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AIDS, GROWTH AND DISTRIBUTION IN SOUTH AFRICA

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Abstract

This paper discusses recent research into the economic impact of AIDS in South Africa. It focuses on demographic and macroeconomic modelling and on firm-level impact studies. While the overall picture is murky, certain trends and findings are indicative of a likely increase in inequality. Relatively skilled workers could benefit from greater employment, higher wages, a larger supply of products produced for their niche markets, and may also live longer as it becomes economically viable for firms to provide anti-retroviral medication. The relatively unskilled and unemployed will probably experience declining income, falling consumer welfare, and suffer greater morbidity and mortality from AIDS. The size of the pie may shrink as a result of AIDS, but employed people – and especially the skilled amongst them – will enjoy a growing share.

Introduction

How is the AIDS pandemic affecting growth and distribution in South Africa? The short answer is: it's impossible to say – the data simply isn't available. At best, there are several (sometimes contradictory) fragments of information which, when fitted together, perhaps provide some indication of the broad picture. The main sources of information are these:

1) two demographic models which project the path of the epidemic based primarily on ante-natal survey data, mortality figures and assumptions about sexual behaviour in the population;
2) three macro-economic projections of the impact of AIDS on economic growth, employment, etc.; and
3) an uneven but growing body of research on the impact of AIDS on firms, household and economic sectors.

This paper discusses the three research areas and draws tentative implications for the likely impact of AIDS on growth in general, and on distribution in particular. It is not a comprehensive bibliographic review (as in CADRE 2000a and 2000b), but rather a more selective and discursive analysis of important and recent pieces of research.

The Demographics

Of all the available fragments of information, the two[1] main demographic models (ASSA 2000[2] and Metropolitan[3]) are the most consistent. Both models assume that the HIV epidemic moves through the population via sexual interaction between four risk groups (ranging from high-risk groups such as commercial sex workers, to those with no risk of HIV infection). Projections of the epidemic differ depending on assumptions and input parameters (e.g. probabilities of infection, fertility rates, median term to death, mother-to-child transmission rates etc.). Both the ASSA 2000 and Metropolitan models are calibrated to fit the ante-natal survey data, but the ASSA 2000 model (which is also calibrated to fit the latest (1999/2000) mortality data released by the Department of Home Affairs), is widely regarded as the more sophisticated of the two.

Both models predict that the South African population will grow by a mere 1,5 million between 2000 and 2015 (i.e. 10 million fewer than would have been the case in a no-AIDS scenario) and that the labour force will remain almost stagnant over the next fourteen years. ASSA 2000 predicts that HIV prevalence will grow from its current level of 11%, and will peak at 16,2% in 2006 (i.e. 7,7 million people). The number of people with full-blown AIDS is predicted to rise five-fold to 880 000 in 2005, and then to 1,2 million people in 2015. AIDS-related deaths follow the trend for full-blown AIDS with a two-year lag.

Peak prevalence occurs between the ages of 20 and 45 for men, and 15 and 30 for women. The demographic models use data showing a higher HIV prevalence for women than for men. There is some evidence that there is little difference in HIV prevalence between men and women who are employed (Dorrington, 2001). This suggests that unemployed women are particularly vulnerable to HIV infection. HIV prevalence rates amongst the unemployed are typically 30-50% higher than among the employed – reflecting in part the large share of young people (and females) amongst the unemployed (BER, 2000:7).

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[1] There are other models as well – such as that of Abt/Metropolitan and ING-Barings – but these are typically variants of the ASSA or Metropolitan models.

[2] The ASSA 2000 model was developed by the Actuarial Society of South Africa (originally as an extension of the Doyle Metropolitan model).

[3] This model was developed by Peter Doyle and is propriety to Metropolitan Life (a large insurer in South Africa).

Prevalence also appears to vary between skill levels (see Table 1 below). Drawing on insurance data and other private sector information, Dorrington (2001) reports that those in the higher job grades have an HIV prevalence of only 2,5% to 3%. This information was used in the ASSA 2000 model to fit the epidemic curves for white and Asian people (who tend to be concentrated in the higher job grades) rather than the ante-natal survey data (which is unreliable for higher income groups[4]). The ASSA 2000 model predicts that HIV prevalence will peak at 3,2% (2011) for whites, at 4,8% (2010) for Asians, at 6% (2010) for coloureds and at 19,5% (2006) for Africans.

One of the problems with the demographic models for economic analysis is the difficulty involved in teasing out the impact of race from other variables such as skills and income. As noted above, the ASSA 2000 model used information on HIV prevalence by skill to project epidemic curves for whites and Asians. However, for Africans and coloureds, researchers have had to move from information about race to assumptions about skill prevalence. The Metropolitan and ING-Barings models derive HIV skills profiles by 'overlaying' the 1996 census data on occupation with age, gender and racial HIV profiles per province (see ING-Barings, 2000: 7). This results in a far higher estimate for HIV prevalence amongst skilled workers in 2000 (7,2% for highly-skilled workers, to 12,1% for skilled workers and 14,3% for unskilled workers) than is assumed in the ASSA 2000 model (reported in BER, 2001: 7).

These highly varying estimates of prevalence by skill level are a problem for macroeconomic models because of the profound impact of skills shortages on economic growth. As can be seen in Table 1, unemployment amongst the highly skilled is already very low. According to an ILO study, more than 60% of firms in 2000 reported that they would have problems replacing skilled labour (2000: 5). The point at which the economy 'runs out' of skilled labour has major implications for the projected macroeconomic impact of AIDS. According to the Metropolitan model, 1.4% of highly skilled workers will have full-blown AIDS by 2005, this estimate rising to 3.5% in 2015 (Abt/Metropolitan, 2000). Given that less than 1% of the highly skilled are unemployed, there will not be nearly enough people to replace those dying of AIDS in these categories. Therefore, unless firms react by providing their skilled workers with life-prolonging anti-retroviral medication, the economy will be constrained by skills shortages and skilled wage pressure (as described in BER, 2001). This constraint will kick in later if the ASSA estimates are closer to the mark.

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[4] The ante-natal survey data is taken from women attending government-run clinics. Higher-income people tend to visit private sector facilities and hence will not be adequately represented in the ante-natal survey.

Table 1. The Structure of South Africa's Labour Force (1996 Census Data)

	Highly Skilled***		Skilled**		Semi & Unskilled*	
Economically active	Number	%	Number	%	Number	%
Formally employed	1,300,009	92.1	2,899,334	76.5	3,509,890	40.9
Informally employed	100,177	7.1	289,901	7.7	710,223	8.3
Unemployed	11,148	0.8	598,083	15.8	4,366,238	50.8
Total labour force	1,411,334	100	3,787,318	100	8,586,351	100
Composition (%)	10.2%		27.5%		62.3%	
HIV prevalence in 2005 (2015)#	13.3% (18.3%)		20.2% (25.4%)		22.8% (27.6%)	
AIDS prevalence in 2005 (2015)#	1.4% (3.5%)		1.9% (4.2%)		2.2% (4.7%)	

***Highly-skilled (professional, semi-professional and technical occupations, managerial, administrative and executive occupations)
** Skilled (clerical services and sales occupations, farmers, farm managers, artisans, apprentices and related occupations, production foreman, production advisor)
* Semi- and unskilled (all occupations not defined as highly-skilled or skilled)
# Data from Abt/Metropolitan
Source: BER, 2001: 11, 12.

The close association between unemployment and poverty has been well established (Leibbrandt *et al*, 2000, Seekings, 2000). A recent household survey in the Free State indicates that AIDS-affected households are in a particularly vulnerable position as they have higher rates of unemployment and are more dependent on non-employment income like pensions (Booysen *et al*, 2001b). This suggests that one or more of the following is the case: people living in households with limited (if any) access to wage employment are more vulnerable to HIV/AIDS infection; that AIDS-affected households have experienced disproportional employment losses because of AIDS; and that people living with AIDS migrate to households with pensioners in order to be taken care of.

   What does this mean for overall inequality? All else being equal, households which lose a breadwinner through AIDS will fall further down the income distribution. If the job is taken by a previously unemployed person, then that person's household will move up the income distribution. The overall Gini coefficient will thus remain broadly unchanged. However, if firms react by cutting back on the number of jobs, then the number of households without access to a breadwinner will rise, thus worsening the Gini coefficient. If average wages rise at the same time (perhaps in response

to increased pressure from workers to compensate them for the burden of higher medical insurance and health expenditure, or perhaps because the average worker is becoming more skilled as firms get rid of unskilled workers first) then inequality will worsen further.

At this point the importance of economic modelling becomes clear. Questions like 'What is the likely impact of AIDS on labour demand and income?' need to be answered before anything can be said about the impact of AIDS on income distribution. But the issue goes beyond the 'partial equilibrium' impact of labour demand and wages. We need to know how the impact of AIDS on firms (and the government) feeds through the entire macroeconomy to impact on the level of national income. This means tracing the likely impact on the level and composition of demand, on investment, on economic structure (as some sectors benefit or lose more than others) and on the level and composition of government spending.

Any discussion of the impact on distribution requires information about the size of the pie (the GDP) and the number of people in need of a slice (the population). AIDS slows income growth – but it also slows population growth. If the population falls faster than income, then *per capita* income will rise. But while this is theoretically possible, it is not common. Econometric research indicates that AIDS has either had an insignificant impact on the growth of *per capita* income in developing countries (Bloom, 1997) or has reduced it (Bonnel, 2000). Bonnel's results indicate that 'in the case of a typical sub-Saharan country with a prevalence rate of 20 percent', the growth rate of *per capita* income would be reduced by 1.2 percentage points a year because of AIDS (2000: 846). But whether absolute *per capita* income is higher or lower as a result of AIDS in any particular country is ultimately an empirical question.

As shown below, two of the three South African models predict a rise in *per capita* income, whereas the third predicts a fall.[5] Whether *per capita* income rises or falls has disturbing ethical and policy implications. The Malthusian possibility that AIDS may increase *per capita* income might suggest to those policy-makers with no respect for human life that AIDS may be in some sense 'welfare-enhancing'. They may conclude that it is economically rational to do little to prevent the AIDS epidemic from taking its course. Leaving aside the moral and ethical problems of such a position, it does point, at minimum, to the importance of producing the best possible

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[5] Abt Associates (2000: 49-50) also conclude that AIDS is likely to increase *per capita* incomes – although they do so not on the basis of their own macroeconomic model, but rather by reviewing modelling work from the rest of Africa and modifying it to take into account factors specific to South Africa (such as high unemployment).

macroeconomic modelling work - and showing how different assumptions and theoretical underpinnings produce different results.

Modelling the Macroeconomic Impact of AIDS

The earliest attempts to model the economic impact of AIDS in South Africa were those of Broomberg *et al* (1991) and Trotter (1993). They adopted a 'human capital' approach which summed up both the expected direct costs of AIDS (i.e. health costs) as well as indirect costs (discounted lost future earnings) over time. However this approach is not suitable for examining the full macroeconomic impact of AIDS, because it does not trace through the repercussions of these costs on consumption, investment and savings – and thus ultimately on the pattern and rate of growth.

Macroeconomic modellers take the demographic projections and try to estimate how the impact of AIDS will affect the economy. This entails a three-step process. First, they use an existing macroeconomic model to project what growth would look like in the absence of AIDS. Then they hypothesise a set of presumed 'channels' through which the epidemic is assumed to affect the macroeconomy. Finally, they estimate (and guesstimate) the size of these various channel effects, plug the assumption into the model and see what growth path results. This growth 'with AIDS' scenario is then contrasted with the 'growth without AIDS' scenario.

The model projections depend in the first instance on the nature and design of the macroeconomic model. The first big modelling exercise (ING-Barings, 2000) used time series information together with a 'social accounting matrix' (SAM) that provided more detailed household-level data. Arndt and Lewis (2000) made use of the same SAM, but in the context of a more neoclassical 'computational general equilibrium' (CGE) model. The most recent macroeconomic modelling exercise – that of the Bureau for Economic Research (BER, 2001) at Stellenbosch – does not use a SAM, but instead builds on their Keynesian framework (using insights from available research, including that by ING-Barings).

There are many 'channels' through which the AIDS pandemic can affect the macroeconomy. AIDS has an immediate (or 'first order') impact on the size (and efficiency) of the labour force. But while demographic models can provide a broad indication of the impact on the size of the labour force, the impact on the efficiency of the labour force is much harder to estimate. There is very little reliable data on the distribution of HIV prevalence across skill bands – or between the employed and unemployed parts of the labour force.

The other first-order impact of AIDS is on patterns of consumption (i.e. it is usually expected that more household resources will be allocated to health care). Although there is an emerging body of household-level research (e.g. Booysen *et al* 2001b), there is as yet no information that can be generalised

to the national level. International research in developing countries is suggestive, but often contradictory. For example, there is research showing that households may erode savings by paying for the health costs of AIDS sufferers, and increase savings by supporting surviving household members (see Ainsworth & Over, 1994; and CADRE, 2000a). Given that HIV infection is concentrated amongst poorer South Africans, it is unlikely that savings will increase as a result of AIDS. Indeed, Booysen *et al* (2001) find that AIDS-affected households draw on available savings to finance medical costs and funerals. However, there is as yet no information about the impact of AIDS on total household savings.

Research in Africa indicates that AIDS-affected households shift spending away from durable goods towards non-durables like food (ILO, 2000: 5-7; Abt Associates, 2000: 52). This does not, however, mean that the overall pattern of demand will change in this direction. Firstly, AIDS-affected households could spend relatively less on durables and absolutely less on non-durables like food (as was the case in the Booysen *et al* (2001) study). In such a scenario, the demand for both durables and non-durables will fall.

Secondly, the overall impact on the pattern of consumption is mediated by the distribution of AIDS-affected households across the income distribution (and by differential consumption patterns across income brackets). For example, the ING-Barings model assumes that AIDS will result in a greater share of income going to richer households (as skilled wages rise in response to skilled labour shortages). Data in the SAM used by ING-Barings indicates that richer households spend more on services and durable goods than do poorer households. Thus as skilled workers rise up the income distribution, the model predicts that this will cushion the impact of lower demand for durable goods from AIDS-affected households. CADRE argues that this is 'at odds with research elsewhere which suggests that households cut back on durable consumption to maintain food intake' (2000b: 14). In this regard, however, CADRE misses the point that the overall impact on demand is a function not only of changes in expenditure patterns at the level of the individual household, but also a function of the allocation of income between households.

The ING-Barings model uses demographic data on the expected size of the labour force and then 'weights' it to account for different skill composition (i.e. skilled labour carries a higher weight) and adjusts it downwards to account for loss of productivity as a result of AIDS.[6] This has been criticised by CADRE (2000b: 14) on the grounds that it probably

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[6] ING-Barings assumes that 'for every person with full-blown AIDS, four months of person year equivalent labour supply will be lost' (2000: 11).

underestimates the productivity contribution of experienced workers in lower-skill categories (and hence the impact of replacing such workers) and the potential for high-skill capacity bottlenecks in some sectors. But in the absence of better information, macroeconomic modelling work is often forced to make such blanket assumptions.

AIDS also affects people indirectly – i.e. through the impact of 'second-order' effects which occur after firms and the government have responded to the first-order impact of AIDS. These are even more difficult to estimate. Does one assume that firms will respond to higher medical costs for employees and lower productivity by replacing labour with machinery – and if so, by how much and in which sectors? Will firms respond to higher (direct and indirect) labour costs by raising prices (i.e. passing costs on to consumers) or reducing profits (thereby probably reducing investment in subsequent periods)? To what extent will they share the costs with workers – thereby reducing take-home pay, consequently lowering consumer demand, and thus dampening growth in subsequent periods? The different models assume different scenarios and model the way in which the assumptions impact on economic growth in different ways.[7]

There are similar problems regarding the reaction of government to the AIDS pandemic. Will government increase spending on health – and if so, will this be at the cost of lower spending on other items; and if so which? There are very different implications for growth in the long run, depending on where spending is cut – whether on education or the military. Alternatively, one could assume that the government responds by increasing borrowing or taxation to finance the increase in health spending. Depending on the nature of the macro model, such increases have further knock-on effects. In more Keynesian models (like ING-Barings and BER) deficit-financed health spending increases demand and growth, whereas in the CGE model of Arndt and Lewis (which assumes full-employment), increased borrowing reduces private investment and hence constrains growth over time.

Both the ING-Barings and BER models predict a slight worsening of the ratio of budget deficit to GDP as government faces the dual pressure of

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[7] Employers shoulder two-thirds of the higher medical cost burden in the ING-Barings model, and half in the BER model. Both assume that half of this burden is subsequently passed onto consumers. As regards the indirect effect of AIDS on firms (i.e. lower productivity, increased turnover, recruitment costs etc.) the BER model assumes that productivity of infected workers is reduced by 40% (thus lowering the effective labour supply) and that this burden is shared between firms and consumers (BER, 2000: 23). ING-Barings assumes no such additional reduction in the effective labour supply – hence the differences in projected trends for the labour force growth in the models (see Table 2).

depressed tax revenues and increased demand for spending on health. They assume that the government will continue on the path of fiscal discipline and not engage in excessive borrowing or inflationary forms of financing the deficit.   However the BER model assumes greater wage pressure as a result of AIDS (driven primarily by skilled-labour shortages) and assumes that the Reserve Bank responds to such inflationary forces by pushing up interest rates.

Despite these differences, the ING-Barings and BER models arrive at broadly similar findings with regard to GDP and employment (see Table 2). They both estimate that AIDS will reduce the growth rate of GDP by 0.6 percentage points per annum. As AIDS is assumed to reduce population growth by more than it reduces GDP growth, both models predict an increase in *per capita* income (of just under 1 percentage point per annum). A similar logic underpins the prediction in both models that the rate of unemployment will fall as a result of the AIDS pandemic (employment falls, but because the labour force falls faster, the proportion of those without work decreases relative to that which would have occurred in a no-AIDS scenario).

Table 2: Percentage Point Differences between the AIDS and No-AIDS Scenarios in the ING-Barings (2000) and Bureau for Economic Research (2001) Macroeconomic Models

	ING-Barings (2000)	BER (2001)
Impact of AIDS on:	*2002-2015*	*2002-2015*
Real GDP growth p.a.	–0.6	–0.5
Real Gross Domestic Fixed Investment growth p.a.	0.0	–1.2
Real Private Consumption growth p.a.	–0.7	–0.3
Total population growth p.a.**	–1.5	–1.3
Total labour force growth p.a.***	–1.2	–1.6
Employment growth p.a.****	–0.6	–0.6
Growth in the unemployment rate (i.e. % of labour force without formal jobs)*	–0.9	–2.0
Real *per capita* GDP growth p.a.#	0.9	0.9
Interest rate (% point difference in the level)	0.6	2.9
Budget Deficit/GDP (% point difference in the level)	0.7	0.2

* Figures for BER estimated from level data in (2001: 38).
** Figures for ING-Barings calculated from data in (2000: 6).
*** Figures for ING-Barings calculated from data in (2000: 10). NB data for ING-Barings is a labour force figure weighted by skill-level.
**** Employment figure for ING-Barings estimated from data in (2000: 2).
# Figures for ING-Barings calculated from data in the table.`

Despite similarities in the overall growth impact, the BER and ING-Barings models tell different stories as to why growth is constrained by AIDS. Whereas the ING-Barings model assumes that lower labour supply and lower labour productivity will induce firms to invest in capital (thus preventing investment demand from falling in the aggregate),[8] the BER model assumes that investment will be limited by shortages of skilled workers (needed to operate the capital equipment) and by reduced profitability. ING-Barings tells the story of a 'vicious cycle' in which reduced household income translates into lower consumption spending – which translates into lower demand and hence lower growth and household income.

By contrast, the BER model assumes that there will be a strong upward pressure on skilled wages (as skills shortages intensify and as workers resist the erosion of their take-home pay due to rising costs of medical insurance). The BER modellers assume that the increase in wages will exceed any decrease in employment – and thus that wage increases will boost household income in the aggregate (although by implication it will be more concentrated in the hands of those households which still have employed members). Neither model provides an explicit projection for income distribution – although both predict that the share of income going to higher-income households will rise over time (ING-Barings, 2000: 14; BER, 2001: 31-2). But at the same time, the models predict that average living standards (i.e *per capita* income) will rise relative to a no-AIDS scenario and that one of the central determinants of poverty – unemployment – will fall.

The macroeconomic model of Arndt and Lewis (2000) contains different assumptions and arrives at different conclusions. They assume a far greater negative impact on productivity and investment, and a far greater impact on government spending and interest rates.[9] Largely as a result of this, they project a much greater impact on GDP growth – i.e. growth is reduced by an average of about two percentage points a year between 2002 and 2010. They attribute almost half (45%) the blame for this to the increase in the government deficit (which in their model 'crowds out' private investment)

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[8] CADRE has criticized this aspect of the ING-Barings model, describing the induced investment response as 'mechanistic' and failing to take into account the possibility that lower growth will undermine investor confidence – and hence will reduce investment (2000b: 15-16).

[9] Arndt and Lewis assume that total factor productivity growth is reduced to one half of that in the non-AIDS scenario at the height of the epidemic. This is an attempt to capture more fully the harmful economic impact of hiring, training, absenteeism, work-force disruption, slower technological adaptation etc (2000: 872-4).

and about a third (34%) of the blame to the negative impact of AIDS on total factor productivity growth (2000: 879-881). This drop in growth is sufficiently large to exceed the drop in population – and hence *per capita* income in their model is projected to fall. They conclude that *per capita* income in 2010 will be 8% lower than it would otherwise have been in the absence of the AIDS pandemic (2000: 877). Arndt and Lewis show that if government-related AIDS expenditures and private expenditure on health and food is excluded, then *per capita* incomes decline by 13% (relative to the no-AIDS scenario). They thus conclude that 'the survivors of the AIDS epidemic are left with a smaller economic "pie" and more of this pie is directed towards non-discretionary health and food expenditures' (2000: 877).

Also, unlike the BER and ING-Barings models, Arndt and Lewis predict that the unemployment rate amongst semi- and unskilled workers will rise and that the overall unemployment rate will remain broadly constant. They argue that 'while the unskilled labour pool is smaller, slower growth means that the demand for labour is correspondingly lower. These two effects offset one another leaving the unemployment rate essentially unchanged' (2000: 879).

So where does this leave our understanding about the macroeconomic impact of AIDS? In a rather confused state, to say the least. The ING-Barings and BER models come to similar conclusions about the likely impact on growth, unemployment and *per capita* income - but they do so via different economic channels. The Arndt and Lewis model not only highlights a different set of economic dynamics, but concludes that the impact on growth will be more significant and that the final impact of AIDS on *per capita* income will be negative.

Part of the problem lies in the different theoretical underpinnings of the macroeconomic models. Macroeconomic modelling entails imposing a theoretical framework (in the form of a set of simultaneous equations) on a set of economic data, and then using the model to project forward in time (or to simulate the impact of economic shocks). The key point is that very different theoretical models assuming different relations between economic variables can all generate a good 'fit' with the current (and historical) data - but produce very different predictions and results from simulations. In the case of the three macroeconomic models discussed here, a key difference pertains to the way in which they model the economic impact of higher government expenditure. As discussed above, the Arndt and Lewis model assumes that government borrowing crowds out private investment and lower growth over the longer term. In the more Keynesian models of ING-Barings and the BER, the increase in government spending is assumed to support growth by keeping consumption buoyant. ING-Barings in fact argues that if the government maintains strict fiscal discipline in the face of

the AIDS pandemic (i.e. does not allow the deficit to rise as a proportion of the GDP) then this would serve to drain demand even faster out of the economy, thus dragging down GDP (and government revenues) in a 'downward spiral' (2000: 22). The Arndt and Lewis model, by contrast, assumes that such a downward spiral would not happen because private investment would increase.

Such differences have major implications for government policy. One theoretical approach implies that borrowing in order to finance increased health expenditure supports growth, the other implies the reverse. And in the absence of any clear way of evaluating the different models, policymakers are left in a state of befuddlement over how to respond at the fiscal level.

But differences between the models also arise as a result of the lack of adequate information about key behavioural coefficients in the models: how much will total factor productivity fall and to what extent will the available pool of labour become less effective? How will households realign their spending priorities in the face of AIDS? How much more expensive will labour become for firms? To what extent will they be able to pass on the higher costs in the form of price increases? And will investment rise in response to incentives to become more capital-intensive, or will investors take their money out of the country? Any macroeconomic modelling exercise has to make judgements about all of these choices – and in each case, the estimate could be wildly off track. As Over (1992) showed ten years ago, modelling the macroeconomic impact of AIDS in Southern Africa is highly sensitive to assumptions about the prevalence of HIV across skill bands and the proportion of health expenditure that is financed out of savings. This remains true today. One must thus be very cautious about all macroeconomic models of the impact of AIDS. At best, they help us think through the dynamic economic impact of AIDS. At worst, they are a misleading and shaky house of cards.

The Impact of AIDS on Firms

There is a great need for more detailed research on the impact of AIDS on the investment, production, pricing and hiring decisions of firms. AIDS affects firms through various channels including the demand for their output, efficiency losses on the production side and via changes in the social and legal environment. Naidu (2001) provides a conceptual review of the ways in which AIDS affects the broader 'macro market environment' facing firms in South Africa. This part of the paper concentrates primarily on the impact of AIDS on production, but also touches upon the possible impact of AIDS on demand patterns.

International research on the impact of AIDS on firms tends to draw a distinction between direct and indirect costs.[10] Direct (or 'out-of-pocket') costs include pension and provident fund contributions, service bonuses, absenteeism and sick leave, death and funeral benefits, in-firm medical services, and the costs of recruiting and training replacement workers. Indirect or 'unquantifiable' costs include lower productivity of sick workers and the disruptive impact on teams and production processes. The total impact on firms will vary depending on factors such as whether firms provide in-house medical facilities, the way in which employment benefits are structured, and the distribution of HIV+ people across the skill-structure.[11]

Until recently, there were no reliable studies of the impact of AIDS on firms in South Africa. Press reports varied wildly and there was little clear understanding of how different estimates of productivity losses were arrived at (Michael, 2000; Abt Associates, 2000: 40-1). Nevertheless, research into the impact of AIDS on a sugar mill in KwaZulu Natal (Morris *et al*, 2000; Morris and Cheevers, 2000), and synthetic modelling work by Rosen *et al* (2000), are improving our understanding about the nature of the impact on firms in South Africa. However, this kind of empirical work remains (inevitably) subjective – both in terms of estimating indirect costs and in terms of how direct costs are framed and quantified – and difficult to generalise across the entire economy. Booysen and Molelekoa (2001) go some of the way towards rectifying this problem in their survey of firms in the Bloemfontein and Welkom areas. But while this study has the advantage of pooling the results from twenty firms, the results cannot be generalised to the region (only 10% of surveyed firms responded, and most were small to medium-sized businesses) let alone to the whole of South Africa.

The standard demographic assumption in South Africa appears to be that individuals who contract HIV live for an additional seven to ten years and that most of the debilitating illness and symptoms are manifest in the last two years of life. The Natal sugar mill study found that in the two years prior to the men taking retirement (on grounds of ill-health), an average of 27.7 days were lost in each year (Morris *et al*, 2000: 940). Of these, 11.7 days were accounted for by sick-leave, 5.4 days by hospitalisation, and 10.6 by visits to the clinic (assuming that each visit to the clinic during work hours resulted in half a day lost).

Taking into account estimates for lost wages (due to lost days), the costs of hiring and training replacement workers (roughly doubled to proxy for

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[10] See Avetin and Huard (2000) for a clear exposition of this methodology as applied to three manufacturing firms in Cote d'Ivoire.

[11] See ILO, 2000: 13-18 for a discussion of the impact of AIDS on enterprises in Africa.

lost productivity due to disruption) and limited clinic and hospital-related costs, they estimated the cost of each HIV infection to be roughly three times the annual salary in each of the final two years of employment. No adjustment was made for increased pension or medical aid costs, on the grounds that most (94%) of the HIV+ workers were in the lowest skill bands (Morris *et al*, 2000: 939). These unskilled workers presumably did not have access to firm-based pension plans, and would have made use of government clinics rather than private medical facilities.[12]

In their modelling work on the impact of AIDS on South African firms, Rosen *et al* assume that direct firm-based medical expenditure is low. Instead, they focus on pension benefits, service gratuities and death benefits for HIV+ workers, costs relating to sick leave and recruitment and training[13] of replacement workers. These (present value of future) costs come to just under twice the annual salary of workers (see Table 3).

Table 3: Rosen *et al's* Present Value of the Future Costs of a New HIV Infection, assuming a Seven Year Interval between Infection and Death.

Cost component	Salary = R25,000	Salary = R50,000	Salary = R100,000
Paid sick leave	R5,741	R11,481	R22,961
Pension benefits	R38,487	R76,974	R15,947
Recruitment /training	R4,313	R4,313	R4,313
Total	R48,540	R92,767	R181,222
Ratio of total costs to annual salary	1.94	1.86	1.81
Savings (life extended by one year)*	R4,412 (9%)	R8,433 (9%)	R16,475 (9%)
Savings (life extended by three years)*	R12,071 (12%)	R23,070 (12%)	R45,067 (12%)
Savings (life extended by five years)*	R18,400 (38%)	R35,166 (38%)	R68,697 (38%)

* Savings are reductions in the present value of future costs of a new HIV infection due to interventions that extend life by one, three or five years. A discount rate of 10% is used. The figures in parentheses are total savings as a percentage of base-line costs.

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[12] Morris and Cheevers (2000) say that the relatively low proportion of costs attributable to health care (11%) is similar to that found in a study of six companies in Kenya (2000: 7). Morris *et al* note that medical expenditure is not prominent in this population (i.e. the sugar mill) 'because of the public health system available' (2000: 943).

[13] They use data on recruitment and training from a five-firm study in Botswana.

Rosen *et al* use the model to show how medical interventions which increase life expectancy save firms money (by pushing costs further into the future - thus causing them to be discounted more heavily). Their model shows that 'the present value of a new HIV infection would fall by 9% if employees' average life expectancy could be extended for one year, by 25% for a three year extension and by 38% if five more years of productive life could be achieved' (*ibid*: 303). (This is simply because they are using a 10% discount rate). The implication is that any treatment costing less than R4,412 that extends productive life by a year would be feasible for those on salaries of R25,000 or lower. For higher-paid (skilled) workers, the upper limit of economically feasible treatment rises to R8,433 and R16,475.

Booysen and Molelekoa (2001) adopt a similar methodology to estimate the impact of AIDS on the twenty firms they surveyed in Bloemfontein and Welkom. Their figures were similar to those reported in Rosen *et al* (see Table 3). Booysen and Molelekoa estimated present value of the cost per AIDS death was R44,319 for unskilled employees, R70,437 for skilled employees, and R190,877 for highly-skilled employees (2001: 15). However, the ratio of total costs to annual salary was more sensitive to skills level in the Booysen and Molelekoa study (1.35 for unskilled, 1.27 for skilled and 2.5 for the highly-skilled). This appears to be because the information obtained from the survey allowed them to differentiate more clearly than Rosen *et al* between the different benefits provided for different skill levels. They found that only a quarter of firms offered medical benefits (and in those cases, mostly to skilled workers (2001: 9)). Booysen and Molelekoa conclude that the average savings to firms of extending productive life by one year is R5,491 per worker (20001: 16).

Note that the estimates discussed so far only take only direct costs into account. Once indirect costs and benefits are factored into the calculation, then the case for life-saving interventions becomes even more compelling for firms. As Rosen *et al* explain:

> 'The financial benefits of pushing further into the future the types of costs analysed above are only a subset of the overall gains to a company of investing in keeping its workforce as healthy as possible for as long as possible. By retaining skilled and experienced employees for an additional year or years, the company also:
> - buys time for drug prices to fall and for medical and social science researchers to develop new ways to treat HIV/AIDS;
> - reduces the time managers must spend coping with employee deaths and high turnover;

- reduces the impact on the morale, motivation and concentration of the rest of its workforce of having colleagues fall sick and die; and
- creates more time to implement strategies to cope with the epidemic, such as training replacement employees, shifting to less labour-intensive technologies, and managing the loss of overall workforce skill, experience, institutional memory and cohesion that HIV/AIDS is causing.' (2000: 303).

When Rosen *et al* did their study, the cost of antiretroviral (ARV) medication for a worker (i.e. over R36,000 a year) was between two and nine times higher than the (direct) benefits to business of providing such medication. However, since mid-2001, the cost of ARV medication has fallen so much, that Medicare (a medical aid company in South Africa) is now able to provide ARV medication and CD4 counts and blood tests for about R800 a month – i.e. about R9,600 a year (Regensberg, 2001). If we assume the firm absorbs half these costs, then this will amount to R4,800 a year. Assuming a discount rate of 10%, the present value of projected expenditure on ARVs over three years is R13,131 and over five years it is R20,016. As indicated by the data in Table 4, this suggests that it will be cost-effective for firms to provide access to ARV medication to their more highly skilled personnel and that the cost (to the company) is only marginally higher than the benefits of extending the lives of less skilled workers for a year. However, as discussed below, these results consider only the direct costs of AIDS. Once indirect costs are included, the cost-effectiveness of providing ARV medication to workers becomes much more compelling.

If, following the KwaZulu sugar mill study, we assume that the indirect cost of AIDS (i.e. on productivity, team-cohesion etc.) amounts to about 50% of total (direct and indirect) economic costs, then we can double the Rosen *et al* estimates to include these factors.[14] This will push the Rosen *et al* estimate for the lowest-paid workers up to R97,080 - and make it feasible to provide ARVs even to the low-skilled workers. As can be seen from the figures in parentheses in Table 4, doubling the economic costs (as a rough proxy for including indirect costs) renders it economically feasible for firms to treat all workers with ARVs in order to prolong life and minimise disruption.

This kind of exercise illustrates the important point *not* taken into account by macroeconomic modellers – i.e. that firms can react to minimise the impact of AIDS on their businesses. As argued above, firms may chose to

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[14] This is consistent with research from East Africa showing high costs associated with disruption of production (ILO, 2000: 14).

provide ARVs to their skilled workers – and perhaps even to all workers – thereby extending the life of the workforce and minimising the disruptive impact on the labour market and patterns of consumption.   All three macroeconomic models discussed above assumed that providing ARV medication was out of the question. While this is understandable with regard to the ING-Barings and Arndt and Lewis studies (because the cost of ARVs was still high in 2000), it is less understandable with respect to the BER study (as the costs of ARVs had fallen dramatically before the study was published).   If firms do react by providing ARVs (as is already being considered by Anglo-American) then all three macroeconomic models will have over-estimated the impact of AIDS on the workforce - the skills shortages, wages, consumption and medical costs – and thus overestimated the impact on growth and *per capita* incomes.

Table 4: Net Savings to Firms as a Result of Providing Anti-retroviral Treatment to Workers (own calculations)

	Additional 1 year	Additional 3 years	Additional 5 years
Discounted cost to firms of ARV treatment	R4,800	R13,131	R20,016
Net savings (for salaries of R25,000)	R4,412 – R4,800 = –R388 (R4,024)	R12,071 – R13,131= –R1,060 (R11,011)	R18,400 – R20,016= –R1,616 (R16,784)
Net savings (for salaries of R50,000)	R8,433 – R4 ,800 = R3,633 (R12,066)	R23,070 – R13,131= R9,939 (R33,009)	R35,166 – R20,016= R15,150 (R50,316)
Net savings (for salaries of R100,000)	R16,475 – R4,800= R11,675 (R28,150)	R45,067 – R13,131= R31,936 (R77,003)	R68,697 – R20,016= R48,681 (R117,378)

Sources: Calculated from data in Rosen *et al* (2000) and Regenberg (2001); assuming a discount rate of 10%.   The figures in parentheses include an estimate for productivity losses (i.e. indirect costs) which doubles the savings shown in Table 3.

In addition to providing ARVs, firms may opt for other strategies to reduce their exposure to AIDS. As Abt Associates observe:

> 'Firms may substitute capital for labour, allowing them to 'shed' a proportion of labour due to HIV-AIDS without substantial productivity loss.   Some sectors and businesses may also substitute more plentiful (unskilled) labour for less

> plentiful (skilled) labour, enabling them to replace lost/sick workers more easily. Other potential strategies may include selectively hiring people who are likely to be at lower risk for key positions.' (2000: 46).

Although shifting towards more labour-intensive strategies (in order to take advantage of South Africa's large pool of unemployed unskilled labour) is a possible strategy, this is unlikely to be widespread. Firstly, such firms expose themselves to the disruptive impact of high turnover and absenteeism – costs which could easily swamp the 'benefits' of being able to replace sick workers. Secondly, as ARVs become cheaper and more widely available through medical aid packages, firms are more likely to opt for a strategy that extends the lives of their workers - and especially their skilled workers.

In addition to reacting to the risks associated with HIV infection in their workforce, firms will also react to AIDS-related changes in the demand for their products. In a recent publication by J.P. Morgan (2001) entitled *How to AIDS-Proof Your Consumer Portfolio*, investors are advised to avoid companies whose consumers are relatively young and relatively poor – or whose products are luxury goods with a high income-elasticity of demand (because these companies could suffer as expenditure is reallocated towards health spending) or who rely on consumer purchases on credit (as defaults are likely to become more common[15]). This kind of market advice is likely to depress stock prices for such firms and industries - thus sending a signal to entrepreneurs to diversify and gradually shift out of such markets. In this way, firms will be better able to better protect their profit margins than is typically assumed by static analyses of the overall economic impact of AIDS.

Recent Student Research on the Impact of AIDS on Firms

Case studies involving the impact of AIDS on firms can help improve our understanding of the way that firms react. However, given the wide range of possible reactions (and the likelihood that responses will vary according to economic sector), a substantive body of case-study research is required

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[15] MetAM is reported in the *Business Day*, 17 Jan 2002 as follows: 'People will have less disposable income due to rising medical and insurance costs. Consumers will pose an increased credit risk to retailers… With credit retailers expected to be more affected, our retail stockpicking has been favouring those companies that target the upper section of the market where credit risk is lower'.

before even tentative conclusions can be reached about economy-wide reactions. Fortunately, this is beginning to take place. The Anglo-American Chairman's fund has recently provided scholarships to graduate students at the University of Cape Town to support such case-study investigations through the AIDS and Society Research Unit (ASRU). This research, whilst inevitably being uneven in quality, has pointed to some very interesting aspects of the economic impact of AIDS.

Firstly, firms may not be using even the most basic information from their records to estimate the impact of AIDS. Models, such as that developed in Table 4 above, assume that firms: a) know basic information such as the number of days' sick leave lost due to AIDS; b) are able to calculate the cost of the lost time (in terms of lost wages, the costs of training replacements, etc.); and c) are able to estimate the impact on their financial bottom line. In reality, it would appear, firms either have not collected or used existing information; and where they have collected it, they have not used it to the full in estimating the economic impact. Alan Whiteside of the Health Economics Research Department (HEARD) reports that this is common amongst South African firms he has dealt with.[16]

In her study of one of the largest food manufacturers in Zimbabwe, Sanders (2001) found that the firm not only had no idea about HIV prevalence, but did not even have any readily available information on employment trends or on 'sick' days lost. This basic information was available in the company archive (on paper and not on computer), but no one had pulled the data together in order to examine the trend across time. It was thus unsurprising that the company employees and managers she interviewed had only a gut-feel notion of the impact of AIDS on the company. The firm did, however, have an indication of the number of deaths that were either confirmed as, or suspected of being, AIDS-related (as evaluated by the company nurse). Over the previous ten years, Sanders found that 2% of employees died each year and that, on average, 74% were AIDS-related deaths. The company management complained about the cost of funerals (which Sanders estimated amounted to 2.3 times the monthly salary of the average worker) but otherwise had a limited understanding of the broader impact of AIDS on the enterprise. This is surprising because the company had an AIDS prevention programme and compiled a monthly health services report.

Kennedy (2001) encountered a similar problem in her study of a South African colliery. The colliery was in the process of digitalising its records and was not yet in a position to provide her (or themselves) with trend data on days lost due to sick leave, compassionate leave and absenteeism (2001: 8-9). The colliery had recently started compiling data on the different causes

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[16] Personal communication.

of turnover, but had decided it 'was not worth it' to retrieve the data pre-1998 in order to see the trend over time. Rather than engage in a colliery-specific analysis of the possible impact of AIDS, the holding company had commissioned an economic impact study. Kennedy was highly critical of this study as it relied on demographic projections rather than colliery-level data, showed no understanding of the possible impact of AIDS on the production process, and failed to account for costs such as severance pay, the salaries of medical personnel etc. (2001: 5-8).

Byrne's (2001) examination of a major cement producer in South Africa revealed a far greater awareness of the importance of collecting AIDS data on the part of management. The firm had not only instituted a major AIDS awareness programme, but had gone so far to as test for HIV prevalence in two sites. AIDS-related health data is collected at all sites and sent to the national head office. But while the firm had a good idea of HIV prevalence and showed an extraordinarily positive approach to collecting relevant data, no systematic economic impact analysis appeared to have been done with the data.

Secondly, the case studies reveal that direct (quantifiable) costs of HIV/AIDS comprise less than 5% of the wage bill – which is broadly in line with the case study research from Abidjan (Avetin and Huard (2000)). Part of the reason for the relatively low estimate of direct impact was the lack of provision of pension and medical benefits to all workers. This is in line with the results of the KwaZulu sugar mill study and the survey of firms in Bloemfontein and Welkon (discussed above). It reflects the fact that most HIV+ workers are concentrated in the lower skill bands,[17] which do not enjoy the same level of benefit provision as skilled and managerial employees.

Thirdly, firms have only the vaguest sense of indirect costs – i.e. those 'difficult to quantify costs' which impact on productivity, efficiency, morale etc.. This is partly because of the inherent difficulty involved in estimating such costs - and because it is almost impossible to be certain what trends can and cannot be attributed to AIDS. Researchers have to be very careful of the *post hoc ergo procter hoc* fallacy: just because a firm shifts towards greater capital-intensity this does not mean that it was because of AIDS-related problems with labour supply. Kennedy suggests that this may be the case with regard to the coal mining industry. She argues that the colliery was engaged in a deliberate and long-standing strategy of mechanisation and

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[17] Byrne (2001: 7) found in the cement plant which had undertaken the voluntary saliva seroprevalence test amongst its employees, that 79% of HIV+ individuals were in the lower (predominantly unskilled) job bands. Sanders (2001: 16) reported that deaths in the Zimbabwe food manufacturing firm were all amongst the least skilled job categories.

downsizing which was independent of the impact of AIDS. According to a manager she interviewed 'AIDS is not actually a problem, in fact it is helping us (downsize the workforce)' (quoted in 2001: 20).

Fourthly, employees who are HIV+ may choose not to remain with the firm - and hence may leave before the economic costs to the firm resulting from ill-health and absenteeism become serious. Sanders, for example, found the puzzling result that AIDS-related deaths had fallen in recent years whilst 'sick' days lost had increased – at a time when the epidemic was approaching its peak in Zimbabwe. One possible explanation (which was not explored) was that employees were leaving when they became sick and did not remain employed until death. Kennedy found concrete evidence for this possibility at the colliery. She quotes the nurse in charge of pre-test counselling and AIDS-testing as saying that most of those who test positive leave immediately because they 'cannot handle the news, they just get up and run away' (2001: 10).

Fifthly, the colliery study illustrates the importance of detailed case study research 'at the coal face'. She reports a supervisor as complaining that senior management has its 'head in the sand' about the impact of HIV on the morale, output, and safety of his production teams (2001: 22).

Conclusion

What does the discussion so far suggest about the impact of AIDS on distribution in South Africa? The data and information is sketchy and uneven, and macroeconomic and firm-level modelling research work is highly dependent on theoretical and other assumptions. Nevertheless, some worrying themes suggest themselves. If firms react by continuing to decrease their reliance on unskilled labour (a trend that started before the AIDS pandemic) and by moving out of economic sectors whose customer-base comprises lower-income consumers, then poor households will find themselves doubly disadvantaged. Not only will their access to the labour market become ever more tenuous, but the products that they purchase may become scarcer (and more costly).

Conversely, relatively skilled workers could benefit from greater employment opportunities (as production becomes more skill- and capital-intensive) and higher wages (as the relative demand for skilled labour increases). They will probably also live longer and more productive lives as firms begin to provide them with greater access to ARV medication. The size of the pie may shrink as a result of AIDS, but employed (especially skilled) workers will enjoy a growing share.

South Africa is increasingly divided along class lines with the gap between the employed and unemployed being of major importance (Nattrass

and Seekings, 2001). The horrifying element that AIDS brings to the picture is that the divide will mean the difference between life and death for many people. Those without access to jobs (especially good jobs) will bear the brunt of the AIDS pandemic. Whether inequality is lower or higher twenty years from now is a moot point. But over the next couple of decades, inequality will probably rise as AIDS lowers growth and slices its way through the poor and disadvantaged in South Africa.

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