority of the population who would require treatment does not receive it, which means that—through explicit or implicit mechanisms—rationing of access to ART does occur. In this regard, Rosen et al. (2005) distinguish between explicit mechanisms (such as programs prioritizing access to treatment for pregnant women) and implicit mechanisms. Below, we argue that implicit rationing contributes to mitigating the macroeconomic impacts of HIV/AIDS.

One implicit rationing mechanism is the cost of accessing treatment. Even where treatment is provided for free, patients have to incur the costs of accessing health facilities, which can be substantial for poor households. Rosen et al. (2007d) find that the average cost of a visit to a health clinic for patients receiving ART is R120 (about $20), in addition to travel and waiting time, and that it is incurred at least six times in the year in which patients start ART. Together with other costs such as non-prescription medicines, special foods, other medical expenses, etc., these are high costs for a substantial portion of the population. As a key aspect of the costs of accessing treatment is transportation, this example understates obstacles to access to treatment in rural areas where the density of health facilities is lower. Another dimension of rationing is inequity in the quality of services provided across sites. In this regard, Scott et al. (2005) analyze the quality of HIV/AIDS-related services and find large differences between an urban and two rural sites.

The other element of implicit rationing that is particularly relevant for our discussion regards the link between access to health services and the employment status of a person seeking health services. Many large companies provide access

to health services to their employees, either directly or through some financial arrangement with health providers. These facilities were instrumental in providing access to ART before the large increase in access through public health services experienced since 2003. Additionally, large employers are more likely to provide medical insurance for employees in lieu of, or in addition to, company-controlled health facilities.

In addition to the availability of health services through employment relations (an important factor in a context where access to health services is uneven across the population), there are studies suggesting that provision of ART does yield immediate financial benefits to companies extending it to their employees. Based on an assumed treatment cost of US$360 per year, Rosen et al. (2006) find that providing ART saves money for all categories of employees (managers, skilled workers, and unskilled workers) for a number of companies, although this may not hold for labor-intensive, low-technology industries where the costs of labor attrition are relatively low.

Thus, there is substantial circumstantial evidence suggesting that access to ART is higher among employees in the formal sector, especially those working for large companies. This adds another dimension to our argument that key sectors of the economy, in terms of the contribution to GDP, but not necessarily in terms of the number of people depending on them, have certain tools at their disposal to mitigate the adverse impacts of HIV/AIDS. This may help explain the small magnitude of the macroeconomic impacts of HIV/AIDS observed so far.

V. Impact of HIV/AIDS on Inequality

Some of the factors described in the previous section—such as privileged access to health services for people employed in or associated with the formal sector—while mitigating the magnitude of macroeconomic impacts of HIV/AIDS, have distributional implications. Uneven access to health services and other interventions, which—as we argue—mitigates the impacts of HIV/AIDS on GDP, exacerbates existing inequities across the population. Another reason why an analysis of the distributional impacts of HIV/AIDS is crucial for understanding and evaluating the economic impacts of the epidemic flows from the uneven impact of the epidemic across households (primarily depending on whether a household is directly affected by the epidemic or not). Thus, small impacts of HIV/AIDS on the macroeconomic level may mask impacts of HIV/AIDS on the household level which are relevant from a welfare perspective, in terms of poverty- or development-related policy objectives, and may have macroeconomic consequences in the longer run.[28]

Against this background, our discussion of the impacts of HIV/AIDS on poverty and inequality proceeds in three steps. First, we review the macroeconomic

impact of HIV/AIDS in the context of the dual economy and explain why GDP per capita is not a reliable indicator of living standards in this context. Second, we review the available literature on the impacts of HIV/AIDS on the household level. Third, we discuss the implications of the evidence on the impacts of HIV/AIDS on the household level for risks of poverty and income distribution. This also includes a discussion of the available evidence on equity aspects of access to treatment.

GDP per capita and HIV/AIDS in the dual economy

One implication of the dual structure of many economies facing high rates of HIV prevalence and the high degrees of inequality in the region, is that GDP per capita is an unreliable indicator for changes in material living standards associated with HIV/AIDS. This point is illustrated in Figure 1.5, which presents a very stylized description of the impact of HIV/AIDS.

For our illustration, we assume that the economy consists of two sectors, and that output per capita is much higher in the formal sector than in the informal sector, but that it is even within sectors. As a consequence of HIV/AIDS, value added per capita in both sectors declines, and the population shrinks owing to increased mortality. Since the impact of increased mortality is somewhat larger in the informal sector,[29] its share in the working population increases. This means that GDP per capita increases, although survivors in each sector are worse off.[30]

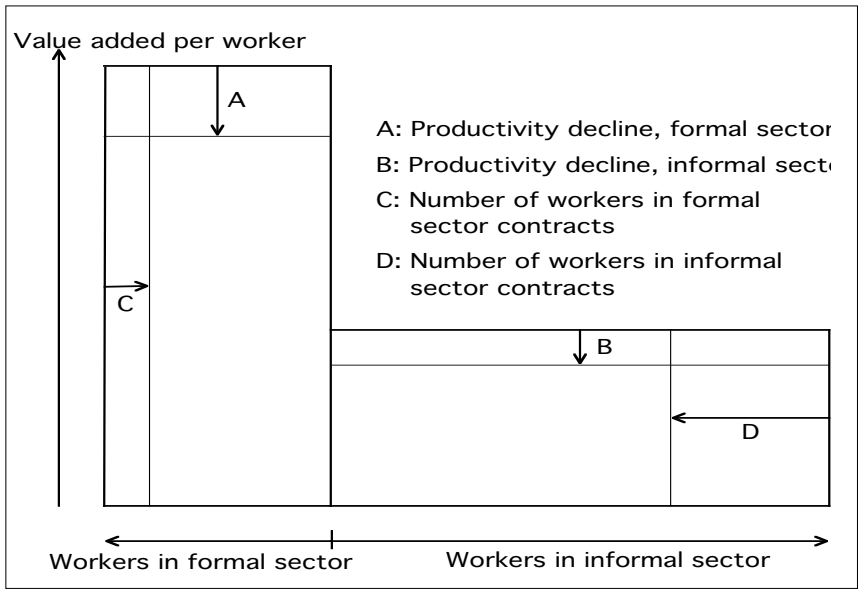

Figure 1.5 HIV/AIDS: Productivity Losses, Sectoral Shifts, and GDP per Capita

More generally, the macroeconomic perspective misses out on one crucial aspect of the economic impact of HIV/AIDS: the impacts differ significantly across households, ranging from households that may become impoverished owing to loss of income or health-related costs, to households experiencing only indirect effects, to households who may financially benefit, e.g., through additional employment (filling jobs vacated by people who have died or are too ill to work). We explore these points in more detail in the two sections below, focusing first on the direct impacts of HIV/AIDS for the affected households, and then discussing the implications of HIV/AIDS for poverty and inequality from a bird's eye perspective.

The impact of HIV/AIDS on the household level

There are two principal sources of information on the impact of HIV/AIDS on the household level—studies analyzing features of or trends among households affected by HIV/AIDS, and studies analyzing the implications of mortality on households. Additionally, for a macroeconomic assessment, it is also necessary to understand the "socioeconomic gradient" of the epidemic, i.e. the extent to which HIV incidence differs across population groups. Among studies of the first type, Steinberg and others (2002) find that households affected by HIV/AIDS spend about one-third of their income on health care, compared with a national average of 4 percent, and that funeral expenses are, on average, equivalent to four months of salary. They also find that the cost of the disease relative to household income is twice as large in rural as in urban areas, which means that the lowest deciles are bearing disproportionately large expenses. Over two-thirds of caregivers are women, and 22 percent of caregivers have to take time off from work and other income-generating activities.

Bachmann and Booysen (2003) find that incomes and expenditures for households affected by illness are substantially lower than for households not affected, and that expenditures and incomes for households affected by HIV/AIDS are lower than for households facing other forms of illness. While this could point to higher HIV incidence among households in the sample, or a stronger impact of HIV/AIDS compared to other health conditions, both would be consistent with an asymmetric impact of HIV/AIDS on poor households. Booysen (2005) provides a more dynamic analysis, showing that the income ranking of households affected by HIV/AIDS is more likely to deteriorate and less likely to improve than that of other households.

As HIV/AIDS accounts for a significant share of adult deaths in sub-Saharan Africa (especially among the working-age population), and deaths and their aftermath represent an important aspect of the impact of HIV/AIDS, the other useful branch of literature regards the impacts of adult mortality more generally. Mather

and others (2004) synthesize studies of the impact of adult mortality on rural households from five countries (Kenya, Malawi, Mozambique, Rwanda, and Zambia), finding households affected by adult deaths do not uniformly have less available prime-age labor than non-affected households (a finding that may reflect the ability of those households to attract new members); and that the death of a male household head is associated with a larger decline in crop production and non-farm income than the death of any other type of household member. Yamano and Jayne (2004), whose study is one of those covered by Mather and others (2004), suggest that the impact of adult mortality on households in Kenya is related to household wealth. They "find negative impacts on the net value of crop production, assets, and off-farm income only in the case of male head-of-household mortality among relatively poor households" (115).

In addition to understanding the impacts of HIV/AIDS for the affected households, an assessment of the economic impacts of HIV/AIDS also requires an understanding of who becomes infected. The early literature (e.g., Over and Piot (1993)) suggested that the epidemic primarily affected individuals who are better educated and belong to higher occupational classes. Similarly, Hargreaves and Glynn (2002), in a systematic review of the literature, noted that HIV prevalence across four African regions was higher among the well-educated (primarily for the older cohorts). However, de Walque (2006), using recent Demographic and Health Surveys that include HIV testing for a representative sample of the adult population, arrives at more differentiated results—education is associated with a higher level of infidelity and a lower level of abstinence, but also with preventive behavior and knowledge, and overall there is no clear correlation between HIV prevalence and education. HIV prevalence also tends to be positively correlated with wealth (although findings differ across countries). Mishra et al. (2007b) and others, using a similar but more comprehensive dataset as de Walque (2006), emphasize the positive correlation of HIV prevalence with wealth. Most recently, Fortson (2008a) finds a robust link between HIV/AIDS and the level of education, but uneven results for wealth variables. The primary limitation of this literature regarding the impact of HIV/AIDS is the fact that the analysis is based on HIV prevalence rather than incidence. As survival rates are arguably correlated with socioeconomic factors like education and wealth, the available studies suffer from selection bias and do not adequately assess the impact of HIV/AIDS across population groups.

Implications of HIV/AIDS for poverty and inequality

Our discussion of the impacts of HIV/AIDS on the household level suggested that HIV/AIDS resulted in an impoverishment of the affected households, and that poor households were less able to cope with the disease. However, finding an

adverse impact of HIV/AIDS or increased mortality in household studies is not sufficient to establish a link between HIV/AIDS, poverty, and inequality, or to quantify its impact, for two reasons: First, to assess the significance of HIV/AIDS as a contributor to poverty, it is necessary to relate data on the household impact of HIV/AIDS to estimates on HIV prevalence across the population or across types of households (as HIV prevalence may be correlated with household characteristics, including income). Second, it is necessary to take into account indirect effects arising in households not directly affected by HIV/AIDS, which could include financial support to households directly affected by HIV/AIDS, but also financial gains through economic opportunities associated with HIV/AIDS-related vacancies.[31]

The most significant efforts so far discussing the implications of the microeconomic evidence on household impacts of HIV/AIDS for poverty and inequality are the studies by Greener, Jefferis, and Siphambe (2000); Greener (2004); and Salinas and Haacker (2006). Their approach involves combining data on the household impacts of HIV/AIDS with economy-wide data on household characteristics, treating the costs and income losses associated with HIV/AIDS as shocks to the existing income and expenditure patterns.

Salinas and Haacker (2006) extend the earlier studies by adding a labor market, allowing for vacancies associated with HIV/AIDS-related attrition to be filled again. Their analysis is based on data from Demographic and Health Surveys or sentinel reports (as well as data and estimates on the household impacts of HIV/AIDS), and add a cross-country perspective, covering Ghana, Kenya, Swaziland, and Zambia. They find that in three of the sample countries, poverty incidence and the poverty gap increase more than would be expected from the decline in income per capita. Key determinants of the impact of HIV/AIDS on poverty are the size of the population at risk of falling into poverty and the HIV prevalence among this population group. Their findings also provide some additional insights on informal insurance mechanisms whereby households affected by HIV benefit from financial and others forms of support, suggesting that these would have some impact in terms of avoiding extreme poverty, but that they may not have an impact on common poverty indicators, once the households providing support (i.e., experiencing a deterioration in living standards) are included in the analysis.

The principal shortcomings of the studies described are the simplistic assumptions regarding the structure of households in treating HIV/AIDS as a shock to otherwise static households. This excludes important mechanisms of coping with and mitigating the impacts of HIV/AIDS, such as remarriage, joining a different household, and children growing up and leaving the household. While the studies described go some way toward a macroeconomic analysis of the impacts of HIV/AIDS on poverty and the distribution of income, our understanding of this issue remains limited.

One area not well researched thus far is that of the implications of the increased availability of ART for the economic impacts of HIV/AIDS, including poverty and inequality. Medical data, as well as the few available economic studies, suggest that ART reverses or mitigates the adverse impacts of HIV/AIDS on productivity. For example, Larson and others (2008), in a study focusing on the productivity of tea pluckers, find that workers on ART quickly returned to their primary work assignment, and that men quickly returned to nearly similar work patterns as the general workforce during the initial 12 months on ART, while women spent fewer days on plucking tea and more days on other tasks.

Meanwhile, ART adds a dimension to the distributional impacts of HIV/AIDS, as access to treatment is not necessarily even across population groups. This was obvious when access to ART was still very expensive, and access was de facto restricted to the most wealthy segments of the population and parts of the population depending on the formal sector. With the large increase in access to treatment, economic determinants of access have become less pervasive, but with coverage rates in sub-Saharan Africa estimated at about 30 percent at the end of 2007, uneven access to treatment could conceivably exacerbate the distributional impacts of HIV/AIDS.[32]

Available studies point to some disparities in access to treatment according to socioeconomic status. Rosen and others (2008a, 200) find that "relative to the HIV-positive population as a whole, ART patients are older, more likely to be female and have 1 long-term partner, live in informal housing, have reached secondary school, and earn an income from formal or informal employment." Scott et al. (2005) emphasize the difference in the quality of services between urban and rural sites. Tsai and others (2009) suggest that persons seen in clinic were more likely to have completed secondary or tertiary education, less likely to be unemployed, and more likely to live in households with access to a private tap water supply, compared to a community sample. Overall, these studies suggest some correlation between social status and access to ART. However, the point of reference for comparison with the sample of people receiving treatment is not fully satisfactory in each of these studies (a point discussed in Rosen et al. (2008a)), and our understanding of the equity implications of access to treatment is far from satisfactory at this stage.

VI. Conclusions

In light of the magnitude of the demographic and health disruptions caused by HIV/AIDS in many countries, it is important to understand the economic and development impacts of the disease, as these may have implications beyond the immediate health impacts of the epidemic, complicating the attainment of

development objectives or material living standards. Against this background, the chapter contrasts the large health impacts of HIV/AIDS with the moderate (if any) impacts on GDP or GDP per capita that can be observed thus far. A key hypothesis we pursue is that the dual structure of many economies affected by HIV/AIDS, where much value added is concentrated in fairly narrow segments of the economy, plays a role in mitigating the adverse impacts of HIV/AIDS on GDP. However, this argument implies that a disproportionate share of the impact of HIV/AIDS is borne by the low-income informal sector, suggesting that the small macroeconomic impact of HIV/AIDS masks adverse developments regarding inequality or poverty.

More specifically, our findings include the following: Econometric inference is complicated by the fact that the countries featuring the highest HIV prevalence rates in sub-Saharan Africa differ very substantially from other countries in the region in terms of their economic structure. Econometric findings are generally not robust to the exclusion of such outliers. The impact of HIV/AIDS on GDP or GDP per capita appears to be small so far, and countries with the highest prevalence rates do not show a marked slowdown in GDP growth, relative to the rest of sub-Saharan Africa.

We do not find compelling evidence for a link between inequality (Gini coefficient) and HIV prevalence. GDP per capita is more closely correlated with HIV prevalence than inequality and when—in light of the previous points—a dummy for SACU countries is included in the regression, any correlation between HIV prevalence, GDP per capita, and inequality disappears.

We also find the contributions to GDP across sectors are very uneven in countries with high HIV prevalence. This applies, in particular, to countries featuring a large mining sector.

Responses to HIV/AIDS also differ by company size. Most large companies have HIV policies in place, and many of them have been leading in extending access to treatment to employees (consistent with findings that, in companies with high value added per employee, providing access to ART tends to save money). On the other hand, in surveys HIV/AIDS does not feature among the most pressing concerns in small- and medium-sized businesses (let alone the informal sector), and establishing or accessing HIV-related services appears relatively difficult for small establishments. In the context of HIV/AIDS and a dual economy, GDP per capita is not a good indicator for material living standards across the population. Further, the (weak) evidence on macroeconomic impacts of HIV/AIDS contrasts with microeconomic evidence showing adverse impacts among households affected by HIV/AIDS. However, other households apparently gain from additional employment.

Studies integrating the microeconomic evidence on HIV/AIDS in a macro framework, including a simple model of the labor market, suggest that a small

impact of HIV/AIDS on the macroeconomic level can coincide with increases in poverty and inequality. These findings are primarily driven by the large size of the shocks to households affected by HIV/AIDS. The shape of the income distribution and the socioeconomic profile of HIV/AIDS are important factors in determining the size of the impacts of HIV/AIDS on poverty.

Overall, regarding our hypothesis that the small size of the macroeconomic impact of HIV/AIDS is related to the uneven structure of many economies facing large HIV epidemics, we do not obtain a confession from the (weak) data, and the trial proceeds on the basis of circumstantial evidence. Consistent with our hypothesis, we see asymmetries in the response to HIV/AIDS across sectors, and economic data illustrating the incentives and scope for making outlays to protect high value added businesses from adverse impacts of HIV/AIDS. Conversely, our hypothesis implies that the brunt of the impact of HIV/AIDS is borne by households at the lower end of the income distribution and the informal sector, contributing to poverty and inequality, and the limited data at our disposal are consistent with this aspect of our hypothesis, too.

Notes

1. Based on symposium held by United Nations University, New York Office at United Nations, New York, September 9, 2008.

2. It is worth noting that the estimates offered by the United Nations Population Division (2009b) are model-generated, based on a set of data and assumptions on the impacts of HIV/AIDS, as well as broader demographic trends. As the understanding of the health and demographic implications of HIV/AIDS is still evolving, the estimates are subject to some uncertainty.

3. The other major world region experiencing a substantial decline in life expectancy over a sustained period was Eastern Europe where life expectancy declined by about 1.9 years between 1990–95 and 2000–05. We argue that the adverse developments in Africa are more significant as they occur from a much lower base, as the population of sub-Saharan Africa is much larger than that of Eastern Europe, and as the declines in life expectancy in some of the countries with high HIV prevalence (15 to 20 years) are much higher than any declines experienced in Eastern Europe (up to four years, in Russia between 1985–90 and 2000–05, of which more than one year reflected the impact of HIV/AIDS).

4. As the impact of HIV/AIDS is fully realized by the population, it could also result in changes in the number of desired children. Fortson (2009, 170) finds that, "HIV/ AIDS had very little impact on fertility, both overall" (which could reflect both behavioral effects but also the direct effects of HIV infections), "and in a sample of HIV-negative women." Juhn, Kalemli-Ozcan, and Turan (2008a, 1) find that, "HIV-infected women have significantly lower fertility," and that "local community HIV prevalence has no significant effect on non-infected women's fertility." See also Juhn, Kalemli-Ozcan, and Turan (2008b) for a more concise discussion.

5. It is important to note that these estimates are averages across sub-Saharan Africa. WHO (2008b) does not provide country-level estimates. However, the earlier estimates

included in WHO (2004a) suggest that HIV/AIDS accounted for one-third of all deaths in Malawi, and more than half of all deaths in South Africa and Swaziland in 2002.

6. The countries for which growth trajectories are shown are: Botswana (BTW), Central African Republic (CAR), Lesotho (LSO), Malawi (MWI), Mozambique (MOZ), Namibia (NMB), South Africa (RSA), Swaziland (SWZ), Zambia (ZMB), and Zimbabwe (ZWE). SSA stands for sub-Saharan Africa (including the 10 countries shown).

7. Many of the key issues regarding the link between health and economic outcomes are discussed in a comprehensive (but somewhat outdated) survey by Strauss and Thomas (1998).

8. Sala-i-Martin (2005) also provides a discussion of different impacts of health on income or growth.

9. It is important not to equate birth rates with fertility rates (i.e., the average number of children a women bears). As birth rates are defined as the ratio of births to population size, an increase in mortality can result in an increase in the birth rate if it primarily affects people after childbearing age. On the other hand, an epidemic would reduce birth rates if behavioral changes, increased mortality, or lower health states among women of childbearing age results in a drop in the number of pregnancies, or if increased morbidity results in fewer successful pregnancies.

10. We focus on the direct effects of health shocks. Additionally, cross-effects between h and k may occur.

11. Additionally, Bloom, Canning, and Sevilla (2004) provide a survey of 13 earlier growth accounting exercises. In that literature, an increase in life expectancy of five years was associated with a growth rate that is between 0.0 and 0.6 percentage points higher than otherwise.

12. Additionally, Lorentzen, McMillan, and Wacziarg (2005) suggest that there may be an effect of mortality on risk behavior, as measured by smoking rates or HIV prevalence.

13. A second set of studies covered by Weil (2007) considers the link between age at menarche (first menstrual period) and labor productivity.

14. In Bloom and Mahal (1997), the key explanatory variable regarding the impact of HIV/AIDS (the number of AIDS cases) was constructed by the authors from very preliminary (and, from our perspective in 2010, obsolete) data.

15. Arndt (2006) assumes that an AIDS incidence rate of 1 percent translates into a slowdown in productivity growth of 1 percentage point. Arndt and Lewis (2001) apply a non-linear specification, whereby an AIDS death rate of 1 percent slows down productivity growth by 23 percent (not percentage points).

16. As the impact of these demand-side effects on GDP dissipates in the longer run, as the increased demand for health services is met by a reallocation of productive resources to the health sector (at the expense of other sectors), and as increased expenditures on health imply reduced budgets for other expenditures.

17. Another study, frequently quoted but as yet unpublished, that highlights the impacts of HIV/AIDS on investments in physical capital and education, is Ferreira and Pessoa (2003).

18. As pointed out earlier, we cannot distinguish well, empirically, between the impact of HIV/AIDS on the growth of GDP and GDP per capita because of peculiarities in the demographic transition across countries in sub-Saharan Africa.

19. This argument is sometimes made comparing the impacts of HIV/AIDS to those of malaria, suggesting that malaria is characterized by stints of illness (and thus productivity losses) over a long period, which are not well captured by proxies like mortality. The estimates by WHO (2008b) suggest that these comparisons are misplaced, as the contributions of both HIV/AIDS and malaria to DALYs lost to disability is similarly small, relative to

their contribution to mortality. Disability associated with HIV/AIDS, however, is concentrated over a shorter time period.

20. The Central Bureau of Statistics (2006) of Namibia, based on 2003/04 data, reports a Gini coefficient of 0.6 (as decimal, rather than percentage as we use it), and provides data according to which the poorest 33.5 percent of the population command 6.4 percent of consumption, while the share of the richest 17.4 percent is 66.4 percent. For Botswana, the Central Statistics Office (2006), based on different methodologies, describes an increase in the Gini coefficient in terms of "disposable income," and a very small decline in terms of "disposable cash income." According to the Lesotho Bureau of Statistics (n.d.), the 2002/03 Household Budget Survey Report returns a decline in the Gini coefficient of 52 (down from 57 in the 1994/95 survey for which the United Nations Development Programme (UNDP), applying a different methodology, reports a Gini coefficient of 63).

21. As mining is intensive in capital and other inputs, e.g., energy, the share of mining-related activities in GDP exceeds the value added based figure.

22. Regarding the impact of health-related disruptions on productivity or GDP, it makes little difference whether the output of a given group of workers declines, or whether additional workers are hired to maintain output at the previous level. Both developments would signify a decline in productivity.

23. In line with this, the mining sector in South Africa is among the most active sectors in terms of the share of businesses implementing policies to address HIV/AIDS, according to Ellis and Terwin (2005).

24. Rents from resource extraction arise when the value of output substantially exceeds the costs of extracting the resources (e.g., in case of diamonds that can be extracted at low costs). Typically, these rents are taxed through royalties or profit-sharing arrangements between a company obtaining an extraction license and the government.

25. In the commonly applied macroeconomic models, there is no role for rents from resource extraction, as the marginal product of labor (and, similarly, capital) is equal to the wage rate, whereas the marginal product exceeds the wage rate in an economy where rents from resource extraction play a role.

26. United Nations Population Division (2009b), summarizing the available evidence, assume that antiretroviral treatment extends the life span by about eight years.

27. A more comprehensive discussion would also need to cover the macroeconomic implications of external and domestic resources being shifted to providing HIV-related services.

28. The latter point is most forcefully argued by Bell, Devarajan, and Gersbach (2006), who analyze the long-term impacts of HIV/AIDS, focusing on the impacts of premature mortality among parents on the accumulation of human capital.

29. For this exercise, we abstract from the role of population growth. The essential point is that in our example the share of the population depending on the formal sector increases.

30. Moreover, even though GDP per capita increases, it is not possible to construct any transfers which would offset the income losses across the population, so that all survivors are better off materially.

31. An additional element, not addressed in the literature in this context so far, is the increase in employment opportunities associated with the response to HIV/AIDS.

32. In view of the limited availability of ART in the region, a number of studies discuss the (implicit or explicit) rationing of treatment and its economic and ethical implications. Rosen et al. (2005) and Bennett and Chanfreau (2005) are good starting points to this literature.