Chapter 10

The HIV/AIDS Impact on the Rural and Urban Economy*

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Summary: This chapter assesses the impact of HIV/AIDS on the functioning of the economy, its GDP growth and the growth of the main sectors. In most developing economies, even a moderate AIDS-induced decline in the rate of growth leads – in the absence of a robust public policy response - to a considerable impoverishment of families and children and to a gradual fall in the long term growth of the economy via an erosion of the stocks of production factors, adverse inter-sectoral and intergenerational effects and loss of social capital.

The chapter starts by analyzing the pathways through which AIDS affects the economy, emphasizing in particular its differential impact among by sector of employment, skill level and age group. It then reviews the macro, micro, cross sectional and panel literature on the aggregate growth impact of AIDS and discusses briefly the main merits and limitations of these approaches. Such literature reaches different conclusions on the economic impact of HIV/AIDS depending on the modeling approach followed, the period, HIV prevalence rate and country considered, and the main hypotheses made on the functioning of the economy. In spite of this, most studies find a decline of 0.5-1.0 percent in the annual GDP growth rate in low income countries with medium to high prevalence rates. Most of this literature and the results of the model presented in the chapter suggest also that the economic impact is lagged by a decade or so and that action to offset such impact ought to be introduced before then.

The chapter then develops a simple dualistic model to solve some of the limitation of existing models on the impact of HIV. The model comprises an urban and rural sector, two types of skills, the existence of surplus labour, time lags between the onset of the infection and the impact and other features and is used to simulate the impact of public policies aiming at offsetting the economic impact of HIV. The chapter concludes by reviewing the policy and program responses that would minimize the impact of HIV on aggregate growth, distribution and child wellbeing.

JEL: C12, D24, E21, E24, O47

* This study presents the views of its authors and not the official UNICEF position in this field.

UNICEF-IRC (www.unicef-icdc.org) Florence, June 2002

This is chapter 10 of the overall study “AIDS, Public Policy and Child Well-Being” edited by Giovanni Andrea Cornia.
CHAPTER 10: THE HIV/AIDS IMPACT ON THE RURAL AND URBAN ECONOMY

AIDS, PUBLIC POLICY AND CHILD WELL-BEING *
edited by Giovanni Andrea Cornia

Table of contents
Introduction - Giovanni Andrea Cornia

Part I: Overview of the HIV/AIDS Impact and Policy-Programme Responses
1. Overview of the Impact and Best Practice Responses in Favour of Children in a World Affected by HIV/AIDS - Giovanni Andrea Cornia

2. The Impact of HIV/AIDS on Children: Lights and Shadows in the “Successful Case” of Uganda - Robert Basaza and Darlison Kaija
3. The Impact of a Growing HIV/AIDS Epidemic on the Kenyan Children – Boniface O.K’Oyugi and Jane Muita
6. The Current and Future Impact of the HIV/AIDS Epidemic on South Africa’s Children - Chris Desmond and Jeff Gow
7. Perinatal AIDS Mortality and Orphanhood in the Aftermath of the Successful Control of the HIV Epidemics: The Case of Thailand - Wattana S. Janjaroen and Suwanee Khamman
9. Limiting the Future Impact of HIV/AIDS on Children in Yunnan (China) - China HIV/AIDS Socio-Economic Impact Study Team

12. Mitigating the Impact of HIV/AIDS on Education Supply, Demand and Quality - Carol Coombe
13. The Impact of HIV/AIDS on the Health System and Child Health - Giovanni Andrea Cornia, Mahesh Patel and Fabio Zagonari

* This project was started in 2000 at the UNICEF’s Innocenti Research Centre under the leadership of the Director of the Centre and of the Regional Director of the Eastern and Southern Africa Region Office (ESARO) of UNICEF. Giovanni Andrea Cornia of the University of Florence took care of the framing, implementation and finalisation of the study, with the assistance of Leonardo Menchini. The project could not have been implemented without the support of many colleagues in many UNICEF offices around the world. The financial support of the Italian Government and UNICEF ESARO is gratefully acknowledged. The papers included in this study present the views of their authors and not those of UNICEF.
1. Introduction

The purpose of this chapter is to assess the impact of HIV and AIDS on economic growth in countries characterized by different prevalence rates and economic structures and to suggest policy interventions aiming at minimizing the negative economic effects of this epidemic and avoiding the widespread impoverishment of children in families infected or affected by AIDS.

This is not an easy objective to reach. To start with, economic growth and child welfare are simultaneously affected not only by of AIDS but also by other economic, military and social events, such as changes in the external terms of trade, natural disasters and humanitarian conflicts. Disentangling the individual impact of each of these different effects is complex. In addition, the impact of AIDS is highly non linear and cumulative and characterized by threshold effects that vary from country to country. It is possible – for instance- that the economic impact of HIV rises more than proportionately with the rise of the prevalence rate. Third, that of HIV/AIDS can be described as ‘a long wave effect’, i.e. a phenomenon that manifests its impact after considerable time lags (ten or twenty years). Thus, countries where the epidemic is in its initial or intermediate stage hardly feel a perceptible impact on growth and poverty, and may therefore postpone the introduction of offsetting measures. Fourth, the AIDS phenomenon generates dynamic intersectoral and intergenerational effects that are not yet well understood and satisfactorily modelled. Some of the former manifest themselves through the gradual spread of the initial impact from one sector to the rest of the economy. For instance, in Cote D'Ivoire (see chapter 5) HIV prevalence has risen initially in the urban sector but has then gradually spread to the rural areas. In Yunnan (see chapter 9), the epidemic developed initially among ethnic minorities but then spread among the dominant Han population. The impact of such shifts in prevalence rates on labour supply, labour surplus, aggregate growth, poverty, income distribution and public policy remains largely unexplored.

2. Transmission of the HIV/AIDS impact on the economy: evidence from sectoral studies

The impact of AIDS on the economy and child poverty is influenced by variety of factors that change from country to country but that always depend on the prevalence rate (on average and by subgroups), the initial endowment of unskilled, semiskilled and skilled laborers (teachers, doctors, managers, enterprises cadres) and changes in financial savings and capital accumulation. For instance, both skilled and unskilled labor is plentiful in South Asia but less so (including for unskilled labor at harvest time) in Sub-Saharan Africa. A decline (or slower growth) in labor supply induced by HIV/AIDS is therefore likely to impact the African economy more than the Indian one. The economic impact depends also on the organization of production – i.e. on whether this depends on highly specialized workers of whether there is some substitutability among different types of labor and capital equipment – on the modalities of saving formation, on the existence of formal informal health insurance,
social safety nets and so on. The evidence about the impact of AIDS is reviewed hereafter according to the main pathways the epidemics transmits its negative effect on the economy.

2.1 Impact on production via a decline in labour supply and lower productivity.

A considerable literature on the local level impact of the HIV epidemic suggests that a first impact is due to the spread of the infection among the workers and – with a lag of 5-7 years – due to a surge in the number of deaths among them. All this entails that the total labor supply declines because of the spread of the illness and the fall in the number of young and middle age workers. In Tanzania, for instance, the mean age of death among workers in 7 enterprises was between 31 and 37 years (ILO 1995).

During the HIV phase, the worker slowly starts loosing his/her energy and experiencing a drop in productivity due a decline in body mass, energy, motivation and morale. This effect does not immediately surface and it is quite possible that a HIV positive worker carries on with a normal working life for some years after the onset of the infection. During the second phase, when the full blown AIDS has manifested itself, the loss of work capacity and productivity is nearly complete. Such period lasts up to two-three years depending on the nutritional status of the worker affected and on access to the care of opportunistic infections.

(i) impact by skill level and sector of employment. The loss of productivity and output varies in line with the skills and experience of the workers affected and is generally greater among better educated than unskilled workers. The evidence about the incidence of the disease among workers by skill level provides mixed results. A survey of blood donors in Malawi found higher infection levels among the educated than the unskilled ones. And in Zambia, 62 percent of deaths among managers between 1984 and 1992 were caused by AIDS. But this rate was slightly higher than for the middle-level workers but slightly lower than that for the lower-level workers (ILO 2000). Data from Zambia confirm the lack of significant differentials by skill levels as between 1984 and 1992 AIDS accounted for 56 percent of the deaths among general workers, 71 percent among lower level workers, 57 percent among middle level workers and 62 percent among top level managers (Ching'ambo 1995).

In contrast, the incidence of HIV/AIDS and the number of deaths among workers vary significantly according to the sector of employment, as a number of occupational groups show higher than average rates of infection. Among them those whose job entails considerable spatial mobility or interpersonal contacts, as is the case for contract and transport workers, miners, fishermen, sales-representatives, seasonal workers in agriculture, construction and tourism. Jobs that entail considerable social status and power – as in the case of security personnel, teachers, health workers and wealthy mangers – also exhibit rates of infection higher than the average (ILO 2000).

A survey of drivers in East Africa revealed an average infection rate of 33 percent. And in one Zambian hospital, deaths among staff increased 13 times between 1980 and 1990, mainly because of AIDS. In the Kagera region in Tanzania, 55 health workers died of AIDS between 1987 and 1993; the increase was so pronounced that other health workers refused to be posted there. According to the South African Medical Research Council approximately 25 percent of miners are living with HIV/AIDS, while the AIDS Society believes the true figure to be nearer 45 percent. A recent study of Carletonville, the centre of South Africa's gold industry, found that 60
percent of women under 25 were HIV positive (ILO 2000). High levels of infection were found also on many commercial farms (FAO 1999a, Haslwimmer 1994). In Zimbabwe, in 1996 one major transport company with 11,500 workers found that 3,400 of them were HIV-positive (Whiteside 2000). And in a three-year follow-up survey of demographic changes in a Ugandan town on the trans-African highway a significant inverse relation between wealth and seropositivity was found for women but not for men (Pickering and Nunn 1997).

(ii) impact on the rural labor force. The effects of HIV/AIDS on agricultural growth are most immediate, as in this sector there are generally few concrete possibilities for substituting a dwindling supply of labor with capital and for eschewing social norms about the care of sick and attendance to funerals. The ensuing labour shortage hampers agricultural production in a number of ways. Lack of skilled labour over the entire agricultural cycle obliged the farmers of several West African countries to perform agricultural operations with delay and, consequently, to experience a reduction in land yields (Black-Michaud 1997). In a Kenyan sugar estate the spread of HIV among the wage labourers led to a 50 percent drop in sugar output between 1993 and 1997 (ILO 2000). The general experience of the HIV and AIDS impact is that of a slow but perceptible decline in productivity. Between 1979 and 1991 per capita production has been falling in Mozambique (-3.1 percent), Tanzania (-1.4 percent) and Uganda (-0.6 percent) (Ruigu 1995).

The impact of HIV/AIDS on farm productivity follows also other paths. The care of sick relatives, participation to funerals and sale of equipment in the aftermath of an AIDS death are three indirect ways that contribute to reduce the labour supply and the productivity of uninfected workers. In Zimbabwe, for instance, an agricultural extension worker estimated that funerals took up to three days a month, or 10 percent of his working time (Ncube 1999). In Zambia, an adult in an affected household looses in personal sickness 952 hours per annum, with an even more time needed for the care of the sick and funerals. These figures must be compared with the 518 hours per personal sickness and 300 hours for the care of the sick and for attending funerals typical of unaffected households (Bangwe 1997). In Ethiopia, women and children in afflicted households spent around 7 percent less hours per week in farming than those in non-afflicted households (Black-Michaud 1997). In Namibia, 25 percent of the production time in critical periods was lost due to mourning alone (Engh et al 2000). And Tibaijuca (1997) found that in the Kagera region in Tanzania, 29 percent of household labour was spent on AIDS-related matters, including care of the patient and funeral duties. Accordingly, 81 percent of the respondents felt that hired labour was difficult to find, and wages increased tremendously over the decade. Fourth, HIV AIDS affects also long term rural growth, as AIDS interrupts the transmission of farming knowledge across generations is done by having children working with their parents (du Guerny 1999). Barnett’s (1994) study on Uganda, Tanzania and Zambia confirms that mortality seems to have a greater impact than morbidity in rural areas not only because of labour loss but also as a result of the termination of farming knowledge. In Zambia HIV/AIDS has contributed to an increasing number of women being alone in charge of agricultural production and to a decline in their productivity (Topouzis and du Guerny 2000).

(iii) responses by farmers to the impact of HIV/AIDS. The farmers adopt a series of adjustments to respond to the decline in their work power. In a first phase, they
may increase the family labour supply. In Zambia, for instance, heads of households in AIDS affected families responded to loss of work power among adults by teaching and supervising male teenagers to take over the fields. Tibaijuca’s (1997) Kagera study shows, for instance, that larger farmers compensated the decline in hired labour by marrying more wives, though this strategy was not an option for women-headed households which continue to depend on a dwindling supply of external paid work. The spontaneous pooling of community labour resources is a third way through which farmers sustain the supply of labour and get their land farmed despite rising HIV and AIDS within their family.

Second, when family labour supply can no longer be expanded, the affected households reallocate their diminishing work away from labour- and input-intensive crops and towards land-intensive crops. Generally speaking, tasks that yield benefits over the long run tend to be neglected – as farmers expect to die soon - in favour of tasks that generate more immediate, if smaller, returns (ILO 2000, Barnett and Blaikie 1992). Studies of African smallholders find that affected families in Uganda substituted resource-intensive cash crops – such as coffee or tomatoes - for less labour intensive crops such as cassava (Topouzis 1994, Mutangadura et al. 1999a, Rugalema 1999, Du Guerny 2000). Similar results are obtained in the communal agricultural systems of Zimbabwe (Kwaramba 1997) and in the North of Cote d'Ivoire (Black-Michaud 1997). Third, the death of an income earner may lead to a decline in purchased inputs and the sale of draught power and farm implements to cover medical and funeral expenses (Ncube 1999). The impact of these measures on medium term output is obviously unfavourable. When these adjustments prove insufficient, the affected households reduce crop cultivation, especially in fields that are further away and that take up more time to reach. And in extreme cases, as in the Monze district of Zambia, women had no time to collect their crops and had no choice but to abandon them (Waller 1996).

(iv) impact on the urban labour force. The impact of HIV on the skilled urban labour force may be less immediate – because of greater possibilities of substitution of labour with capital – but AIDS deaths cause greater damage, as the possibility of replacing highly skilled workers is generally lower and its costs higher. A study of enterprises in South Africa found that fewer than 40 percent of the employers believed they had a good chance of replacing skilled workers (ILO 2000). Even when replacement is feasible, there is an unrecoverable loss of experience that leads to lower productivity. For instance, the Uganda Railway Corporation experienced in recent years an annual turnover of 15 percent that substantially reduced the average staff experience. Absenteeism is another problem. Recent studies of businesses in East Africa show that it accounts for between a quarter and a half of the AIDS cost because of the disruption of the production cycle, underutilisation of equipment and the cost of hiring temporary staff (ILO 2000). But the negative impact of HIV/AIDS is not borne out by all surveys reviewed. In Zambia, for instance, 78 percent of the 18 firms interviewed in 1993 argued that labour productivity had yet to be affected by AIDS (Ching’ambo 1995) (the situation might, however, be different today as HIV prevalence and AIDS deaths have reached higher levels). Likewise, in Uganda the deaths of 10 percent of the top and middle management over the last 4-5 years did not cause any significant impact on the output of the organisations covered by the study (Sentongo 1995).
In turn, the AIDS death of an unskilled worker seem to generate a lower cost and fewer replacement difficulties. In a study on the work organisation of several companies in Uganda (ibid) found that about 90 percent of the deaths occurring as a result of AIDS affected the low skilled employees or the casual labourer who, because of the high level of unemployment in the country, could be easily replaced at any time.

2.2 Impact on soil fertility and land productivity

Mounting morbidity and mortality among rural workers can generate a permanent economic impact via a decline in soil fertility. First, land can be left idle or agricultural practices such as regular weeding and maintenance of irrigation systems which maintain soil fertility may be neglected because of a fall in labour supply. In extreme cases, food plantations have reverted into bushes. Such phenomena are well documented and only a few studies will be mentioned hereafter. In the commercial sector of Kenya, for instance, much of the fertile land of families hard hit by the epidemic remains idle due to labour shortages (Rugalema 1999). In Cote d'Ivoire, 28 percent of farmers interviewed answered to have reduced the cultivated area in response to labour shortages caused by AIDS-related illnesses and death (Black-Michaud 1997). Waller (1996) study on the farming impact in the Monze district of Zambia shows that the poorest households reduced the cultivated area and 10 out of 15 of them reverted to zero-tillage. And Ncube’s (1999) smallholders study in Gweru, Zimbabwe, show that shortage of labour, agricultural inputs, draught power and farm implements (sold to cover medical and funeral expenses) forced all 53 households studied to leave some land uncultivated during the 1997/98 season. In particular, land fertility may be affected over the long term by a drop in fertilizers’ use. In Zambia, for instance, 90 percent of farmers reported to have stopped using fertiliser altogether or to have reduced their application below the recommended amount (Waller 1996). The livestock sector also suffers via a reduction of care for the animals and the consequent increase in their morbidity/mortality, decreased livestock products and reduced draught power. In Gweru, some cattle died or were stolen when they could no longer be herded properly (Ncube 1999).

2.3 Impact on savings and capital accumulation

Another impact of HIV/AIDS on growth is through a slow down in the formation of public and private savings and in their investment in productive capital. Such impact is not straightforward and is scarcely documented. While public savings and infrastructure are likely to diminish – because of the increased pressure on current expenditure – the impact on household savings and firm profits is more difficult to predict and likely depends on the extent to which the additional health and welfare expenditures due to AIDS are borne by the households or by the public sector. In principle, HIV/AIDS should raise the pressure to increase household savings (for future health care, funerals, and obligatory bequests) as well as to reduce them (due to impoverishment and increased current health costs).

The evidence reviewed in chapter 13 and the case studies included in this compilation seem to suggest that the additional costs entailed by the spread of HIV were mainly
borne by the households in low income countries and by the state budget in the middle income ones. And the evidence provided in the household surveys included in Chapter 3 (Kenya) and Chapter 5 (Cote d’Ivoire) confirm a greater frequency of the sales of rural assets among families whose head died of AIDS than among the control groups. And the Monze study on farming households shows that 33 percent of the households studied felt that high medical fees cut into farming investments, particularly for livestock (Waller 1996).

Another line of argumentation is that as a result of the spread of HIV/AIDS, firms might be pushed to substitute capital for labour and so increase capital accumulation. Yet, there is hardly any evidence of this phenomenon that is hard to surmise in a situation of declining incomes and highly imperfect credit markets. A study on Benin (UNDP 1998) records a fall in savings in 84 percent of the 68 families with a member employed in the formal sector who died of AIDS. The study of the Rakai district in Uganda by Menon et al (1997) shows that the households affected by an AIDS-related death lost their savings and were forced to sell their properties to pay for health care and funeral expenditures to a larger extent than households affected by other types of death.

2.4 Impact on wages, earnings, profits and overall incomes.

An interesting analytical issue concerns the impact of HIV/AIDS on earnings, wages and profits. In principle, given a fixed supply of labor for each skill category, AIDS may have the effect of increasing wages and enterprise costs (e.g. for health insurance) and – assuming competitive product markets – of compressing profits. This effect ought to be much less pronounced when the labor markets is characterized by excess labor supply. An important empirical issue consists thus in ascertaining the changes intervened in wages, earnings and profits in AIDS affected economies.

As for earnings, a study on female traders in the Owino market in Uganda shows how quickly they can loose their livelihoods. The majority of market women trade in perishable goods (vegetable, fish, fruit, cooked food) which require short turn around time: business collapses when women attend to the sick for long periods of time. Moreover, many have had to forfeit their stalls in the market and are unable to resume trading after their personal savings have been depleted (Sentongo 1995). A ILO (1999) workshop came to the conclusion that many of the HIV or AIDS-infected workers in the informal sector are forced to give up their workshops, causing their business to collapse. And in Zimbabwe the households studied lost half a million Z$ in earnings during the 1997-98 agricultural season because of their inability to cultivate their land (Ncube 1999).

In many countries, commercial farms suffered sharp cuts in output and profits as a result of the loss of workers and decreased working hours due to illness, death, stress, attendance at funerals and home care of ill dependents. In Tanzania and Zambia large urban sector companies reported that AIDS health costs surpassed their total annual profits. In Botswana, large companies estimated that AIDS-related costs will increase from under 1 to 5 percent of the wage bill in 6 years (ILO 1999). Sentongo (1995) underscores the large if non-easily quantifiable rise in labour costs due to sick leave benefits and medical treatment, transport and funeral costs among top managers.
AIDS, PUBLIC POLICY AND CHILD WELL-BEING

In Zambia, the medical expenses incurred by the INDENI Petroleum Refinery in 1993 were 1.2 times the net profits. In addition, millions of Kwacha were paid to relatives of deceased employees in the form of basic salaries and funeral grants (Ching'amo 1995). In turn, the cost of AIDS to the National Railways of Zimbabwe in 1997 was equivalent to 20 percent of its profits (Guinness and Alban 2000). Clancy (1998) shows on a survey of six firms in Tanzania that the AIDS related annual average medical and burial costs per employee increased 3.5 time and 5.1 times between 1993 and 1997, respectively. Finally, Roberts and Rau (1997) argue that in Botswana and Kenya, the most significant factors in increased labour costs for the firms analysed were absenteeism due to HIV/AIDS and increased burial costs (Bollinger and Stover 1999, p 4).

Table 1. Percentage reduction in family incomes due to HIV/AIDS in relation to control group

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>REFERENCE</th>
<th>Rural</th>
<th>Middle class</th>
<th>Rural lower class</th>
<th>Urban upper class</th>
<th>Urban middle class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cote d'Ivoire</td>
<td>Béchu (1999)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>Black-Michaud (1997)</td>
<td>0-33</td>
<td></td>
<td></td>
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<tr>
<td>Malawi</td>
<td>Jones (1997)</td>
<td>3</td>
<td></td>
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<tr>
<td>Malawi</td>
<td>Jones (1997)</td>
<td>6</td>
<td></td>
<td></td>
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<tr>
<td>Namibia</td>
<td>Beresford (2001)</td>
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<td>10</td>
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<tr>
<td>Tanzania</td>
<td>Mutangadura et al (1999b)</td>
<td>10</td>
<td></td>
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<tr>
<td>Tanzania</td>
<td>Moshi (1995)</td>
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<td></td>
<td></td>
<td>45</td>
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<tr>
<td>Zimbabwe</td>
<td>Kwaramba (1997)</td>
<td>37-61</td>
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<tr>
<td>Zimbabwe</td>
<td>Roberts and Rau (1997)</td>
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<td>20</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Ncube (1999)</td>
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<tr>
<td>Côte d'Ivoire</td>
<td>Pégatienan and Blibolo (ch.5 of this compilation)</td>
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<td>18</td>
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<tr>
<td>Kenya</td>
<td>K'Oyugi and Muita (ch.3 of this compilation)</td>
<td>- 79</td>
<td></td>
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<tr>
<td>Thailand</td>
<td>Janjaroen et al (see ch.7 of this compilation)</td>
<td>41</td>
<td>41</td>
<td></td>
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<td></td>
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<tr>
<td>South Africa</td>
<td>Prov. Survey (2001)</td>
<td>39</td>
<td>39</td>
<td>41</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

Notes: a reduction in net revenues from agriculture production, b fall in individual expenditures in households where a person died over the whole period (mean number of dependents is 6.3), c reduction in savannah and forest are, respectively, 33% and 11% for cash crops, 17% and 0% for other crops, 11% and 9% for animals, d reduction in incomes due to an AIDS death of an economically active adult in a three-adult household, e reduction in the annual production in a tea estate, f the annual cost of HIV/AIDS as a percentage of operating profits, g percentage of time spent attending funerals by agricultural extension workers, h worked out from the observed 27.73 total days lost due to illness per year for each of the last two years of employment (mean number of dependents per worker is 6.4), i figured out by noticing that adults having experienced a death spent 5 hours less in farming in the previous week than those without a death in order to attend funerals, j worked out by observing that a woman whose husband is sick spend 45% less time in agriculture than if he were healthy, k the annual production of maize, cotton, vegetables and groundnuts reduced by 61, 47, 49, and 37%, respectively, l the total costs of AIDS to the transport company studied in 1996 as percentage of its profits, m percentage of salaries lost by AGRITEX extension workers because of the 3 days per month (10% of working time) spent on average attending funerals. The negative sign is due to recent sales of assets.
The impact on profits may however be offset by economic reforms that reduce the legal obligations of the firms vis à vis labor. In Tanzania, for instance, the Economic Recovery Program permitted to get rid of employees living with AIDS (Moshi 1995). Likewise, a study by Haslwimmer (1994) on the Nakambala Sugar Estate in Zambia concluded that while 75 percent of all workers deaths recorded between April 1992 and March 1993 were due to AIDS, the financial burden attributable to them accounted for only 1.9 percent of total costs. Kad'iebwe (1995) study of the impact of HIV/AIDS on the labour force in Rwanda between April 1992 and March 1993 shows that the immediate dismissal and replacement of middle and senior personnel was common.

Several case studies, including those included in this compilation, estimated the decline in income over one year period in families that have suffered the AIDS death of the head of household in relation to a control group of families that are identical to them in all respects but for the AIDS death. The estimates of such income decline are summarized in Table 1. While such results are obviously affected by the sampling problems, they all point (with the exception of Kenya, see footnote 14) to income drops ranging between 10 and 70 percent, with the majority of the studies showing declines in the 30-40 percent range (Table 1).

2.5 Impact on consumption

The decline in income due to HIV AIDS is invariably translated in lower consumption levels, though such decline is generally less pronounced than that on income as families reduce financial savings, sell assets and borrow from friends and relatives to sustain consumption. Yet, the decline in overall consumption can still be as large (up to 30-40 percent in relation to the control group) to affect permanently the welfare of children and families. This occurs because the overall drop in consumption and the rise in expenditures on health care and funerals may compress other essential expenditures such as food and schooling.

For instance, Béchu (1997) shows that in the urban areas of Cote d'Ivoire, households where a person with AIDS died showed a 28 percent fall in per capita consumption of basic needs, while changes in per capita consumption were insignificant in households where there are no instances of an AIDS death. However, the same study shows that the consumption of basic needs recovered during the following year so that the overall reduction amounted to 12 percent. Janjaroen (1997) analysis confirms these findings in the case of Thailand. Lundberg et al (2000) suggests that a 30 percent fall in food expenditure over the short-term was found in the lower income group affected by AIDS. In urban areas of Cote d'Ivoire, the proportion of household budget spent on health care is 10.6 and 5.6 in case of people affected by AIDS and people affected by other illness (Béchu 1998).

Concerning the substitution between different types of consumption expenditures, UNAIDS (2000) shows that in the urban areas of Cote d'Ivoire, families with a member affected by AIDS spend half of what they did on schooling while spending on health care went up 4 times on average. Likewise, Over et al (1996) found that in Kagera, Tanzania, health care expenditures were 8 percent of annual household expenditures in those affected by AIDS, and 0.8 percent in those not affected. In Cote
d'Ivoire, households with an HIV/AIDS patient spent twice as much on medical expenses as other households.

2.6 Impact on government expenditure

Another impact of HIV/AIDS arises from the increase in government expenditure on health, teachers’ training and welfare transfers, within the context of a declining tax revenue. This could lead to growing budget deficits and, eventually, to the adoption of restrictive adjustment policies. Alternatively, if the deficit is monetized or covered through public bonds, it could lead to higher inflation or a rapid accumulation of public debt.

Though there are few convincing analysis in this area, it may well be that – except for economies counting on large mineral rents (as Botswana) – tax revenue may decline because of the slow down in economic activity induced by AIDS. Much will depend on the sector affected the most, whether the urban (and more easily taxable) sector or the rural and informal sector that generally contributes less to the fiscus. Meanwhile, it is likely that non-AIDS related expenditure on health, education, the training of teachers, nurses, food subsidies etc. and other social programs may fall. As noted, health and social welfare systems are being affected by a surge in health spending on AIDS and pressures to introduce orphan and other allowances. The decline in non-AIDS expenditure may in turn affect non-AIDS mortality/morbidity and other aspects of child well-being.

Chapters 6 and 7 show that the demands for orphan allowances and welfare transfers rose in South Africa and Thailand. These demands may however compete with other claims on the budget, with the risk that the support to families with orphans, foster families, poor relief and so on, may stagnate in the face of mounting needs.

3. Assessment of the overall impact of AIDS on the economy

The studies reviewed in section 2 consist of local level analyses (often based on a small number of observations) the result of which – for this reason - cannot be extrapolated to the national level. These analyses, furthermore account only for the local effects and do not account for their systemic effects or for the impact of the responses to HIV/AIDS by the families, communities and government affected. The overall impact of AIDS is therefore assessed by other kinds of studies reviewed hereafter which rely on different approaches.

3.1 Microeconomic approach: estimating the impact on a sample of AIDS affected families

Some studies try to assess the economic impact of HIV/AIDS by computing the loss of household income and the greater medical and other costs incurred over a given period of time by the families affected by HIV/AIDS in relation to families with similar socio-economic characteristics but which have not been affected by the epidemic. Such approach normally entails the identification of a representative sample
of AIDS affected households and an equally representative control group, the measurement of the average incomes loss and higher costs incurred by the HIV/AIDS affected family in relation to the control group, the actualization of all income loses and greater costs at one point in time, and the extrapolation of the ‘unit cost of AIDS per affected family’ to the total number of present families affected by HIV/AIDS cases divided by GDP.

Anand et al (1999) for instance assess the total annual cost of HIV/AIDS for the period 1986-1995 in India under different (low, medium and high) estimates of HIV prevalence. The total annual cost of HIV includes i) the loss of productivity among HIV patients due to sickness and death, ii) the productivity loss of caregivers of AIDS patients, and iii) the cost of management of AIDS patients. The loss of output due to HIV is estimated in rural and in urban areas separately through a life table approach using two cohorts, one with and one without HIV/AIDS: the difference in person-years lived between the two scenarios is then converted in monetary terms by mean of the national per capita income for 1992-93. In turn, the loss of productivity among working but enfeebled HIV patients is estimated by relying on current data and expert opinion. In particular, a patient with HIV is assumed to need 6 hospital admissions for HIV-related illnesses before death for an estimated total of 100 to 200 hospital days.

The productivity loss of the caregivers of AIDS patients is estimated by assuming that each patient requires a full-time care giver. The analysis is restricted to the reproductive active population, the incidence rates in young adults are assumed to be twice those among older adults, the rural incidence is assumed to be one fourth of the urban incidence, the median survival after the onset of infection in 1986 is assumed to be 10 years. The study by Anand et al. concludes that the estimated annual costs of HIV/AIDS ranges between 0.1 and 1.1 percent of GDP depending on the assumption made about the prevalence rate. The loss of productivity due to premature death and treatment costs explain respectively 80 and 10 of the total cost of HIV/AIDS.

This kind of studies could be improved in some respects. For instance, in most of them it would make sense to disaggregate the aggregate economy into its rural and urban components as incomes, hospitalisation rates, care patterns and so on differ substantially between the two locations. Yet, while this class of analyses illustrates accurately the economic losses endured by AIDS-affected households and the sources of such losses, it suffers from a few inherent methodological problems that weaken their conclusions. First, these analyses are static, as the surveys are taken at one point in time and cannot therefore capture the interaction between the impact of AIDS (on labor supply, income, consumption, etc.) and the subsequent reactions by the families and community affected. Second, these studies provide a partial analysis of the phenomenon at hand, as they reflect only the changes that occur in the AIDS-affected sector but not their interaction with the rest of the economy. A third drawback is what may be termed the micro-macro inconsistency or aggregation bias. Indeed, in extrapolating the income losses from the micro to the macro level, it is assumed that all workers are fully occupied while this is in practice seldom the case. In reality, an income loss at the micro level (that results in the severe impoverishment of a family) may cause no perceptible contraction in GDP because the loss of output due to the AIDS death of a worker is replaced by the rise in output by a formerly unemployed worker that now occupies the position vacated by the dead worker. Fourth, the aggregate impact may change also because of the adoption of policies facilitating, for
instance, the substitution of labour with capital or the development of collective labour pooling arrangements. Finally, the results of these studies are very country specific.

3.2 Macroeconomic approach

Another approach to the estimation of the impact of HIV/AIDS consists in building partial equilibrium or Computable General Equilibrium (CGE) models in which GDP is a function of the stocks of production factors (physical capital, land, labour and human capital) that are, in turn, eroded by HIV/AIDS in a variety of ways. The most prominent of such models are discussed hereafter:

(i) Kambou et al (1992) built one of the first detailed CGE models to assess the impact of HIV/AIDS in Cameroon. The model is calibrated on the years 1979-80 and includes a multi sectors production function which captures the intersectoral interactions through prices, demand and allocative effects. It includes also a detailed treatment of the government and household sector. On the production side, there are three categories of labour (rural, urban-skilled and urban-unskilled) that are imperfectly substitutable between each other while investment is driven by domestic savings. The world demand and prices for Cameroonian exports, and the net capital inflows remain unchanged and government expenditure is constant.

A static, one year, simulation of the model under the assumptions that the unskilled labour force is unaffected by the epidemic and that the capital stock is constant, suggests that the various sectors of the economy contract in line with the fall in their supply of urban-skilled labour. A dynamic, multi year simulation over 1986-1991 under the assumption that the unskilled labour supply continue to be unaffected by AIDS, the contraction of the skilled labour has the strongest impact on performance. If the skilled urban workforce is assumed to decline each year by 6.0 percent because of AIDS deaths, compared to 0.4 percent for the unskilled labour force, the growth of GDP contracts by some 2 percent a year. If, in contrast, it is assumed that all types of labour are affected by AIDS to the same extent, the annual growth rate drops from 4.3 to 2.4 percent, with the impact being inversely related to the ease of substitution between different types of labour. If substitutability is limited, wages and prices will increase and lead to an appreciation of the exchange rate and a decline in exports.

This model is closer to the real world than most other studies reviewed in this chapter. Yet, its conclusions are affected by problems. First, as in all CGE models, the structural parameters are not estimated econometrically but are assigned values derived from the literature that are then ‘calibrated’ to make the model reproduce the correct value of the dependent variables. Such procedure has obvious limitations. Furthermore, in the Kambou study, the calibration is carried out with reference to 1979-80, i.e. a period in which the HIV prevalence rate was very low and AIDS had not manifested its impact. Also, like in most other studies reviewed, no allowance is made for excess labour supply as the labour markets are assumed to clear. The model is also not “dynamic” strictu sensu (it is a sequence of static models obtained by updating over time the exogenous variables) a fact that does not capture the cumulative effects and non lineairties of the relation between AIDS and the economy (for instance, it assumes that AIDS causes a constant annual decline in the supply of workers) and makes no difference between HIV and AIDS. Finally, the model
assumes there are no financial assets, while it is plausible that one of the main impacts of AIDS is precisely via the financial sector.

(ii) Over (1992) builds a model to estimate the impact of AIDS on the growth of GDP and GDP per capita in 30 African countries over the period 1990 to 2025 under alternative assumptions about the distribution of the epidemic and the financing of the costs it generates. The author represents the growth process using two generalised Cobb-Douglas production functions, one for the rural sector (making use of unskilled labour and farmable land, the supply of which expands exogenously at a given annual rate) and one for the urban sector (making use of skilled labour and capital). The capital stock in the urban sector rises in line with the yearly gross investment that is in turn the sum of exogenous foreign savings and domestic savings. The labour force in each year is disaggregated into six groups according to schooling achievements and sector of work. The risk of contagion rises monotonically with the level of education of workers, which means that the loss of labour is greater in an economy with more educated workers. The cost of treating AIDS is also assumed to rise steeply in line with the level of education. The cost of AIDS are borne by the private or the public sector and the model shows that when the proportion of the cost of treating AIDS is financed from private savings, the negative impact on growth of GDP is greater. The main result of the model is that raising the share of the treatment cost financed from savings or assuming that the epidemic affects more the productive workers increases the negative impact on income growth. Overall, AIDS depresses the growth rates of GDP by some 0.33 percent a year.

(iii) Also Cuddington (1993a) (see also Cuddington 1993b and Cuddington and Hancock 1994) assumes that GDP growth can be described by a Cobb-Douglas production function including among its arguments labour, capital stock and an exogenously given technical progress that in the non-AIDS scenario raises output at 0.5 percent a year between 1990 and 2000. The economy comprises two sectors, the informal (labour intensive and low wage) and the formal sector (skill intensive and high wage). Labourers who are not hired by the latter find low productivity employment in the former. Capital formation in each sector is limited by the amount of saving generated within it, given constant saving propensity and constant capital inflows. The size and composition of the labour force is influenced by the spread of HIV/AIDS prevalence among adults that is assumed to rise from 0.1 percent in 1985 to 3.1 percent in 2010. HIV/AIDS affects growth via a drop in labour supply, labour productivity and a fall in the saving rate as 80 percent of the medical costs incurred by workers are self financed. Another effect is through a faster rise in wages over 1985 to 2010. Overall, the model predicts that the economy in 2010 will be, on average, 16 percent smaller than in the non-AIDS scenario, with alternative estimates ranging between 11 to 28 percent depending on the assumptions made. The effect on AIDS on per capita GDP is less marked due to slower growth of the population.

(iv) Ainsworth and Over (1994) model the impact of AIDS on per capita income through changes in the capital output-ratio, the cost of AIDS treatment cost to per capita income, an the proportion of the treatment costs financed from savings. The extent of the economic impact is determined by the prevalence rate and incubation period. They assume that the national output is produced by two factors of production, work and capital, that AIDS has an incubation period ranging between five to 10 years and that a country has a steady HIV prevalence rate of 10 percent. Every 10
percent increase in the epidemic slows growth of the work force by 0.6 to 1.0 percent a year. About half of AIDS treatment costs is financed through a reduction of savings that results in a reduction in the growth rate of capital accumulation. These assumptions lead to the conclusion that fall in the growth rate of per capita income ranges from 0.1 percent if the national prevalence rate is 10 percent and the incubation period is 10 years to 0.8 percent if the prevalence rate is 30 percent and the incubation period 5 years. Despite its pioneering nature, the model is too aggregate and somewhat simplistic.

(v) Another macro CGE study on the growth impact of AIDS epidemic in South Africa is that by Arndt and Lewis (2000) who built a disaggregated economy-wide simulation model including 14 sectors, five production factors, five households quintiles, ten government expenditure categories. In this model, producers maximize profits, government expenditure is allocated according to fixed shares but allows budget deficits, while consumers assign their income to savings and consumption categories according to fixed shares. The estimates of labour supply, AIDS and non AIDS death rates and HIV prevalence rate are derived from the extrapolations of Quattek (2000). AIDS deaths are assumed to affect the economy by reducing proportionately the workers in each skill class while HIV-positive workers are half as productive as non affected workers. Simulations of the model show that the GDP growth rate declines gradually over time to reach a maximum fall of 2.6 percent in 2008 in relation to the non AIDS scenarios. The decomposition of the overall decline shows that this is due to a rise in AIDS-induced government deficits (46 percent), losses of labour supplies (14) and declines in labour (8) and total (32) factors productivity. These results, however, suffer from the shortcomings typical of the CGE models (see above) as well as by a few specific ones.

(vi) A non CGE model by BER (2001) also attempts to quantify the macro impact of HIV/AIDS in South Africa over 2000-2015. The main emphasis here is on sensitivity analysis rather than precise point estimates. As other models for South Africa it makes use of the ASSA model for all demographic projections for population groups by age, gender, skill and area. The HIV/AIDS impact is transmitted to the economy via five channels: first, a fall in the population and labour force and in its efficiency leads to a 21 percent reduction in the growth of total factor productivity. Second, greater costs to the business sector for pension, life, disability and medical benefits would add 5 percent to the wage bill of skilled employees by 2005 and 10 percent by 2010. Companies pass 50 percent of this cost on prices while the rest is absorbed through a cut in profits. Third, the business sector bears a higher costs due to greater recruitment and training cost as well as to greater absenteeism, physical disability, stress and reduce morale among the staff that reduce productivity among both skilled and unskilled sick workers by 40 percent. Fourth, because of AIDS, the government has to increase its expenditure, direct taxes and deficit. Public health expenditure in the non-AIDS sector is cut and that on AIDS rises twice as much this amount to employ additional health staff and purchase health inputs to care for the unskilled and unemployed affected by AIDS. The government bears also additional costs for foster care grants for orphans and financial assistance for foster parents and because of the spread of AIDS among government workers leads nevertheless to a non negligible fall in government employment. And fifth, households finance half of their additional AIDS related expenditures from personal savings and half by reducing their expenditure on goods and services. The model forecasts that GDP will be 1.5 percent
lower than in the non-AIDS scenario by 2010 and 5.7 lower by 2015, which in year-on-year terms translates in declines in the average growth rate of 0.1 percent over 2002-05, 0.3 percent over 2006-10 and 0.9 percent in 2011-15, i.e. values somehow lower than those estimated in other studies.

(vii) The BIDPA (2000b) study on the impact of AIDS in Botswana makes use of household and individual data from a 1993/4 survey. Each person is assigned the probability of being infected with HIV equal to the prevalence rates estimated in 1998 for various population and income groups. The study predicts that by 2010, 49 percent of households will have at least one infected member, 7 will have disappeared and 26 will lose income as a result of the death of a family member.

The analysis evaluates the impact of HIV/AIDS on income and expenditures over a 10 year horizon (by which time HIV infected people are assumed to have died) by means of a basic and two alternative scenarios that assume a 5.7 percent reduction in the overall unemployment rate and a 12.2 percent increase in the wage of skilled workers (but not of the unskilled ones). The additional medical and funeral expenditures entailed by AIDS are estimated on the basis of discussions with general practitioners and are included among the household expenditures. Households are assumed to spend an additional 25 percent of their income on each person with HIV/AIDS. The study predicts an 8 percent fall in income per capita and a 5 percent rise in the number of the people living in poor households, no change in income inequality and an increase in the dependency ratio. The situation of the first quartile of households is the worst as their income and dependency ratios worsen more than on average. The introduction of medical and funeral expenditures does not change the income levels but increases the incidence of poverty. Also this model suffers from shortcomings related to the time consistency of the data sources used for the estimation of the parameters, the inaccurate modelling of the risk of infection by level of education, and of the impact on income distribution. More generally, the model results depend on too many assumptions a fact that makes the estimate of the AIDS impact too hypothetical.

(viii) Quattek (2000) assesses the economic impact of AIDS by means of a 90 equations model of the South African economy including the demographic projections of the ASSA model (that foresees that HIV prevalence rate among the total population peaks at 17 percent by 2006 and that AIDS deaths peak five years later). The impact of AIDS on each sector depends on the mix of workers between unskilled workers (that have infection rates of 30 percent and are assumed to cause no additional costs as they are less likely to be covered by health and other benefits) and skilled and highly skilled workers who are less affected by AIDS (their infection rates reach 23 and 13 percent respectively) but have a high replacement cost. Transport, storage, catering and accommodation are the sectors most exposed to the HIV epidemic, while machinery, communication and metals fare relatively better and service industries such as finance and business rank in the middle. The impact of AIDS is estimated by assuming a work loss of four months per person-year weighted by skills for every person with full-blown AIDS. In the formal sector, the companies bear two thirds of the increase in wage costs due to the direct and indirect impact of AIDS, while the employees bear the remaining part. The employers pass a half of the wage cost increase to customers, while the remaining half is absorbed in the form of lower operating surpluses.
The model estimates that over 2006-2010 and 2011-2015 the trend GDP growth and domestic savings will be on average 0.3-0.4 percent a year and 2 percent lower than in the absence of AIDS, while the consumer price index will rise due to cost pressures on companies and higher interest rates, while capacity utilisation and investment hold up due to a capital intensive technologies.

(ix) Nicholl et al (2000) model the macroeconomic impact of HIV/AIDS for Trinidad Tobago and Jamaica. They assume a three sector economy (agriculture, industry, and services) characterised by a Cobb-Douglas production function and male and female labour markets for all 3 sectors. Domestic savings are proportional to income and finance all investments but are affected negatively by expenditures on AIDS (drugs, HIV tests, hospitalisation). In this model, the HIV prevalence rate is raised by 20 percent over 1997-2005. The simulation outcomes leads to the conclusion that GDP in Jamaica and Trinidad and Tobago declines on average by 6.4 and 4.2 percent respectively. These estimates may seem excessive since the cost of treating AIDS has significantly declined and as the model does not permit spontaneous adjustments in production techniques (e.g. a substitution of labour by capital) and there are no dynamic changes in dependency ratios or investments in human capital.

(x) Cuesta (2001) builds a partial equilibrium model for Honduras that includes a Cobb-Douglas production function with low and high human capital workers, in which each of these two groups has a different HIV prevalence rate, saving rate and costs for HIV prevention and AIDS treatment. Capital formation is a proportion of domestic saving, foreign resources and depreciation of existing capital stock and is carried out only by the high human capital group. The model simulations assume alternative HIV and AIDS incidence rates, while all other variables are kept constant in real terms. The model suggests that the direct impact of growth is mediated by an increase in the productivity gap between human capital groups following a greater productivity reduction in the low human capital group. The simulation of 10 alternative scenarios with different levels of HIV incidence, financing of AIDS treatment and environmental conditions, suggests that the growth impact ranges between 0.7 and 2.7 percent a year and is mainly due to the negative impact on labour availability rather than on capital accumulation.

In conclusion, the CGE and partial equilibrium approach allows a more complete representation of the structural relationships of an economy and of the direct and indirect AIDS effects but also suffer from a few shortcomings: they provides estimates that depend on a large set of assumptions and tend to be country specific, even when sensitivity analysis is carried out. CGE models are mostly not estimated econometrically and offer few insights on the distributive impact of the epidemic across sectors or social groups. The models are mostly ‘positive’ models and allow for limited simulations of policy interventions in the field of financing of health expenditure, orphan allowances and in terms of the policy of accelerated formation of production factors.
3.3 Cross country regressions

This class of models examines the relationship between changes in growth rates of GDP in countries affected by different HIV prevalence rates and AIDS death rates at one point in time or over a period of time, after controlling for as many interfering variables as possible.

One of such studies is that by Bloom and Mahal (1997) who basically dismiss the claim that AIDS reduces the growth of the economy on the basis of cross country regression analysis for 51 countries over 1980 and 1992 and over 1987 and 1992. Their study revolves around three equations: the first estimates the rate of growth of real per capita GDP on the basis of the average annual increase in the prevalence of AIDS, the initial levels of GDP/capita and other determinants of per capita GDP such as human capital, public investment in defense and education, degree of openness of an economy and so on. The second equation determines the cumulative number of AIDS cases on the basis of the lagged levels of HIV prevalence, while the third estimates the number of HIV cases in a particular year on the basis of GDP and other variables that influence HIV transmission rates such as urbanisation, the degree of people mobility and so on. The study shows that both over 1980-1992 and 1987-1992, the negative relationship between economic growth and the rise in AIDS prevalence is a spurious one that is explained by the fact that AIDS increased most in countries with low income per capita, and that AIDS has an insignificant effect on the rate of growth of GDP. In sum, the authors conclude that the AIDS epidemic has had an imperceptible effect on the growth rate of GDP and per capita income.

However, these strong conclusions are weakened by a number of technical and theoretical problems. To start with, the HIV and AIDS data utilized in the study come from different, and possibly inconsistent, sources. The results may also be period-specific and not apply to a longer period of observation. Indeed, both period analysed (1980-1992 and 1987-1990) have a low number of AIDS cases even as HIV prevalence has started to rise (AIDS deaths tend to lag HIV prevalence by 6-8 years). Also, the impact of AIDS and HIV on GDP and GDP per capita tends to be quite different, so that the overall impact may change over time. Also the model by Bloom and Mahal (1997) is a kind of ‘black box’ in which it is not clear through which channel AIDS affects the economy, either via a decline in the labour force, the differential spread of the epidemic in rural and urban areas, a diversion of scarce public expenditure to the prevention and treatment of HIV, and so on.

A cross sectional study of some 70-80 developing countries over 1990-7 by Bonnel (2000b) comes to rather different conclusions and suggests that while in low prevalence countries the growth impact is negligible, for Africa as a whole (that had a 1999 average prevalence rate of 8.6 percent) the growth of per capita income was reduced by 0.7 percentage points a year. In the words of the author, in the absence of HIV ‘Africa’s income per capita would have grown at 1.1 percent a year – as opposed to the 0.4 percent effectively achieved in 1990-7. In turn, a country with a 20 percent HIV prevalence rate would see its per capita GDP growth rate drop by 2.6 a year, as a sum of the reduction in growth per capita (1.2 percent) and the shortfall in population growth (1.4 percent ). Also this study relies on three equations. The first expresses GDP growth as a function of the initial per capita income, infrastructure per capita, strength of the legal framework and macroeconomic policy, human capital and other
exogenous variables. In the second equation the macroeconomic policy rating is linked to the HIV prevalence rate, the initial per capita income, growth rate during the 1980-1990 period, the initial macroeconomic policy rating, the level of development, human capital, and an exogenous variable. The third equation expresses the HIV prevalence rates as a function of the level of development, past growth rate, share of Muslim population in 1990-1995, number of years since the first HIV case was first reported, share of female labour in industry and the secondary school enrolment rate.

Cross-country regressions are subject to a number of well known critiques. First of all, there is the problem of unobserved variables. While both studies cited above tried to address this problem, it is not clear that they succeeded in accounting adequately for all factors that may affect growth, HIV prevalence or both. Second, both studies do not allow for any time lag between the rise of HIV prevalence and the growth impact, an hypothesis that can be seriously challenge. Third, the use of period averages over several years for both per capita income growth and HIV prevalence, rather than their dynamic changes over the same period, conceals the possible non-linearity of the relations analysed and the growing ‘cumulative effect’ of rising prevalence rates on GDP growth. Fourth, neither study pays attention to the fact that the impact of HIV/AIDS on growth depends on whether labour is fully employed or whether there is a labour surplus, and to the differential impact of HIV by sectors, areas or skills. And in the Bonnel (2000b) there is no empirical support for the proposition that the AIDS impact on growth depends on its impact on the effectiveness of policy and regulations.

3.4 Regressions on panel-data : assumptions, results and shortcomings

Econometric analyses conducted on panel data are in principle able to correct for several of the methodological problems encountered in cross-country regressions and to best capture the impact of the HIV/AIDS on economic growth even if such impact may have been quite modest until recently in several countries.

Dixon et al (2001), for instance, try to assess the impact of the HIV epidemic on growth by means of a two equations econometric model estimated on panel data covering 41 African countries over the period 1960 to 1998. The model used consists of an aggregate Cobb-Douglas production function with constant return to scale and with labour augmenting technical progress, education and health capital, where health capital depends on the material standard of living, health care expenditures and the incidence of contagious diseases and ill health. A seemingly unrelated regression of the 2 equations model with both time and fixed effects based on 3 sub-samples (Africa, Southern and Eastern Africa, and the rest of Africa) leads to the conclusion that the growth performances are country specific and varies over time. More specifically, the model predicts a reduction of 1.3 percent in economic growth at HIV prevalence rate of 20 percent. This growth reduction is about half that estimated by Bonnel (2000). Also this model is however highly aggregate and misses some of the real life interactions between HIV/AIDS and the economy. For instance, the model assumes full employment of all the labour force and does not allow for the existence of a labour surplus that would nullify the impact of the loss of abundant skills. Also the model makes no distinction between HIV and AIDS. In addition, it suffers from a
few estimation problems as some of the estimated coefficients (on education and health capital) are not significant or take a wrong sign.

Table 2 hereafter summarizes the main results of the studies reviewed above in terms of the GDP growth impact of HIV/AIDS. These results are not immediately comparable as they sometimes refer to rather different assumptions about the HIV prevalence rate and in some cases reflect the influence of specific country situations in terms of human capital, starting level of GDP per capita, maturity of the HIV epidemics and public response to it. Be as it may, the studies summarized in Table 2 suggests a few important conclusions: first, the impact of HIV/AIDS tends to be imperceptible in countries with HIV prevalence rates of less than 3-4 percent. Second, most studies suggest that a mature epidemic (above 5-20 percent, and above) can reduce the growth rate by a non-catastrophic but non-negligible amount, that is 0.5-1.0 GDP growth points a year, an impact that is certainly costly when it is sustained over the medium and long term. Finally, the studies referring to the entire economy (sections 3.1 through 3.4) generate GDP impact results that are substantially smaller than those derived from local surveys (section 2) summarized in Table 1 where it appears that an affected family looses some 30-40 percent of its income in comparison to a non-affected one. This means that in countries – such as Botswana – where the HIV prevalence rate exceeds 35 percent GDP should decline by some 10.5-14 percentage points, a result that is at variance with both the studies reviewed above and empirical observation.

Table 2. Summary of the annual reduction in GDP growth rate per year due to HIV/AIDS identified in studies based on macro, micro, cross country and panel studies

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>REFERENCE</th>
<th>Average reduction in annual GDP growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>Anand et al (1999)</td>
<td>0.1-1.0</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Kambou et al (1992)</td>
<td>1.9</td>
</tr>
<tr>
<td>South Africa</td>
<td>Arndt and Lewis (2000)</td>
<td>1.4-2.6</td>
</tr>
<tr>
<td>South Africa</td>
<td>BER (2001)</td>
<td>0.1-0.9</td>
</tr>
<tr>
<td>A representative African Country</td>
<td>Ainsworth and Over (1994)</td>
<td>0.1-0.8</td>
</tr>
<tr>
<td>South Africa</td>
<td>Quatek (2000)</td>
<td>0.3-0.4</td>
</tr>
<tr>
<td>Botswana</td>
<td>BIDPA (2000b)</td>
<td>8 (over ten years)</td>
</tr>
<tr>
<td>Botswana</td>
<td>Jefferis and Greener (1999)</td>
<td>1-2</td>
</tr>
<tr>
<td>Trinidad Tobago</td>
<td>Nicholls et al (2000)</td>
<td>4.2 (over 8 years)</td>
</tr>
<tr>
<td>Jamaica</td>
<td>Nicholls et al (2000)</td>
<td>6.4 (over 8 years)</td>
</tr>
<tr>
<td>Honduras</td>
<td>Cuesta (2001)</td>
<td>0.7-2.7</td>
</tr>
<tr>
<td>A representative Sub-Saharan African country</td>
<td>Over (1992)</td>
<td>0.15-0.33</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Cuddington (1993)</td>
<td>0.10</td>
</tr>
<tr>
<td>Malawi</td>
<td>Cuddington and Hancock (1994)</td>
<td>0.25</td>
</tr>
<tr>
<td>51 developing and industrial countries</td>
<td>Bloom and Mahal (1997)</td>
<td>Insignificant</td>
</tr>
<tr>
<td>70-80 developing countries</td>
<td>Bonnel (2000b)</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>(in case of prevalence of 20%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.80 (as in SSA, prevalence 8%)</td>
<td></td>
</tr>
<tr>
<td>41 African countries</td>
<td>Dixon et al (2001)</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>(in case of prevalence of 20%)</td>
<td></td>
</tr>
</tbody>
</table>

Note: a National household income
4. A simple model of the HIV/AIDS impact on GDP growth

The studies reviewed in section 3 describe several channels through which HIV/AIDS transmits its impact on economic growth and, through that, child poverty. Unsurprisingly, each of these studies suffers from some problems due either to overly simple assumptions or the neglect of impact pathways identified in the local-level analyses reviewed in Section 2. For instance, the microeconomic studies (section 3.1) allow only for declines in GDP driven by losses of labour but ignore the effects of slow downs in saving formation and capital accumulation. In addition, these studies do not allow for ‘demand effects’ – by which the decline in GDP growth is due also to a drop in the demand by infected families for goods produced by the non-infected ones. In turn, the macroeconomic models tend to be highly aggregated, to rely on large sets of assumptions and to generate only country-specific results. Meanwhile, the cross-countries econometric analyses do not allow to assess whether the growth performance varies over time and may be biased by problems of spurious correlation, omitted variables and reverse causation. Finally, the analyses based on panel data tend to underestimate the impact on performance in countries (such as South Africa) with recent epidemics.

4.1 Model’s structure

This section develops a simple aggregate model, described formally in Annex 1, that tries to overcome some of the inconsistencies described above. The model: (i) treats separately agriculture (A) and all ‘other sectors’ (O) such as industry, services and the public sector that are assumed to be located only in urban areas, while excluding the possibility of migration between A and O. This distinction is useful as it allows to represent the different epidemiological patterns in the urban and rural sector and their shifts over time; (ii) allows for two different production technologies depicted by generalized Cobb-Douglas production functions. In agriculture, production depends on unskilled labor (U) and arable land while in the ‘other sectors’ it depends upon physical capital (K), skilled labor (S) and unskilled labor. This allows to take into account the impact of differences in prevalence rates and labour productivity between the workers of these two sectors; (iii) allows ‘labour surplus’ for both skilled and unskilled workers so that the death of a worker in a labour surplus area causes family impoverishment but not of aggregate effects on GDP as the job left vacant is filled by an unemployed worker; (iv) allows for ‘demand effects’, that is it computes the decline in the output of one sector (e.g. the rural sector) caused by the AIDS-induced decline in purchases from it by the other (e.g. urban) sector. This means that growth rates in A and O are both supply and demand driven; (v) allows implicitly for the emergence of public deficits incurred by governments to finance a rise in medical and social welfare expenditure. Over the medium term, such deficit is seen as not harmful to growth; (vi) makes private saving (and therefore capital accumulation) in both A and O an inverse function of the HIV prevalence rate; (vii) HIV reduces land and labour productivity in A and labour and capital productivity in O, while AIDS reduces the employed workforce in both A and O except in case of labour surplus; (viii) represents the dynamics of the HIV prevalence rate with a logistic functions and that of the cumulative AIDS-deaths with a similar function lagged one period (7 years) with respect to the HIV prevalence rate. Table 3 describes the level of prevalence determined by the model at periods 0, 3 and 6 under different assumptions about z.
(the parameter that aggravates the HIV and AIDS dynamics in relation to the basic scenario).

Table 3. HIV prevalence rates at times 0, 3 and 6 (each of 7 years) and for different values of $z$

<table>
<thead>
<tr>
<th></th>
<th>$z = .1$</th>
<th>$z = .2$</th>
<th>$z = .3$</th>
<th>$z = .4$</th>
<th>$z = .5$</th>
<th>$z = .6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t = 0$</td>
<td>0.050</td>
<td>0.100</td>
<td>0.150</td>
<td>0.200</td>
<td>0.250</td>
<td>0.300</td>
</tr>
<tr>
<td>$t = 3$</td>
<td>0.095</td>
<td>0.190</td>
<td>0.285</td>
<td>0.381</td>
<td>0.476</td>
<td>0.571</td>
</tr>
<tr>
<td>$t = 6$</td>
<td>0.099</td>
<td>0.199</td>
<td>0.299</td>
<td>0.399</td>
<td>0.499</td>
<td>0.566</td>
</tr>
</tbody>
</table>

Source: authors’ calculations

The data sources used to benchmark the model are: the WDI (2001) for the GDP growth rates in 50 relevant countries; ILO (2000) for the projected labour force with and without AIDS; and FAO (1999) for the world-wide estimates of the agricultural population and labour force over 1950-2010. Finally, the values of the parameters used for the simulation of the model were drawn from the literature summarized in Table 4.

Table 4. Sources and values of the parameters used in the model

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
<th>COUNTRY, ESTIMATE AND REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$l_A$</td>
<td>0.3 or 0.7</td>
<td>Cornia et al (1996) and Over (1992)</td>
</tr>
<tr>
<td>$k_A$</td>
<td>0.7 or 0.3</td>
<td>Cornia et al (1996)</td>
</tr>
<tr>
<td>$l_O$</td>
<td>0.3</td>
<td>Cornia et al (1996) and Over (1992)</td>
</tr>
<tr>
<td>$k_O$</td>
<td>0.3</td>
<td>Cornia et al (1996) and Over (1992)</td>
</tr>
<tr>
<td>$h_O$</td>
<td>0.4</td>
<td>Cornia et al (1996) and Over (1992)</td>
</tr>
<tr>
<td>$m^A$</td>
<td>0.8</td>
<td>World Development Indicators (2001)</td>
</tr>
<tr>
<td>$m^O$</td>
<td>0.8</td>
<td>Cornia et al (1996)</td>
</tr>
<tr>
<td>$n_A$</td>
<td>0.8</td>
<td>World Development Indicators (2001)</td>
</tr>
<tr>
<td>$n_O$</td>
<td>0.6</td>
<td>Cornia et al (1996)</td>
</tr>
<tr>
<td>$%$ labour force in A</td>
<td>Not Used</td>
<td>from 3.1 in Botswana to 92.4 in Burkina Faso</td>
</tr>
<tr>
<td>$%$ GDP accounted for by A</td>
<td>Not Used</td>
<td>from 2.5 in Trinidad-Tobago to 60.8 Guinea-Bissau</td>
</tr>
<tr>
<td>$\Gamma_A$</td>
<td>0.1</td>
<td>South Africa 0.08 Morris et al (2000)</td>
</tr>
<tr>
<td>$k^A$</td>
<td>0.1</td>
<td>Cote d’Ivoire 0.1 (land) Black-Michaud (1997)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uganda, Tanzania, Zambia 0.1 (land) Barnett (1994)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uganda 0.6 (livestock) Haslwimmer (1994)</td>
</tr>
<tr>
<td>$k^O$</td>
<td>0.1</td>
<td>Uganda, Tanzania, Zambia 0.02 Barnett (1994)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zambia 0 Ching’amo (1995)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Africa 0.02-0.05 BER (2001)</td>
</tr>
<tr>
<td>$h^O$</td>
<td>0.1</td>
<td>Uganda, Tanzania, Zambia 0 Barnett (1994)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zambia 0 Ching’amo (1995)</td>
</tr>
</tbody>
</table>

The model is sufficiently broad to depict a good number of situations but at the same
time is simple enough to be estimated on panel data. However, the model is unable to
capture several impacts of HIV/AIDS described in the literature such as those
mediated by the erosion of social capital, the rise in orphan-hood and the worsening
of income distribution (the latter can be captured in part by the ratio between the
average urban and rural incomes). Other limitations of the model concern its inability
to endogenize the behavioural changes of the economic agents (a fact that can
however be represented by a ‘manual’ change in the model’s parameters), the lack of
technological progress (as e.g. the discovery of an AIDS vaccine) and government
interventions (for instance in the field of prevention and treatment) that would affect
the logistic-shaped path of HIV prevalence and cumulative AIDS deaths over time.
Also, the model does not incorporate explicitly the public sector and budget deficit,
the external sector (imports, exports, balance of payment, foreign aid, investment and
debt).

4.2 Preliminary results

The main results of the model simulations can be summarized as follows. To start
with, the basic scenario shows that, for any time and reasonable set of HIV prevalence
rates (below 0.4 at time 0) among skilled and unskilled workers in rural and urban
areas, the economic impact of the cumulative AIDS deaths is greater than that of the
increase in HIV prevalence. This means that the economic impact of the epidemics is
somewhat ‘delayed’ with respect to the increase in the HIV infections rate and that in
most countries affected by AIDS the main effect of the epidemic is still to be felt (see
for instance the case study on South Africa, chapter 6). Second, the strongest impact
of AIDS deaths and HIV-related diseases occurs between the period in which HIV
prevalence rises the fastest and that at which it reaches its maximum. This
counterintuitive result is consistent with those obtained from the econometric analysis
of panel data (section 3.4). Third, once the relative importance of agriculture and of the
‘other sectors’ in GDP is taken into account (see Table 2) the growth impact
estimated by the model is consistent with the results of the aggregate economy-wide
models reviewed in Section 3.2. Fourth, the impact on GDP growth depends less on
the relative prevalence across sectors and more on the relative productivity of the
different factors. For example, given a set of HIV prevalence rates for skilled and
unskilled workers in rural and urban areas, the economic impact of HIV/AIDS is
greater in the urban sector as productivity is highest among the urban skilled worker
followed by urban and rural unskilled workers. Fifth, the economic impact of the
epidemic is non linear. The impact of HIV-related diseases is convex, i.e. it rises more
than proportionately for any increase in prevalence. By contrast, the impact of AIDS
deaths is concave because of the decreasing marginal productivity of production
factors in the Cobb-Douglas production function chosen. Altogether, the latter impact
dominates the former, so that the overall impact of AIDS deaths and HIV related
diseases is concave in the HIV prevalence rate.

As for the impact of policy interventions, four main measures were tested. The first
scenario assumes that the government bears all health expenditures to prevent a
reduction in the household saving rates. The second simulates a policy of accelerated
training of scarce skilled workers so that their depletion rate is reduced and growth
CHAPTER 10: THE HIV/AIDS IMPACT ON THE RURAL AND URBAN ECONOMY

sustained. A third scenario assumes that public policy can enhance (e.g. through training) the substitution between different kinds of labour, so that a labour surplus in one sector can fill a gap in another sector. The fourth scenario assumes that antiretroviral treatment is provided to workers so as to reduce the HIV impact on economic growth. The main results of the simulations can be summarised as follows:

- Avoiding the impact of HIV/AIDS on savings and capital formation (e.g. subsidizing the additional expenditure on health and social welfare) is the most effective policy in any scenario. In Table 6, reductions in the growth rates of GDP in the case in which the HIV prevalence rate does not affect the saving rate in rural or urban areas (see column where $m^V_A = m^V_O = 0.8$) are always consistently smaller than those in which the additional AIDS-related expenditures increase the average propensity to consume to the unity ($m^V_A = m^V_O = 1.0$) and that to save to zero. Policy decisions on the financing of additional AIDS-related expenditure have therefore not only an enormous impact on the wellbeing of the sick but also on growth, especially in countries – such as those affected by HIV/AIDS – with weak or inexistent financial markets.

- The accelerated training of urban skilled workers (managers and technicians but also doctors, teachers and nurses) is an effective policy to sustain growth only if the labour productivity in agriculture is low. For example, if the HIV prevalence rate is 0.2 for all kinds of labour (see the last line of each of the two panels of Table 6 in which $z$ is equal to 0.2 for all types of skills), and labour productivity in agriculture is low (as suggested by $l_A = .3$), the training of additional skilled workers would reduce the HIV prevalence among such group ($z_{US} = 0.1$, with $z_U$ and $z_r =0.2$) and allow to contain the reduction of the growth rate of GDP by ten percentage point (37.0-26.9=10.1). A similar policy focused on the accelerated training of additional rural unskilled workers ($z_{US}$ and $z_U = 0.2$, with $z_r =0.1$) would lead to the a smaller reduction in GDP growth (9.3-6.4=2.9). However, in case the labour productivity in the agricultural sector is high ($l_A =.7$, results not shown) – as observed in labour scarce rural Africa dominated by an extensive agriculture – an increased supply of urban skilled workers would lead to a smaller reduction of GDP decline than the training of rural unskilled workers. This result could be restated by saying that the substitution of different kinds of labour should reduce to the largest possible extent the excess demand for the scarcest and most effective one.

- The introduction of measures promoting flexibility (by skill, gender, age and location) in the deployment of labour and facilitating the substitution between different kinds of labour reduces to a considerable degree the excess demand for the most effective and scarcest kind of labour, and so avoids large output reductions. Leaving things unchanged, could leave excess demand for some kind of labour but a growth-limiting HIV/AIDS induced shortage in some kind of labour. Greater sectoral and gender flexibility in production and reproduction of the labour force is thus a way to sustain output in a world affected by AIDS.

- Though this may contrast with a rights based approach to treatment, the model shows that antiretroviral treatment should be focused to the possible extent on the most productive workers rather than on all of them: this is due to the fact that the combined impact of AIDS deaths and HIV related diseases is concave in the HIV prevalence rate. For example, if one considers a scenario where the HIV prevalence
rate is 0.2 for all kinds of labour (Table 6), in case the labour productivity in the agricultural sector is low (l_A=.3), a complete antiretroviral treatment for urban skilled workers (a case represented by the second line of the first panel of table 6), allows to avoid a greater reduction of GDP growth (37.0-16.3=20.7 and 9.3-7.3=2.0) than that (9.3-4.7=4.6 and 37.0-18.8=18.2) obtained by providing an equal access to antiretroviral treatment for all kinds of labour (see the third line of the first panel of Table 5 where prevalence rates are 0.1 for all).

Table 5. Cumulative percentage reduction of the level of GDP in agriculture (A) and other activities (O) with respect to the non HIV/AIDS scenario at time 0 and 3

<table>
<thead>
<tr>
<th>Prevalence rates among rural and urban unskilled</th>
<th>l_A = .3, k_A = .7, l_O = .3, k_O = .3, h_O = .4</th>
</tr>
</thead>
<tbody>
<tr>
<td>m_A^V = m_O^V = 0.8</td>
<td>m_A^V = m_O^V = 1.0</td>
</tr>
<tr>
<td>z_R</td>
<td>z_U</td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>0.1</td>
<td>0.2</td>
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<tr>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: authors’ calculations. Notes: for the explanation of l_A, k_A, l_O, k_O, h_O see table 4. The parameters z_R, z_U, z_US set to 0 represent a situation of surplus for rural, urban and urban skilled workers. m_A^V = m_O^V = 0 describes the case in which the HIV prevalence rate does not affect the saving rates in rural and urban areas.


What are the possible policy responses to sustain the rate of growth and avoid distributive distortions and mass impoverishment in countries affected by AIDS? To answer this question, it is important to underline once more the fact that unlike other shocks such as recessions or terms of trade crises, AIDS is (i) a long wave (and not temporary) phenomenon that exerts a lagged and cumulative effect on the functioning of the economy. In a way, AIDS generates an immediately imperceptible but deepening shock. A second characteristic of HIV/AIDS is that it erodes the stocks of the production factors (skilled and unskilled labor, land fertility, financial savings, investments and social capital). Finally, though this point has not been discussed in this chapter, HIV/AIDS tends to cause considerable distributive distortions and increasing poverty. Accordingly, the objectives of a policy response aiming at sustaining growth and avoiding poverty in the AIDS era should focus on:
6.1 Avoid the decline in the stock of production factors

Avoiding a decline in the stock of available labor should be a primary policy concern of HIV/AIDS affected countries. This objective can be achieved through capillary community, school, health system and firm-based work of prevention as discussed in chapters 12 and 13 of this compilation. In view of the large costs imposed on them by HIV/AIDS (see section 2), the firms should also act more actively than in the past in the field of prevention, counseling, testing and treatment of STD and opportunistic infections. A second policy to preserve the stock of workers concerns the treatment with antiretrovirals. As explained in chapters 13 and 14, there are strong human rights arguments to gradually expand the treatment with antiretrovirals to all infected people. From an efficiency perspective, it is evident that there are also good efficiency arguments to follow this policy, as the replacement cost of many workers (for their upbringing, education and acquisition of on-the-job experience) can be much higher than the cost of generic antiretrovirals.

Consequently, the health policy suggestion is that in case only a small fraction of the population can be treated, one should focus on skilled workers (because their priority treatment generates the strongest overall impact on aggregate poverty), though as soon as a larger fraction of the population can be treated, it is desirable to expand proportionately the treatment of workers with different skills and in different sectors to avoid possible supply bottlenecks. In all cases where the treatment of the existing workers is impracticable, there is a need to accelerate the training of potentially scarce skilled workers. Enterprises and governments should provide budgetary support to accelerate the training or importation of technicians, specialized workers and other categories of laborers in short supply and whose shortage could generate large negative externalities and a contraction of growth. This applies for instance to people in nodal positions entrusted, for instance, with the task of ensuring the functioning of power grids, water and railway systems, health and education, highly specialized industries and so on. Targeted interventions in some of these sectors can generate important positive effects and prevent a slow down of growth.

As for the long term, the negative impact of HIV/AIDS needs to be counterbalanced by ensuring that enrolments in primary and secondary education are sustained by means of traditional academic planning and through measures, discussed in detail in chapter 12, such as curriculum simplification, the waiver of enrolment fees, special provisions for the education and training of a mounting number of orphans and so on.

Compensating the decline in household savings and enterprise profits – and the ensuing drop in investments - is more problematic. Here too, good policies can make some difference. First of all, the review of the literature in this chapter and the model simulations presented above suggest that the financing by the state budget of a substantial part of the additional AIDS-related health and welfare expenditure may contain the decline in household saving, enterprise profits and private investments. Particularly if the initial public debt/GDP ratio is low, governments can finance their AIDS-related deficits by means of non-inflationary signorage and the issuance of state bonds. While such measures may not be sustainable over the long term, they can offer considerable breathing space in some countries over the medium term. Second, improvements in financial markets (making credit available at affordable rates, low transaction costs and with new approaches to collateralisation) may help to sustain
output among both the AIDS affected and unaffected families. Third, international transfer of resources – in the form of budgetary support or international investments – may be a third way to help sustaining capital accumulation.

6.2 Promote greater flexibility in the use of production factors

Another possible response – at the community and enterprise level – can focus on measures that facilitate the mobility of production factors. There is already scattered evidence that communities affected by the virus adopt a less rigid division of labor by skill level, age and gender and encourage labor pooling arrangements (see section 2.1 (iii)). The impact of these measures de facto promotes a greater flexibility in labor deployment and efficiency – and ought to be encouraged through incentive schemes.

At the firm and farm level, greater flexibility in the distribution of tasks and less emphasis on job specialization, may avoid the surfacing of production bottlenecks. This recommendation is, of course, at variance with the trend of the last few decades towards increasing specialization, but fits – in general terms – with the shift towards ‘flexible specialisation’, an approach that attempts to avoid excessive rigidities in the organization and allocation of labor. These conclusions are supported by the simulation results discussed above (Table 5).

In the end, it can be even surmised that - in countries such as Botswana and South Africa where the infection rate among skilled and unskilled workers is very high and the saving constraint not so binding because of the existence of large mineral rents – the organization of production may shift towards a more capital intensive and less labor intensity technology. Shifts in this direction may have started taking place spontaneously in the presence of increases in the wage rates though the evidence in this regard in minimal.

6.3 Sustain the individual-community responses to preserve welfare and the local economies.

When faced with economic adversities, extended families and traditional societies have for long relied on well tested and efficient informal arrangements to sustain consumption and avoid long term economic decline. When faced with a loss of income, families generally begin by rationalizing consumption, increasing the supply of labour (of females, elderly, children) or migrating. They proceed then to liquidating financial savings and other assets and adjusting the family structure. When these measures are no longer sufficient, they revert to damaging measures such as the sale of productive assets (oxen, land, tools), the reduction of essential expenditures on health and basic food, the withdrawal of children out of school and the adoption of risky behaviors (exploitative work, sex trade and crime).

Communities, in turn, undertake collective action (pooling labor) in production, while seeking collective economies of scale in consumption (as in the case of the Peruvian comedores populares, or for child care). The communities also rely on local informal insurance and assistance mechanisms characterized by limited moral hazard, low information requirements and some redistribution. Such activities work well in case of
hidyosinrcatic shocks but – in high HIV prevalence countries - are insufficient to avoid both a decline in wellbeing and a longer term shrinkage of the economic base of families and communities. At the moment, there are indeed several indications that such family and communities strategies are increasingly unable to whether the economic and social impact of HIV/AIDS. It is thus necessary to scale up those community based measures by providing external support to them while considering also the introduction of broader measures.

**i) Employment based programs.** HIV/AIDS impoverishes non only the person infected but also – through demand, supply and systemic effects – also those linked to her by relations of family, employment, trade and exchange. One way to fight these systemic effects is to introduce employment based programs that have the double purpose of sustaining the incomes of the families and communities over the medium term while avoiding a deterioration of the economic basis (physical infrastructure, expertise and so on) of the community.

Employment based programs can effectively reach the needy but able people of working age. Several arguments justify the adoption of public work schemes over pure transfer programmes (see later). To start with, public work programs not only permit the achievement of specific poverty alleviation objectives over the short run, but also contribute to the growth of productivity over the long term by speeding up the accumulation of capital or avoiding its deterioration. In addition, labour programs are less affected by the adverse selection problems associated with direct transfer programmes. There is already considerable experience with the design and management of such programs as suggested by the successful experience of the Maharastra Employment Guarantee Scheme (later replicated in all India as the Jawahar Rozgar Yojana), Chile’s Minimum Employment Program and Occupational Scheme for Heads of Households (that covered in 1984 40 per cent of the jobless) or Botswana’s Labour-Based Relief Programme. These programs have been successful in offsetting the impact of recessions and droughts but need now to be adjusted to the situation of HIV/AIDS affected communities, a situation in which the pandemic tends to reduce the labor power of some (but not all) segments of society.

**ii) micro-credit and training programs.** Employment-based programs are not suitable for poor families that have no surplus labor to employ. In this case, there is a need to intervene through measures that increase the productivity and earnings of the declining amount of labor power already employed. This objective can be achieved for instance through micro credit or skill upgrading programs. Training in activities where new skills generate quick returns (especially in the urban sector) as well as greater access to funds enhance the ability of families and communities to respond to crises.

Also in this case, there is a vast literature on the design and management of such programs, including in HIV affected countries such as those of South Eastern Africa. Obviously such credits create short term liabilities and are therefore not suitable for persons with AIDS (who likely are sick, weak and depressed) though they should be attractive to their family member. Such micro-credit are not granted for long periods – so HIV positive people unaware of their status, may benefit from participating in these community-based schemes that often combine welfare and economic support into one single interventions (see chapter 15).
(iii) **Income transfer** programs avoid not only avoidable suffering but prevent the adoption of destructive survival strategies such as the sale of productive assets and the withdrawal of children from schools. These measures are necessary for those families that cannot be helped through employment based, microcredit and training programs.

Insurance or assistance based transfer programs have been in existence in developing countries for some years, but are generally underdeveloped in the countries affected by HIV AIDS. The standard Western model of social security is of little applicability to low-income HIV-affected countries due to cost and organisational reasons. Yet, there are examples of adaptations of low-income rural settings that have developed a low-cost, non-contributory, state-funded scheme providing coverage against key risks of immiseration arising from old age, sickness, disability and widowhood, i.e risks that cannot be tackled by increasing access to employment. The Kerala and Tamil Nadu non-contributory old age pension schemes, for instance, cover almost all the elderly poor, while some form of social assistance is available to half the workers in the unorganized sector, the physically handicapped and the victims of work injury. An estimated 17 per cent of poor households in Tamil Nadu are covered by this programme, and nearly 60 per cent of the beneficiaries are poor women (Guhan 1992). It is estimated that the extension of such a minimum social assistance package to all poor households of India with these characteristics would cost only 0.3 per cent of the national GDP (ibid).

Income transfers can be targeted directly or indirectly to AIDS affected children (through orphan allowances, foster care allowances, basic pensions for the elderly – who often are in charge of a number of orphans - as well as to impoverished people sick with HIV and AIDS. Such transfers can be in kind (food, clothing, less fungible than money), in cash (book/school/transport allowances) and exemptions from school and medical fees. Elements of such schemes are in existence in several AIDS-affected countries. In Botswana the government introduced in 2000 a ‘package’ of subsidies in kind for orphan children worth 60$ per child/month. South Africa has instituted a child support grant, a foster care allowance and a care dependency grant for children with severe problems (see chapter 6). Thailand has developed a mixed system in which temple- and community-based transfers start to be accompanied by interventions targeted at children originating from the central government (see chapter 7). Even financially-stretched countries such as Zambia have considered a modest transfer system (worth half a million $ a year) to offset school cost of AIDS orphans (personal communication of UNICEF Zambia). These programs have to be expanded, better analyzed and evaluated. Particular attention needs to be placed on key design issues concerning the value of the transfer, the target population (whether all children in AIDS affected families, the AIDS orphans, all orphans, all OVCs), the disbursement channels (the municipal and local authorities, the NGO’s or the communities) and institutional arrangements, incentives traps and stigma and the accountability of such programmes.
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CHAPTER 10: THE HIV/AIDS IMPACT ON THE RURAL AND URBAN ECONOMY


CHAPTER 10: THE HIV/AIDS IMPACT ON THE RURAL AND URBAN ECONOMY


Annex 1. Model structure

In the absence of policy measures aiming at controlling it, the dynamics of HIV and AIDS prevalence rates can be depicted by a non-linear function that can be meaningfully assumed to be a logistic function. The AIDS death rate $D(t)$ raises with a time lag of one period (of the duration of 7 years) with respect to the HIV prevalence rate $V(t)$:

$$V(t) = \frac{e^t}{1 + e^t} \quad D(t) = \frac{e^{t-1}}{1 + e^{t-1}}$$

The model assumes that HIV and AIDS epidemiological patterns are likely to be different in different areas of the country and therefore introduces a distinction between HIV and AIDS prevalence in rural and urban areas. For sake of simplicity, the model assumes that, for each time $t$, the impact of HIV related diseases and AIDS deaths in rural areas is a proportion of that in urban areas. Let $z_R$ and $z_U$ be the parameters attached to $V(t)$ and $D(t)$ to represent the HIV and AIDS dynamics in rural and urban areas, respectively:

$$V_R(t) = z_R \frac{e^t}{1 + e^t} \quad D_R(t) = z_R \frac{e^{t-1}}{1 + e^{t-1}} \quad V_U(t) = z_U \frac{e^t}{1 + e^t} \quad D_U(t) = z_U \frac{e^{t-1}}{1 + e^{t-1}}$$

The impact of HIV related diseases and AIDS deaths on the economy are likely to be different in different sectors so that their aggregate impact depends on the relative importance of these two sectors in the country considered. In this model, the rural economy is devoted only to the production of agricultural goods and the urban economy is involved only in the production of all ‘other sectors’ so that the labour force in agriculture and the ‘other sectors’ is taken to be the rural and urban active population.

The impact of HIV related diseases and AIDS deaths is also likely to differ according to the skill level of the labour force. To make things easier, the model assumes that in each time period $t$ the impact of HIV related diseases and AIDS deaths on skilled workers is a multiple $z_{RS}$ and $z_{US}$ of that on the unskilled workers where the subscripts RS and US refer to rural skilled and urban skilled workers. As a result, the impact of HIV and AIDS on skilled and unskilled workers in the urban and rural sector can be written as follows:

$$V_{RS}(t) = z_{RS} \frac{e^t}{1 + e^t} \quad D_{RS}(t) = z_{RS} \frac{e^{t-1}}{1 + e^{t-1}} \quad V_{US}(t) = z_{US} \frac{e^t}{1 + e^t} \quad D_{US}(t) = z_{US} \frac{e^{t-1}}{1 + e^{t-1}}$$

The growth process is depicted using two generalised Cobb-Douglas production functions one for the rural and one for the urban sector. In agriculture, growth depends on the availability of unskilled labour and land while in the ‘other sectors’ it depends on skilled and unskilled workers and the capital stock. Let $L_A$, $K_A$, $L_O$, $K_O$ and $H_O$ be the amount of unskilled workers, land or physical capital and skilled workers respectively involved in agriculture and the ‘other sectors’ and $l_A$, $k_A$, $l_O$, $k_O$ and $h_O$ be their coefficients in the relevant production functions.

As for the impact of the pandemic on production, the model assumes that the HIV related diseases reduce the productivity of unskilled workers, land, capital and skilled workers. Let $l_{VA}$, $k_{VA}$, $l_{VO}$, $k_{VO}$ and $h_{VO}$ be the coefficients through which the spread of HIV affect the productivity of these factors of production. For simplicity, we assume that the productivity of capital in the ‘other sectors’ declines in line with the spread of HIV among the skilled workers only. Thus, the level of GDP in the agricultural and ‘other sectors’ is given by:

$$Y_A = L_A^l K_A^k (V_R L_A)^{-l_{VA} l_O} (V_A K_A)^{-k_{VA} l_O}$$

$$Y_O = L_O^l K_O^k H_O^{h_{VO}} (V_U L_O)^{-l_{VO} l_O} (V_O K_O)^{-k_{VO} l_O} (V_U H_O)^{-h_{VO}}$$
CHAPTER 10: THE HIV/AIDS IMPACT ON THE RURAL AND URBAN ECONOMY

The impact of AIDS deaths on production is to reduce the amount of unskilled and skilled workers. As the model does not contemplate the possibility of migration between sectors, the impact of AIDS mortality on agriculture and the ‘other sectors’ is given by:

\[
\dot{L}_A(t) = -z_AD(t) L_A(t)
\]

and

\[
\dot{L}_O(t) = -z_OD(t) L_O(t)
\]

where these two relations depict the reduction in the number of workers available in agriculture and the ‘other sectors’, while

\[
\dot{H}_O(t) = -z_{US}D(t) H_O(t)
\]

represent the reduction in human capital due to the death of experienced staff in the ‘other sectors’. Notice that setting \(z_R, z_U\) and \(z_{US}\) equal to 0 allows to simulate a situation of labour surplus for both skilled and unskilled workers. As for capital accumulation, the model assumes that there are no foreign investments and that capital formation in both agriculture and the ‘other sectors’ depends only on the savings generated within each of these two sectors. Let \(m_A\) and \(m_O\) be the average shares of GDP devoted to private consumption in rural and urban areas. HIV related diseases increase such propensities to consume. Let \(1-m_A\) and \(1-m_O\) be the saving rates in rural and urban areas, and let \(m^V_A\) and \(m^V_O\) the coefficients through which the HIV dynamics affect these saving rates. The model assumes that the saving rate in urban areas depends on the HIV prevalence rate among unskilled workers. Thus the changes in capital stock in agriculture and the ‘other sectors’ are given by:

\[
\dot{K}_A(t) = Y_A(t) - m_A Y_A(t) - m_A m^V_A V_A(t) Y_A(t) - d_A K_A(t)
\]

\[
\dot{K}_O(t) = Y_O(t) - m_O Y_O(t) - m_O m^V_O V_U(t) Y_O(t) - d_O K_O(t)
\]

Assuming that \(d_A = d_O = 0\) allows to solve explicitly for:

\[
L_A(t, L_A(0), z_R) \quad K_A(t, K_A(0), Y_A(t), m_A, m^V_A)
\]

\[
L_O(t, L_O(0), z_U) \quad K_O(t, K_O(0), Y_O(t), m_O, m^V_O) \quad H_O(t, H_O(0), z_{US})
\]

Assuming then that \(L_A(0) = L_O(0) = H_O(0) = 1\) (i.e. standardizing the initial values of these variables to 1), the changes in GDP in agriculture and the ‘other sectors’ can thus be written as the log transformation of the GDP levels. Therefore, the HIV and AIDS impact on the change of GDP in these two sectors is given by:

\[
\dot{Y}_A(t) = l_A(1-l_A V_A(t)) \dot{L}_A(t) + k_A(1-k_A V_A(t)) \dot{K}_A(t) - (l_A l_A^V + k_A k_A^V) V_A(t) \dot{V}_A(t)
\]

\[
\dot{Y}_O(t) = l_O(1-l_O V_U(t)) \dot{L}_O(t) + k_O(1-k_O V_U(t)) \dot{K}_O(t) + h_O(1-h_O V_{US}(t)) \dot{H}_O(t) - l_O l_O^V V_U(t) \dot{V}_U(t) - (k_O h_O^V + h_O h_O^V) V_{US}(t) \dot{V}_{US}(t)
\]

This allows to obtain explicit solutions for:

\[
Y_A(t, Y_A(0), m_A, m^V_A, L_A(0), z_R, l_A, l_A^V, K_A(0), k_A, k_A^V)
\]

\[
Y_O(t, Y_O(0), m_O, m^V_O, L_O(0), z_U, l_O, l_O^V, H_O(0), z_{US}, h_O, h_O^V, K_O(0), k_O, k_O^V)
\]
in which the world demand for and prices of national products and the net capital inflows remain unchanged. Finally, the model defines

\[ g_A(t) = \frac{Y_A}{Y_A} \quad g_O(t) = \frac{Y_O}{Y_O} \]

as the growth rates of output in agriculture and the ‘other sectors’. Finally, let us assume that \( Y_A(0) = Y_O(0) = 1 \) and that \( n_A \) and \( n_O \) are the proportions of consumption expenditures allocated to agricultural products by the rural population and to other products by the urban population. This allows to take into account the negative impact on the growth of each of the two sectors of the decline in the demand originating in the other sector. Thus, the supply and demand impact of HIV and AIDS on growth rates of the sectoral GDP is given by:

\[
g^E_A(t) = (1 + m_A n_A) g_A(t) + [m_O (1 - n_O)] g_O(t)
\]

\[
g^E_O(t) = (1 + m_O n_O) g_O(t) + [m_A (1 - n_A)] g_A(t)
\]