The Impact of HIV/AIDS on the South African Economy: A Review of Current Evidence

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The Impact of HIV/AIDS on the South African Economy: A Review of Current Evidence[1]

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Abstract

Even though the approaches, assumptions and results may vary greatly in the macroeconomic models employed in estimating the impact of HIV/AIDS on the South African economy, the overriding message that these models convey remains the same: the cost of HIV/AIDS to South Africa will be significant in economic, social and human terms. However, the accuracy of the models and their results can be faulted for various reasons, not least the shortcomings of current demographic projections and the empirical evidence on the microeconomic impact of the epidemic, shortcomings that can be argued to translate into both under- and overestimation of the likely macroeconomic impacts of the epidemic. More work is also required to quantify the nature of the impact of the epidemic on specific sectors in the economy. In addition, more recent, alternative methodological approaches can also be explored in further investigating the macroeconomic impacts of the epidemic. Finally, models are also constrained by a lack of clarity regarding the key question of how treatment, care and support for HIV/AIDS-affected individuals and households are to be financed in South Africa, given that government at times are unclear as to what policies will be implemented to fights HIV/AIDS.

South Africa currently faces one of the highest HIV prevalence rates in the world. The estimated adult prevalence of HIV amongst 15-49 year olds in 2001 was 20.1% (UNAIDS, 2002), while the ASSA2000 model put adult prevalence amongst 20-65 year olds (in the unchanged scenario) at 24.1% (ASSA, 2003). A recent national household survey in turn has put the 2002 estimate of adult

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prevalence amongst those older than 25 years at 15.5% (HSRC, 2002)[2]. Given that HIV/AIDS primarily effects the economically and sexually active population, the epidemic poses a serious threat to economic growth, development prospects and poverty alleviation. In fact, the predicted macroeconomic impacts of the HIV/AIDS epidemic make light of the macroeconomic targets of GEAR, given the projected decline in economic growth and employment.

The main aim of this paper is to review the current literature and evidence of the impact of HIV/AIDS on the South African economy. The paper is structured as follows. Section 1 provides a brief overview of the methodology of the four macroeconomic models employed in estimating the impacts of the epidemic that are reviewed in this paper. (It should be emphasized however that this is not a methodological review of macroeconomic modeling, which is outside the scope of this paper.) Given that these models project the macroeconomic impacts of the HIV/AIDS epidemic over a 10-15 year period that ranges from 2000 to 2015 and that the HIV epidemic is yet to evolve into a full-scale AIDS epidemic, the emphasis in this paper is therefore on the future challenges that HIV/AIDS poses to the South African economy, rather than the challenges during the first 10 years of democracy[3]. Section 2 describes the main economic impact channels of the HIV/AIDS epidemic as described in these four macroeconomic models, whilst section 3 and 4 respectively focus on an overview of the assumptions (input) and projected impacts on economic growth, investment, employment, and poverty (outputs) of these four models. The assumptions and projections of these models are critically adjudged at the hand of currently available empirical evidence on the economics of HIV/AIDS in South Africa. In section 5, the implications to the macroeconomic modelling results of recent changes in the responses of government, business, communities and other role players in South Africa to the HIV/AIDS epidemic are discussed. Section 6 concludes, summarizing the main lessons to be learned from the review and the key questions that remain unanswered by current research on the economics of HIV/AIDS in South Africa.

1. Macroeconomic modelling of the impact of HIV/AIDS

Initially, the primary focus in HIV/AIDS modelling was demographic, behavioural and epidemiological rather than economic in nature. However, some models have been developed and employed in estimating the resource requirements for financing prevention, care and treatment, and support interventions aimed at curbing the spread of the epidemic and mitigating its adverse

[2] The fact that these estimates are based on prevalence by different age categories precludes a direct comparison of these specific estimates of HIV prevalence.

[3] However, it should be pointed out that Whiteside and Sunter (2000) argue that government's responses to the epidemic have lacked urgency and focus and that the situation could have been different had this not been the case (they point out that the HIV prevalence rate in 1994 stood at 7.6% only, a figure that has since escalated to twice this figure). Section 6 of this paper again touches on these policy shifts with regard to HIV/AIDS over the past 10 years.

impacts on society, notably the Resource Needs Model (RNM), Goals Model (GM) and cost modules of the Spectrum model (Van der Heever, 2003). In more recent times, though, several models have been employed in directly modelling the future macroeconomic impacts of the HIV/AIDS epidemic on the South African economy. Ford *et al*. (2002) distinguishes these models from so-called broad qualitative evaluations of the impact of HIV/AIDS on macroeconomic variables and the case study approach, which entails the application of lessons from other country studies to say South Africa. According to Ford *et al*. (2002), current research on the macroeconomic impact of the epidemic 'seek, in general, to quantify the effect of the epidemic as an endogenous shock on a volatile, emerging and globalised economic system'. Four such models are reviewed in this paper, i.e., the Arndt and Lewis model (2000), the ING Barings model (2000), Burger's (2001) model, and the BER (2001) model[4]. These models each follow a different methodological approach to modelling the economic impact of HIV/AIDS. The ING Barings (2000) and BER (2001) models follow a demand-side driven approach, while Burger (2001) follows a supply-side driven approach. Arndt and Lewis (2000) employ a supply-constrained Computable General Equilibrium (CGE) model in estimating the macroeconomic impact of HIV/AIDS.

Macroeconomic models of the economic impact of HIV/AIDS all require demographic inputs, i.e. actuary-based estimates of the impact of the HIV/AIDS epidemic on the size and structure of the population. To date, most of these models have employed either the earlier Doyle-Metropolitan demographic projections or the later projections from the ASSA2000 model.

Arndt and Lewis (2000) employ an economy-wide supply-constrained CGE model, the focus being South African economy's medium-term growth prospects. The ING Barings (2000) model employs the WEFA consultancy group's annual macro-econometric framework, which is based on the principle that in the short run, demand factors will dominate the economy, whereas in the long run, supply factors are more dominant. The ING Barings (2000) model therefore takes both the supply and the demand factors into account in the econometric modelling and, unlike the Arndt and Lewis (2000) model, the economic forecasts are mainly of a long-term nature.

[4] This review excludes three other studies attempting to estimate the economic impact of HIV/AIDS. Rather than estimate the various macroeconomic impacts of the HIV/AIDS epidemic, Broomberg *et al*. (1991) employed the human capital approach to estimate the impact of HIV/AIDS in South Africa. The human capital approach entails the use of lost earnings as a proxy for total lost production attributable to HIV/AIDS. Haacker (2002) in turn discuss the macroeconomic impact of the HIV/AIDS epidemic and applies a supply-side Cobb-Douglas approach in modelling the impact of the HIV/AIDS epidemic. However, Haacker (2002) discusses this modelling approach in general and without any reference to or direct application to the South African economy. Finally, the recently published report on the estimated intergenerational impact of HIV/AIDS on the South African economy (Bell *et al*., 2003), which although theoretically sound it may be said employs questionable assumptions in some instances with regard to demographic and economic responses to the epidemic, is not discussed here insofar as it employs a forecasting horizon (80 years) beyond those of the models discussed in this paper and does not report comparable forecasts for similar macroeconomic impacts of the epidemic to those discussed in this particular paper.

The BER (2001) model also makes use of econometric modelling techniques. BER (2001) stresses that their study should be seen as a "macroeconomic sensitivity analysis" rather than a forecasting model, with the baseline scenario reflecting the "worst case demographic scenario" that does not allow for behavioural changes or large-scale government intervention.

Supply-side modelling is also a popular approach to determine the impacts of HIV/AIDS on the economy. This type of modelling is fairly simple and less sophisticated than other approaches. Burger (2001) extends the simple Cobb-Douglas production function to incorporate the key macroeconomic variables affected by HIV/AIDS. Being a supply-side oriented model, it relies solely on the factors of production and is used to calculate potential output, i.e. the level of aggregate output that can be sustained in the long run with stable inflation. The essence of this model is that the estimate of the long run growth rate of real GDP is represented as the sum of the growth rates of the labour force, capital and technology.

2. The Main Channels of the Economic Impact of HIV/AIDS

HIV/AIDS affects the economy on the micro- as well as the macro-levels. From a macroeconomic perspective, HIV/AIDS would amongst others affect labour supply and demand, capital investment and utilisation, savings, investment, aggregate demand, GDP and the distribution of income. These macroeconomic impacts follow from a range of micro-level impacts, including the impact of the HIV/AIDS epidemic on business, economic sectors, the public sector, and households (Bollinger and Stover, 1999). The four macroeconomic models reviewed in this paper focus on five primary impact channels (and which drives the assumptions included in these models). These impact channels are the following:

- A decline in total labour supply and in the total population due to HIV/AIDS-related mortality amongst the economically active population, which affects both the demand and supply side of the economy.

- A decline in labour and total factor productivity resulting from HIV/AIDS-related morbidity.

- Direct and indirect costs and productivity losses to the private sector due to HIV/AIDS-related morbidity and mortality amongst employees: Firms will experience higher expenditure due to increased health care costs, burial fees and training costs and payment of other employee benefits, as well as absenteeism and a higher labour turnover, which will increase the cost of

employment. In addition, demand for certain goods and service and therefore sales revenue and turnover may increase or decline due to changes in household expenditure patterns (Bollinger and Stover, 1999). These impacts of the epidemic translate into increased production costs, increased prices (i.e. higher PPI, and perhaps even higher interest rates), and a decline in aggregate demand, savings and investment.

- Household expenditure: The care of and loss of HIV infected family members translate into losses of household income as well as higher medical and funeral expenses, which results in changes in expenditure patterns and in turn in private savings and in investment (Bollinger and Stover, 1999).

- Government expenditure: HIV/AIDS will impact primarily on the health sector due to a higher demand for health services and the high costs of HIV/AIDS treatment. In addition, the public sector will like business in the private sector face higher costs of employment and lower productivity as a result of HIV/AIDS (Bollinger and Stover, 1999), which in turn will result in lower savings due to greater deficits.

3. Model Assumptions

The assumptions of the different models are first presented in tabular form for the sake of simplicity, using the five main impact channels to structure this discussion, after which these assumptions are summarised and evaluated critically with reference to the existing empirical evidence of the economic impact of HIV/AIDS in South Africa. At the end of each section, the main reasons why the overall (or specific) macroeconomic impacts of the epidemic may be over- or underestimated are presented in brief.

Table 1: Model assumptions

Impact Channel	Arndt and Lewis (2000)	ING Barings (2000)	BER (2001)	Burger (2001)

A. Population and labour supply	- ASSA demographic projections. - HIV/AIDS will cause a slower growth in population and labour supply by skill category. - Effective labour input for each skill type will be reduced proportionally with projected AIDS deaths one period hence.	- ASSA demographic projections. - Labour supply will be lower due to HIV/AIDS. - For every person with full-blown AIDS, four months of "person-year equivalent" labour supply will be lost. - Average wage is used as a reasonable proxy for skills; highly skilled labour earn 1.91 times more than the "economy-wide average"; skilled labour earn 1.07 times more than the "economy-wide average"; semi skilled and unskilled labour earn 0.65 times the "economy-wide average".	- Doyle-Metropolitan and ASSA2000 demographic projections. - Lower fertility together with AIDS deaths will cause a lower population and a lower labour force. - Model differentiates between the medium- and high-skilled labour and the semi- and unskilled labour force since the latter can be replaced at a lower cost while having a prevalence rate that is much higher compared to medium- and high-skilled labour.	- ASSA2000 demographic projections. - Individuals infected with HIV have a life expectancy of 10 years and are expected to live 8 years before falling ill with AIDS. - Infection rate is derived from the number of projected AIDS deaths.
B. Labour and total factor productivity	- AIDS afflicted workers stay on the workforce for two years. - Incidence of HIV/AIDS among workers will reduce labour productivity AIDS afflicted workers are half as productive as the rest of the labour force. - Total factor productivity is lower due to prevalence of HIV/AIDS. - At the height of the epidemic, total factor production growth will fall to one half of the no-AIDS rate.	- Increased absenteeism due to HIV/AIDS will result in a decline in labour productivity. - Productivity loss (uniform to all skill categories) is four months per annum.	- The productivity of skilled and unskilled workers infected with HIV/AIDS will be reduced by 40%. - Total factor productivity growth is 21% lower in the AIDS scenario – this is based on the 21% reduction in the total labour force due to AIDS.	- Productivity is only allowed to vary with age and population groups. - Determinants of labour productivity are experience and to some degree schooling. - Assumption is that experience is equal to workers' age less fifteen years; this allows one to see the composition as well as the experience of the labour force.

C. Direct and indirect costs for the private sector	- Insurance and benefit payments will increase, thus putting pressure on costs, profits and savings. - Higher costs together with absenteeism and labour turnover may result in a higher capital intensity of firms. - Transaction costs in enforcing of contracts are assumed to increase.	- Companies face higher direct costs and indirect costs. - Direct costs of skilled and highly skilled employees would increase from 15% in 2005 to 30% in 2010. - Indirect costs of skilled and highly skilled employees would increase from 10% in 2005 to 15% in 2010. - Employees carry two thirds of increased wage costs due to HIV/AIDS. - Employees pass on half of the increase in wage costs that they have to bear to the consumer in the form of higher prices; this results in a higher PPI than in the no-AIDS case. - The remaining half of the increase in wage costs will be born by firms in the form of lower operating surpluses.	- Semi-skilled and unskilled labour was excluded from the direct cost estimates, given that these employees are unlikely to be covered by medical aid. - 20% of South Africans are covered by employment-related health insurance. - Both direct and indirect costs of skilled and highly skilled employees would increase from 5% in 2005 to 10% in 2010. - 60% of the increase in direct costs was related to increases in the costs of medical benefits. - Companies carry 50% of the direct and all of the indirect cost increases resulting from HIV/AIDS. - Companies pass half of these cost increases onto consumers in the form of prices, while the remaining 50% will be absorbed through a reduction in operating surpluses.	- Half of the direct costs of HIV/AIDS is absorbed by companies and the other half is passed on to employees.

D. Government spending	- Higher government spending on health and social services; this will either displace other spending or result in a higher deficit (or a lower surplus). - Health share of total government spending will rise from 15% in 1997 to 26% in 2010, representing a 6.9% average annual increase in public health care expenditure. - Non-AIDS spending stays at a constant proportion of total absorption. - Real expenditure on social programs increased at 2.7% per annum.	– Higher government expenditure due to AIDS. - Public sector spends between R3000 and R4500 per AIDS patient per year. - Expected annual increases in health care spending in excess of R4 billion by 2008. - Higher government spending is financed by a higher budget deficit, expenditure switching within the health department or by sacrificing other expenditure.	- Lower population will imply a reduction in the overall demand for government services other than health services. - A reduction in the demand for government services will result in the decline in government employment set at 50% of the decline in the non-government labour force. - Higher government expenditure due to AIDS. - Government will carry 50% of the increased direct costs, and employees will carry the other 50%. - Cost of providing health care per AIDS-case is R16 900. - 75% of all AIDS victims not employed in the skilled or highly skilled sectors attend public health care facilities. - Public sector spending on health care rises from R6 billion in 2005 to R11.5 billion in 2010. - By 2010, additional welfare spending on orphans will equal R2.9 billion, assuming that 30% of foster parents would turn to the government for financial assistance. - Government will finance 50% of the increased expenditure by cutting back on other expenditure.	- Government carries 50% of direct costs in the public sector. - Expected proportion of AIDS sufferers who are skilled or highly skilled is 11% and 14% for 2000 to 2015. - Skilled and highly skilled attend private health care facilities. - Unskilled AIDS sufferers attend public health care facilities, assuming a 75% take-up rate. - Cost of medical treatment of HIV/AIDS is R11 506 per patient per year.

E. Household spending	- HIV/AIDS affected households shift their spending towards health related expenditure. - HIV/AIDS-affected households save nothing. - HIV/AIDS-affected households increase their share of health service spending between 10% and 15% at the expense of other non-food expenditures.	- Lower population due to HIV/AIDS will cause an initial increase in per capita income of households. - As per capita income increases in the AIDS scenario, consumption will shift away from non-durables towards durable goods and services. - Increased demand for health services diverts funds and resources away from other expenditure categories. - 25% of higher cost to the private sector will be spent on health-related services - Demand for health services could be over 11% higher by 2010 than in the no-AIDS scenario.	- As a result of HIV/AIDS, many consumers are likely to face additional out-of-pocket health care spending (not covered by medical funds); half of these costs will be financed from savings, and the remainder from cutting back on non-health care expenditure. - Employees carry 50% of direct cost increases due to HIV/AIDS; they finance half of this increase from personal savings and the other half by reducing consumption expenditure. - 60% of the direct costs are spent on healthcare.	- Households finance 50% of their share of HIV/AIDS treatment cost from savings and the other 50% through decreasing expenditure.

3.1 Population and labour supply

High unemployment rates mean that the effect of HIV/AIDS on labour supply in South Africa may not be that pronounced (Ford *et al*., 2002). Yet, HIV prevalence rates differ substantially across skill groups and the epidemic will therefore have a differential impact on labour force growth by skill category (Arndt and Lewis, 2000, BER, 2001, ING Barings, 2000). In South Africa there is an inverse relationship between HIV prevalence and skill class, with unskilled and semi-skilled workers having much higher prevalence rates than their skilled or highly skilled counterparts. Due to this fact and the current composition of the labour force[5], projected losses in the labour force at lower skill levels far exceed losses at higher skill levels (Russell, 2002), while the epidemic is also likely to exacerbate the skills shortage in the country (Ford *et al*., 2002). In aggregate terms, the macroeconomic models (based on assumptions about prevalence and morbidity and mortality effects by skill level) all assume that the total labour force or supply will decline and that labour productivity will decline due to the HIV/AIDS epidemic.

This paper does not aim to evaluate the demographic projections employed in these macroeconomic models. Yet, it is important to point out that these projections are key to the results of the modelling and that the demographic projections in turn rely very much on the available HIV prevalence data. As mentioned above, most of these models employ the demographic projections

[5] According to the 1996 census, for example, 62.3% of the South African labour force was semi- or unskilled, whereas 27.5 and 10.2% respectively were classified as skilled and highly skilled (BER, 2001: 11).

of the Doyle-Metropolitan and ASSA2000 actuarial models, which are calibrated with the aid of the HIV prevalence data from the antenatal clinic data reporting on HIV prevalence amongst women attending public antenatal clinics, and which are then fitted to national population data. Outside of the obvious limitations of deriving national HIV prevalence from such limited empirical base, which is the result of the lack in South Africa of large-scale, quality prevalence studies, Van den Heever (2003) is also critical of the focus in the early actuarial modelling on individual firms (the current suite of models include various sub-modules for modelling the impact on workforce populations, including the Momentum model, Lifeworks model, Actuarial Solutions model and the KNOWAIDS model) and pension funds rather than on the impact of the epidemic on the national population and country as a whole. Therefore, Van den Heever (2003) argues that the modelling of the impact of HIV/AIDS on different economic sectors (see Ambert, (2002) for recent work on the impact of HIV/AIDS on the construction industry) and on the labour force as a whole is based on crude extrapolations with relatively little empirical support. According to Ford *et al*. (2002), the limited understanding of the impacts of HIV/AIDS on the mining and informal sectors of the economy are particularly problematic in understanding the wider macroeconomic impact of the epidemic. Van den Heever (2003) lists a large number of assumptions in current demographic models with no or weak empirical basis, including assumptions about certain epidemiological aspects, migration patterns, patterns in sexual behaviour, and health service use – some of which are discussed in more detail elsewhere in this paper, while the lack of behavioural and prevalence data by socio-economic status indicators other than crude job categories preclude meaningful economic analysis). In short, demographic impacts are not modelled by employment status, education or sector, but simply by job category, which represents a crude indication of skill level. It is unclear furthermore how changes in employment by age and gender (and race as well I would assume) is likely to affect HIV prevalence in the workplace, which means that we simply do not know how exactly the epidemic will affect labour supply and therefore employment (Ford *et al*., 2002; Van den Heever, 2003). Socio-economic status, moreover, is a key determinant of the risk of infection and is manifested in characteristics such as job category, income, education, occupation, place of residence, or employment status. In the absence of good HIV prevalence data by these strata (up to before the release of the HIV prevalence estimates from the HSRC (2002) survey prevalence estimates by these strata were simply not available, although this survey was only designed to collect nationally representative data by province, geographical location and race – see footnote 2, page 11), it remains difficult to accurately model the macroeconomic impacts of HIV/AIDS (Van den Heever, 2003). Or as Ford *et al*. (2002: 10) puts it, the 'literature shows us that we have reasonably good information about the rate at which the epidemic is developing, but insufficient information on the rate at which the epidemic is destroying the economic and development potential of the economy, leading to substantial uncertainty about the macroeconomic impact of the epidemic'. The existing macroeconomic models, furthermore, it seems largely model the impact of the epidemic on

information of and assumptions about prevalence rates in formal employment. The very high HIV prevalence rates in informal, urban areas reported in the HSRC (2002) survey (i.e. 21%) poses questions as to the likely impact of the epidemic on the sizeable informal economy in South Africa (Van den Heever, 2003), which possibly translates into an **underestimation** of the impact of the epidemic, particularly on poverty and inequality, but also on employment.

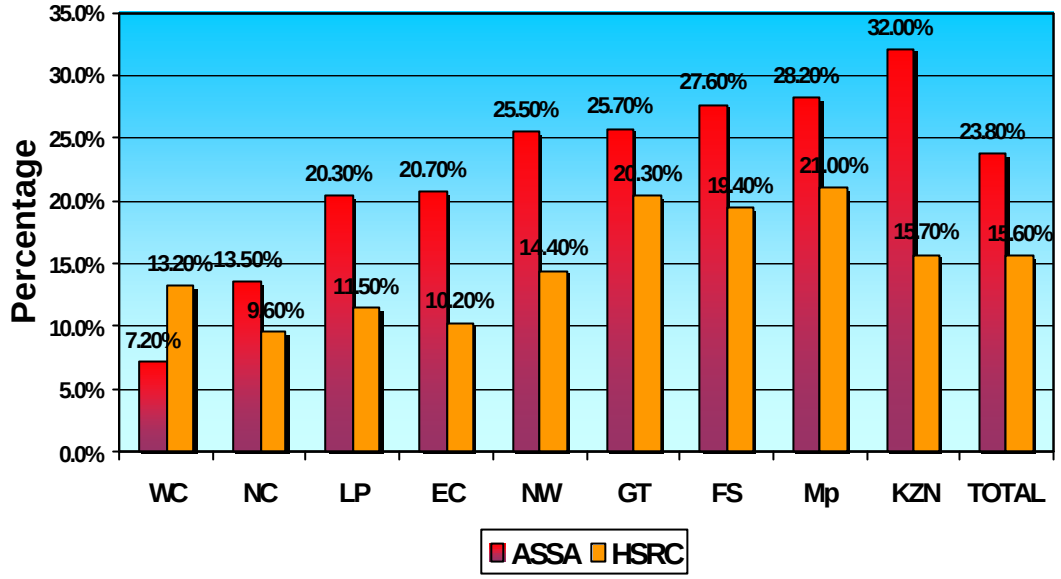
Table 2: Comparison of HIV prevalence by skill level (%)

	Highly skilled		Skilled		Semi- and unskilled	
Study	**2005**	**2010**	**2005**	**2010**	**2005**	**2010**
Arndt & Lewis (2000)	13.1	-	22.8	-	32.8	-
ING Barings (2000)	13.1	-	22.8	-	32.8	-
BER (2001)	13.3	16.7	20.2	23.8	22.8	26.3
	2000				**2000**	
Evian (2002)	**Man & Admin**				**Drivers and Operators**	
Freight and trucking company in Gauteng	4.1				20.6	

Source: Adapted from Van den Heever (2003: 43).

HIV prevalence rates reported in workplace studies are generally lower than the HIV prevalence rates by economic sector and skill level (job category) as assumed in the ASSA models (Van den Heever, 2003). (Estimates for the mining sector in particular though are somewhat similar.) Table 2 above reports estimates by skill level as assumed in the macroeconomic models and as reported in one high risk company in Gauteng province. (Note however that these studies do not allow results to be generalised to industries in general, but give some indication of the wide variability in HIV prevalence estimates across industries.) Rosen *et al*. (2003), for example, report prevalence estimates of between 7.9% (utility) and 29% (mining). HIV prevalence estimates from 33 company studies (20 of which included samples in excess of 300 employees) reported by SABCOHA (2003) range from 5.5 to 29.5% for mining companies and from 0.2 to 21.5% for non-mining companies.

Figure 1: Provincial estimates of HIV Prevalence amongst population aged 15-49 (2002)



Source: Van den Heever (2003: 39).

Moreover, a recent national survey reports HIV prevalence rates that considerably differ from those reported to date, both in total and by province (see Figure 1)[6]. In addition, this study also for the first time reports HIV prevalence by place of residence, by education and by socio-economic status (HSRC, 2002). However, one may argue that the modellers are simply doing the best with the available data and that the emphasis rather should be on doing the type of empirical work necessary to fill these gaps in our understanding of the dynamics of the HIV/AIDS epidemic. Debate is sure to rage about the reliability and validity of the HSRC (2002) findings in particular. The raw data from this national prevalence study is not yet in the public domain for scrutiny by other researchers. In addition, only 65.4% of sampled respondents agreed to provide a specimen for HIV testing (HSRC, 2002: 11), which probably translates into a relatively large response bias, notably for example amongst white and for urban, formal areas (HSRC, 2002: 36). The fact of the matter, however, is that different (and in this case much lower) HIV prevalence estimates reported in these alternative prevalence studies (i.e. other than data from antenatal clinic sentinel surveys) implies that the estimated macroeconomic impact (and reduction in total labour supply and labour productivity in particular) of the epidemic is likely to be **overestimated**.

[6] The survey selected and contacted a total of 13 518 individuals for interview of which 9 963 or 73.3% agreed to be interviewed. The survey obtained specimens for HIV testing from a total 8 840 persons, which represent 65.4% of the total sample. The survey was designed to report results by province, geographic location and race (HSRC, 2002).

– The impact of HIV/AIDS on higher skills groups is likely to be overestimated (Van den Heever, 2003), implying smaller labour supply reduction at this level of skill than is suggested in current models and a subsequent **overestimation** of the economic impact of the epidemic via upward pressure on costs resulting from skills shortages.
– It is possible that reductions in domestic labour supply may be met by immigration, particularly in lower skill bands (Van den Heever, 2003), thus implying smaller reductions in labour supply at this level of skill than is suggested in current models and a subsequent **overestimation** of this economic impact of the epidemic.

3.2 Labour and total factor productivity

The studies all assume a median lifespan of eight to ten years for workers who are HIV-positive. HIV-positive workers that have not yet contracted AIDS are just as productive as their HIV-negative counterparts, while full-blown AIDS spans the last two years of the HIV-positive term. These assumptions are largely based on the ASSA and the Doyle-Metropolitan demographic models that are used to generate demographic inputs for the macroeconomic models. In terms of labour productivity, Arndt and Lewis (2000), for example, assume that AIDS-afflicted workers are half as productive as their colleagues that do not suffer from AIDS. The BER (2001) model and Burger (2001) assumes that the productivity of AIDS-afflicted (skilled and unskilled) workers is reduced by 40%. The ING Barings (2000) model puts this estimate at 0.33 years or in other words that labour productivity is reduced by a third.

The Arndt and Lewis (2000) and BER (2001) models assume that total factor productivity will be reduced severely by the HIV/AIDS epidemic, while the ING Barings (2000) model made no assumptions about changes in total factor productivity. BER (2001) assumes that total factor productivity will be 21% lower in the AIDS scenario, based on a 21% reduction in the total labour force due to AIDS. Arndt and Lewis (2000), on the other hand, assume that, at the height of the epidemic, total factor productivity growth will be reduced to half that of the hypothetical no-AIDS rate. They put the following reasons in support of this view (Arndt and Lewis, 2000):

- The resources that are currently directed towards the epidemic by governments, universities and firms are substantial and involve a high opportunity cost;
- AIDS will generate a high level of workforce disruption – absenteeism and labour turnover are likely to increase;
- As a result of the relatively high capital intensity of the economy, the possibility for idling capital is great (the high capital intensity of the local economy also implies that training needs in South Africa are much higher than in the rest of the Sub-Saharan Africa;

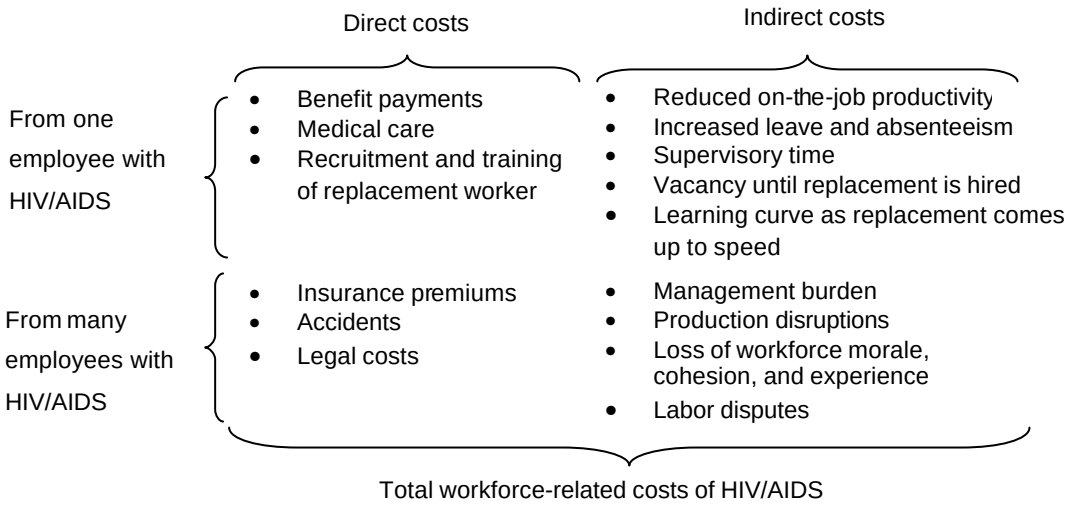
- Transaction costs involved in the enforcement of contracts are also likely to increase; and
- The receptivity of the labour force in implementing process improvements may also be severely curtailed.

The main criticism of these models in this regard is that the impact of AIDS morbidity on productivity is assumed to result in reductions in productivity of between 33 and 50%. Yet, these assumptions are not based on any empirical evidence (Van den Heever, 2003), given that no South African studies have attempted to directly estimate the impact of HIV/AIDS on labour productivity.

3.3 Direct and indirect costs for the private sector

Firms will face higher direct and indirect costs as a result of the HIV/AIDS epidemic. The higher direct costs include increased contributions to pension, life and medical benefit schemes, while the higher indirect costs include the cost of training and recruiting new personnel, loss of turnover and profits as well as additional sickness and compassionate leave (ING Barings, 2000).

Figure 2: Origin of direct and indirect cost of HIV/AIDS to employers



Source: Rosen *et al*. (2003: Figure 1).

The assumptions regarding the relative magnitude of the direct and indirect cost of HIV/AIDS to companies made in the macroeconomic models reviewed here far exceed the cost estimates from available company studies in South Africa (Van den Heever, 2003). Rosen *et al*. (2003), for example, report cost estimates ranging from 0.4 to 5.9% of salaries and wages for six companies with HIV prevalence rates ranging between 7.9 and 29%, whereas the Metropolitan assumes these direct and indirect costs to represent about 10 to 25% of remuneration budgets (Van den Heever, 2003). Ambert (2002) estimate these costs as representing between 4.5 and 7.9% of labour costs, based on a study of the impact of HIV/AIDS on the construction sector. ING Barings (2000) employ the Metropolitan estimates of the direct and indirect cost to companies of HIV/AIDS, whereas BER (2001) assumes that direct and indirect costs would be lower and would make up a smaller percentage of wages and salaries. Furthermore, as the largest employer in any economy, the government will also face higher direct and indirect costs, similar to those faced by private sector employers. BER (2001) employs assumptions regarding direct and indirect cost increases for the public sector analogous to the assumptions made regarding cost increases for the private sector. The reason that the BER assumptions are more conservative than that of ING Barings (2000), is that HIV/AIDS prevalence is assumed to be lower for skilled workers than for unskilled workers, while it is also conceivable that the cost of drugs could decline sharply in the future (BER, 2001). The cost estimates reported by Rosen *et al*. (2003) range from US$2 693 to US$33 725 for skilled workers and from US$11 388 to US$59 438 for managers. These wide variations in the estimates of the cost of HIV/AIDS to companies are attributable to differences in the nature of employment benefits offered by companies, the employment status of unskilled employees, and differences in HIV prevalence rates (Rosen *et al*., 2003). This implies that the economic impact of the epidemic (on productivity levels, prices and output) may be **overestimated**. However, one needs to point out that the costs included in South African company studies reported on by the likes of Morris *et al*.

(2000), Booysen and Molelekoa (2002), Ambert (2002), and Rosen *et al*. (2003) generally only succeed in quantifying some of the direct costs and indirect costs, whilst excluding many of the indirect, systemic costs of the HIV/AIDS epidemic reported in Figure 1. This may very well imply that the total burden of the epidemic on the private sector (and in particular on productivity within this sector) is being **underestimated**. Until such time therefore as study designs allow for a better evaluation of these indirect costs, macroeconomic models will have to do with such assumptions.

Fraser *et al*. (2002) report that small and medium enterprises (SMEs) in South Africa are increasingly facing the reality of HIV/AIDS in the workplace. They report that increased deaths, absenteeism and illness due to HIV/AIDS have been cited by 97 businesses interviewed in Durban, Cape Town and greater-Gauteng. A recent survey commissioned by SABCOHA and DFID, however, shows that more than 50% of respondents in businesses with less than 100 employees envisaged HIV/AIDS to have little or no impact on their company, with fewer managers in larger companies indicating that this is the case. On average, just more than a third of respondents felt that HIV/AIDS would have little or not effect on their companies. Correspondingly, smaller companies were much less likely to have responded to the epidemic by implementing substantive interventions (Deloitte & Touche Human Capital Corporation, 2002). Furthermore, the available empirical estimates of the impact of HIV/AIDS on company costs reported above focus almost exclusively on larger companies, implying that more research is required to estimate the cost to smaller businesses, including those SMEs operating in the informal sector. In fact, Booysen and Molelekoa (2002) argue that the cost of HIV/AIDS to small business may be relatively pronounced.

The ING Barings (2000) model assumes that two thirds of increased wage costs (direct and indirect) will be born by firms, while the BER (2001) model assumes that firms will carry 50% of the increase in direct costs. With regard to indirect costs, BER (2001) assumes that firms will carry the full increase in these costs. Half of this cost increase will be passed on to customers through higher prices (thus leading to a higher PPI), with firms absorbing the other half through reduced operating surpluses (BER, 2001). Both models further assume that of this increase in costs, 50% is passed on to the consumers in the form of higher prices (leading to a higher PPI), with the other 50% being absorbed by the firms in the form of lower operating surpluses (ING Barings, 2000; BER, 2001). However, the available empirical evidence on the impact of HIV/AIDS on South African companies provides no indication of the extent to which companies actually choose to bear costs themselves or pass increased costs on to consumers in the form of price increases. In fact, the ability of companies to pass price increases on to consumers will ultimately depend on the structure of the particular markets. More specifically, firms operating in highly competitive markets where prices are set in international markets will be less likely to be able to pass price increases on to consumers. The mining and agricultural industries are cases in point, i.e. industries facing high prevalence rates

that operate in an environment where prices are largely set on international markets. If of course markets are relatively imperfect, then firms should be able to pass on to consumers at least part of the price increase, as is assumed in these models. It is also unclear as to whether PPP increases resulting from HIV/AIDS impacts on the economy will be a once-off shock (e.g. companies may increases prices to cover future costs resulting from the impacts of HIV/AIDS) or whether these represent continues escalations in price levels. (If the former is the case, the likely impact of HIV/AIDS on the economy may be **overestimated,** due to the inflationary impacts of the model being overestimated). Thus, as in the case of other assumptions employed in these macroeconomic models, there are little if not no empirical evidence to back these assumptions. Furthermore, greater sensitivity analysis in the existing models can at least be employed to elucidate the likely scenarios should different assumptions be employed as regards market structures and competitiveness and likely prices increases and inflationary effects following on the HIV/AIDS impacts on the economy.

The macroeconomic models reviewed here assume a surplus of unskilled labour and flexible labour markets. However, labour legislation introduces costs at all levels of skill in terms of new hiring (Van den Heever, 2003), thus implying that the direct cost of replacing lost workers at low skills levels may be underestimated and the economic impact of the epidemic **underestimated**, given that the cost to companies of workers may be relatively high even in these settings.

3.4 Government spending

Government expenditure will be higher as a result of the HIV/AIDS epidemic. This is mainly due to an increasing demand for public sector health care services, as well as increased social spending, especially in terms of expenditure on social grants (e.g. to provide care for the high number of children that will be orphaned as a result of increased mortality). In fact, all four models assume relatively substantial increase in public expenditure on health care and in the case of some models on social grants. These increases in government expenditure can be financed in several ways, i.e. either through higher budget deficits, expenditure switching within the health department, by sacrificing other expenditure, or by forfeiting public sector capital expenditure (ING Barings, 2000). The ING Barings (2000) model assumes higher budget deficits. ING Barings (2000) assumes a flexible budget deficit, meaning that government expenditure does not decline in line with government revenue (and that tax rates are not increased). The pro-cyclical effects of fiscal discipline, which would lead to a further reduction of the GDP growth rate, are therefore avoided – this would come at the expense of a higher public sector borrowing requirement and lower government savings. BER (2001), given current budget constraints and the conservative fiscal

stance of government, assumes (more realistically it might be said) that government would finance half of the increased health expenditure by cutting back on other forms of expenditure and that marginally higher tax rates will generate extra revenue to fund HIV/AIDS-related expenditures and will reduce the upward pressure on the budget deficit. The main budget deficit has declined from 3.8% of GDP in 1997/98 to 1.5% in 2001/02 (National Treasury, 2003: 54). Projected future budget deficits will remain low, although set to increase marginally to between 2 and 2.5% over the next three financial years (National Treasury, 2003: 53).

According to the projections contained in the ING Barings (2000) and BER (2001) models, the budget deficit will deteriorate as a result of increased government expenditure, due to higher direct and indirect employee costs, increased demand for health services and increased welfare grants. Lower tax revenues, as a result of a lower level of economic activity, as well as lower personal and corporate income tax receipts, will also impact negatively on the budget deficit (BER, 2001; ING Barings, 2000).

According to Van Rensburg *et al*. (2002), social expenditure by government has continued to increase in the recent past, reflecting a continued concern with improved social delivery. Trends in social expenditure also suggests that government will be reprioritising expenditure so as to cope with the HIV/AIDS epidemic, with increasing allocations going towards the Departments of Health and Social Development, which will have to cope most directly with the impact of the epidemic. However, future increases in these allocations, apart perhaps from allocations to Social Development, are relatively small in real per capita terms.

In terms of HIV/AIDS-specific budgetary allocations, though, allocations have increased substantially over past financial years, both in nominal and real terms and both in aggregate and per capita terms (Van Rensburg *et al*., 2002), while projected allocations for future years will continue to increase substantially (Hickey, 2002), amounting to an additional R3.3 billion over the MTEF period (National Treasury, 2003: 158). (However, any analysis of the budgetary implications of HIV/AIDS-related public expenditure needs to weigh up the cost of doing nothing against the benefits of spending more public resources in certain areas, which as Skordis and Nattrass (2002) has shown may results in net savings to the budget.)

On aggregate, the increases in public health care expenditure assumed in these models are therefore overoptimistic in light of the current government's stance on fiscal discipline and has as yet not materialised (Van den Heever, 2003). In addition, as emphasised by Van den Heever (2003), these models employ a relatively wide range of estimates of the cost of AIDS care, i.e. ranging from R3500 to R16 900 per patient, which is likely to translate into substantial variability in

the projections future increases in public health care expenditure and therefore in the projections of the different macroeconomic models. Assumptions about increase in public health care expenditure are also based on assumptions regarding patterns of health care seeking behaviour, which according to Van den Heever (2003) have little empirical basis. Van den Heever (2003) also argues that the uptake of social grants in the face of the HIV/AIDS epidemic has probably been underestimated. While the latter criticism may see the economic impact of HIV/AIDS **underestimated** (greater expenditure on grants will result in more crowding-out of other expenditure and/or higher budget deficits), unrealistic assumptions regarding increases in public health care expenditure (based on the recent stance of government in this regard) means that the economic impact of the epidemic is **overestimated** (the question of how government opt to finance the planned roll-out of ARV treatment has important implications for this assumption in the current models).

In their current form, these macroeconomic models does not assume any role for foreign capital or donor money in funding HIV/AIDS-related public expenditure (Van den Heever, 2003), which represent relatively substantial funding resources (Van Rensburg *et al*., 2002), while such allocations, via the Global Fund for HIV/AIDS, Tuberculosis and Malaria for example, is likely to play a substantial role in future years in funding HIV/AIDS care and support programmes in future years. Such funding implies less crowding out of other public spending and less chance of deficit increases, thus resulting in an **overestimation** of the economic impact of the epidemic.

3.5 Household spending

In theory, the HIV/AIDS epidemic will cause affected individuals and households to change their consumption patterns, as a result of changing incomes, and higher spending on drugs and treatment. The macroeconomic models reviewed here assume that HIV/AIDS affected households and/or individuals will finance part (half) of the increase in medical expenses from savings, while the balance will be financed from cutbacks in other expenditure. In addition, the assumption is made that consumption will be redirected from durable towards non-durable goods and that expenditure on health care will increase, which will result in an increase in the demand for services. However, BER (2001) notes that the liquidation of the deceased's assets should canter the negative impact on the spending power of the remaining household members. The changes in consumption patterns assumed in the ING Barings (2000) and BER (2001) models over the modelled period are described in Table 3 below. (Note that consumption expenditure in general declines due to the combined impact of the epidemic.)

Table 3: Percentage changes in categories of consumption expenditure in the AIDS and no-AIDS scenarios

Year	Durables		Semi-durables		Non-durables		Services	
	ING	BER	ING	BER	ING	BER	ING	BER
2002	-2,6	-1,0	-2,5	-0,7	-1,8	+0,3	+1,2	+1,5
2005	-4,6	-3,1	-4,6	-2,4	-3,8	-0,1	+2,3	+3,0
2010	-8,3	-5,7	-8,9	-5,4	-7,8	-1,6	+4,4	+6,3
2015	-7,8	-7,9	-9,3	-9,8	-9,3	-6,3	+5,5	+3,5

Key: ING = ING Barings (2000); BER = BER (2001).

To date, only a few HIV/AIDS household impact studies have been conducted in South Africa. Furthermore, these surveys are relatively small in scale, were conducted in selected sites in a few provinces only, and are often based on select, purposive samples rather than random, population-based samples (for details see Booysen, 2002; Oni *et al*., 2002; Samson, 2002; Steinberg *et al*., 2002). This means that results cannot be generalised to the national level. However, these surveys do present some indication as to the relative magnitude of the impact of HIV/AIDS on household spending and savings. In fact, the results from South African household impact studies (despite the limitations described above) for the most part support the general gist of the nature of these assumptions, although there (for reasons explained above) is no clear-cut evidence as to the exact magnitude of these changes, at least not findings that can be generalised to the national level.

Booysen *et al*. (2002), for example, in a household impact study in the Free State province found that affected households, in terms of the composition of household expenditure, allocate relatively MORE of their resources to expenses on food, health care, household maintenance and rent and LESS to education, clothing, transport, personal items and durables when compared to non-affected households. Comparisons in expenditure patterns relative to the incidence of illness and death supports these findings regarding differences in expenditure patterns (Booysen *et al*., 2002). Oni *et al*. (2002), based on a household impact study conducted in the Limpopo province, reports that HIV/AIDS- affected households spent more on medical care, transportation, and funerals, but less on education, housing and remittances, often withdrawing children from school. Steinberg *et al*. (2002), based on a household survey conducted in four provinces, report that 54% of households said they had cut back on household expenses since the illness of the index case. The most common items that were cut back were clothing (21% of those who had cut back), accounts (16%), electricity and services (9%), food (6%) and school fees (4%), while 34% of all income received across all households was spent on health care (Steinberg *et al*., 2002).

According to Van den Heever (2003), the evidence of the impact of HIV/AIDS on savings is little and where available conflicting. Booysen *et al*. (2002) report that affected households in two areas in the Free State province on a monthly basis save approximately 40% less than non-affected

households. The utilization of savings and new borrowing appears to be a common response of these affected households to morbidity and particularly to mortality. The sale of assets is a less common response due to households being relatively poor. The amount of savings utilized and money borrowed by affected households are considerable when expressed relative to current savings, total debt, or to average household income. Hence, morbidity and mortality put considerably strain on household finances (Booysen, 2002). Oni *et al*. (2002) report that HIV/AIDS-affected households in the Limpopo province save less, borrow more and disinvest by selling assets to help cope with the impact of the epidemic. Based on this evidence, it appears that although many households finance increases in medical expenses from savings, a large number also finance increases in medical expenses from borrowing or by selling assets, which are not included in current macroeconomic models in terms of household responses to HIV/AIDS impacts. Based on current evidence, therefore, it is unclear what these combinations of financial responses to financial crises in affected households augurs for patterns of household spending and changes in savings and for the results of macroeconomic models.

4. Macroeconomic forecasts generated by the models

Each of the models presents comparisons between an "AIDS scenario" and "no-AIDS scenario" (or a baseline scenario) in terms of the macroeconomic impacts of the HIV/AIDS epidemic on economic growth, savings and investment, labour markets (or employment and unemployment rates), and poverty and inequality. (These models also present projections of impacts on household consumption expenditure, government spending and budget deficits, inflation and interest rates, trade, the balance of payments and exchange rates. Although the discussion elsewhere on the assumptions employed in these macroeconomic models touches on the former two issues, i.e. changes in consumption expenditure and public spending and budget deficits, the latter macroeconomic impacts are not discussed in detail in this paper, given the focus here on the impact of the epidemic on economic growth, investment, employment and poverty and inequality, excepting for references of how projections of effects on these variables influences the impacts on the macroeconomic variables discussed here.) Table 4 below summarises the main macroeconomic impacts of the HIV/AIDS epidemic as projected with the aid of the ING Barings (2000) and BER (2001) model. (Where appropriate, the discussion contrasts these estimates to those projections following from the other two macroeconomic models reviewed in this paper, although it should be emphasised that the format in which projections are reported are not always directly comparable. For example, some models report differences between the "AIDS scenario" and "no-AIDS scenario" in percentage point differences, whereas others report these differences in terms of differences in economic aggregates or growth rates.)

Table 4: Percentage point differences between the AIDS and No-AIDS scenarios in the ING Barings (2000) and BER (2001) models

Macroeconomic Parameter	ING Barings (2000)	BER (2001)
	2002-2015	2002-2015
A. Economic growth		
Annual real growth in GDP	–0.6	–0.5
Average annual growth in real per capita GDP#	0.9	0.9
B. Investment		
Interest rate (% point difference in the level)	0.6	2.9
Annual real growth in Gross Domestic Fixed Investment	0.0	–1.2
C. Employment		
Average annual total population growth**	–1.5	–1.3
Average annual growth in the total labour force***	–1.2	–1.6
Average annual growth in employment****	–0.6	–0.6
Growth in the unemployment rate (i.e. % of labour force without formal jobs)*	–0.9	–2.0

Source: Adapted from Nattrass (2002).
Notes: * 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.

(Had the macroeconomic models of the impact of HIV/AIDS on the South African economy reported the aggregate level macroeconomic estimates, rather than the differentials or percentage point differences between an AIDS and no-AIDS scenario, one could have attempted to compare these estimates with the future macroeconomic scenario reported in the latest budget review for example (National Treasury, 2003). However, such comparison is constrained by the fact that differences between the AIDS-scenarios in the two models and the macroeconomic climate envisaged in the budget review cannot be attributed to the HIV/AIDS epidemic, but depends on a myriad of economic and other forces (including HIV/AIDS, that is if these projects in fact allow for the impact of the HIV/AIDS epidemic) that influence these macroeconomic projections. Nevertheless, it would allow some kind of appreciation of the extent to which the projected impact of the epidemic differs from the macroeconomic climate envisaged in the near future. Furthermore, were there to be contradictions between the macroeconomic projections included in the Budget Review and those modelled once allowing for the impact of HIV/AIDS, one would have to ask the very difficult question as to whether other economic developments or policy changes more particularly are taking place that negates some of these envisaged impacts, or whether these estimates simply do not account for the effects of the epidemic. One could expect the Minister of Finance to be unlikely to present such negative scenarios, even if there is good reason to belief that this will occur, because the budget sends important political economic signals not only to local and international investors, but also to the national and international communities. On the other hand, the forecasting horizon

reported in the Budget Review is relatively short and may very well at this point in time exclude the period during which the AIDS epidemic is likely to take its toll on the South African economy.)

4.1 The impact of HIV/AIDS on Gross Domestic Product (GDP)

The aggregate level of real GDP (for reasons explained elsewhere in this paper) is projected to be lower in the AIDS scenario than in the no-AIDS scenario by all the macroeconomic models. Ford *et al*. (2002) reports estimates from other, earlier studies as putting this figure at between 0.3% and 1.0% per annum. Burger (2001) projects that, by 2015, the level of real GDP will be 16,6% lower than in 2002, while Arndt and Lewis (2000) put this figure at 17% by 2010. Arndt and Lewis (2000), for example, attributes 45 and 34% respectively of the difference between real GDP in the AIDS and no-AIDS scenarios by 2010 to deficit spending by government to finance AIDS-related expenditures and to lower total factor productivity. The reduction in labour supply accounts for 8% and 13% of the differential is attributed to lower factor productivity. Both the ING Barings (2000) and BER (2001) models estimate that per capita incomes might rise as a result of HIV/AIDS. This can be attributed to the fact that both models assume that the decline in income will be less than the decline in the population. According to BER (2001), per capita GDP is projected to be 4,2%; 9,7% and 14,8% higher in 2005, 2010 and 2015, respectively, while ING Barings (2000) also projected that per capita GDP will increase. Arndt and Lewis (2000) on the other hand predict a decline in per capita income. They forecast per capita GDP to be between 4% and 13% lower over the period 2005-2010 (Arndt and Lewis, 2000).

4.2 The impact of HIV/AIDS on savings and investment

The macroeconomic models reviewed in this paper project that domestic savings will decline. ING Barings (2000) list three reasons for the decline in domestic savings:

- lower household savings (due to the fact that the reduction in household consumption is less than the reduction in disposable incomes)
- lower public sector savings (as a result of the higher public sector borrowing requirement)
- lower corporate savings (due to the fact that employers will have to finance higher direct and indirect employee costs from operating surpluses and savings).

Arndt and Lewis (2000) project that AIDS-related government spending from the savings pool will cause total domestic savings to decline from 17% of GDP in 1997 to 14,2% in 2010. According to the ING Barings (2000) model, total domestic savings as a percentage of GDP is forecast to be on

average 2 percentage points lower than in the no-AIDS scenario. BER (2001) forecasts that national savings, as a percentage of GDP, will be 0,9 percentage points lower in the AIDS scenario by 2005 (2,7 percentage points lower by 2010; 3,1 percentage points lower by 2015). Arndt and Lewis (2000) forecast the impact of reduced household savings rates on total savings to be relatively small. One reason is that household savings rates in South Africa are already very low and that the white population, who contributes the largest share to these savings, face low HIV prevalence rates (Ford *et al*., 2002). (The HSRC (2002) prevalence study report higher prevalence rates amongst whites than assumed in other studies and represent the first prevalence rate estimates by race calculated from a national sample of individuals. Hence, the impact of HIV/AIDS on personal savings and therefore on the entire economy may be **underestimated**.) Moreover, AIDS-affected households only are assumed to reduce their savings rates (Arndt and Lewis, 2000). BER (2001) makes similar assumptions and forecasts that the percentage point difference in the personal savings ratio (expressed as a percentage of disposable income) will be as follows: -0,8 percentage points by 2005; -1,5 percentage points by 2010; -0,2 percentage points by 2015. ING Barings (2000), however, predicts relatively large declines in private savings (see Table 5).

Table 5: Percentage difference in real savings in the AIDS and no-AIDS scenarios

Year	Private savings	Public sector savings	Corporate savings
2005	-30,6	-19,1	-1,7
2006-2010	-32,9	-23,2	-2,9
2011-2015	-23,6	-22,7	-7,1

Source: ING Barings (2000).

As argued elsewhere, whether affected households as assumed save nothing is debateable, given existing empirical evidence from household impact studies. In addition, the relatively unrealistic assumptions about changes in government spending (large increases in health care and social expenditure, coupled with higher budget deficits), means that this decline in savings and the associated economic impact therefore is likely to be **overestimated**.

Lower savings rates are likely to have a negative impact on investment, which in turn contributes to a lower level of overall economic activity in the AIDS scenario. ING Barings (2000), however, estimate that the year-on-year real growth in total fixed investment will not decline (according to Table 4, the percentage point difference in real growth rates over the modelling period will be zero). The argument here is that the decline in demand for residential buildings is counterbalanced by the fact that firms might switch to more capital-intensive production methods. Increased capacity utilisation thus induces firms to invest more in capital. (Ambert (2002) presents some research as to the impact of HIV/AIDS on the supply-side in the construction sector, whereas Kayamandi (2002) present some modelling results that support assumptions about a decline in demand for housing.)

BER (2001) on the other hand projects a much more negative impact on fixed investment (a decline in real gross domestic fixed investment of 1.2 percentage points per annum), because the AIDS epidemic affects the supply potential of the economy negatively. BER (2001) identified the following negative influences on investment: a lower overall level of economic activity; higher interest rate levels; lower corporate profits and savings, as well as a smaller pool of national savings. Higher projected direct and indirect costs due to HIV/AIDS, as well as increased capacity utilisation, are likely to put upward pressure on the PPI, which would result in increases in the CPI. Both BER (2001) and ING Barings (2000) assume a policy of inflation targeting to be in place over the entire projection period. Therefore, higher inflation rates will result in a tightening of monetary policy, resulting in upward pressure on interest rates. Additional upward pressure on interest rates originates from the deterioration in national savings and the overall balance of payments position (BER, 2001). The fact that increased capacity utilisation might put upward pressure on fixed investment was not considered by BER (2001) in their macroeconomic simulation, because the increase in capacity utilisation is the result of a decline in the economy's supply potential, rather than an increase in actual GDP (demand). BER (2001) also modelled the impact of HIV/AIDS on private residential fixed investment by including a population variable in their econometric function. The non-black population was used for this purpose, which accounts for the fact that a large proportion of AIDS deaths are unlikely to spill over to a decline in private sector residential investment. AIDS mortality amongst home-owning blacks was therefore implicitly assumed to be similar to that of non-blacks. This of course need not be the case, particularly in the context of evidence of an emerging Black middle class.

Furthermore, the models reviewed in this paper do not assume or project much about changes in foreign direct investment (FDI), nor of public sector fixed investment, although BER (2001) states that the Rand value of capital inflows is assumed to remain unchanged for the AIDS and no-AIDS scenarios. However, flows of FDI may decline as investor confidence falls, thus resulting in an **underestimation** in these models of the economic impact of HIV/AIDS. According to Ford *et al*. (2002), for example, there is evidence that perceptions of risk have increased as far as investment in South African assets is concerned, particular in high-risk industries such as mining. They also point out that higher domestic production costs resulting from the epidemic may see a decline in international competitiveness. Other possible reasons for a decline in foreign investment includes decreases in production and the resulting effects on business supply chains, as well as the higher interest rates, lower spending and slower economic growth resulting fro the impact of the epidemic on the South African economy (Ford *et al*., 2002). Hence, macroeconomic models need to at least consider in some way the likely impact of the epidemic of these two drivers of longer-term economic growth.

4.3 The impact of HIV/AIDS on labour markets

Employment levels will be lower in the AIDS scenario than in the no-AIDS scenario, due mainly to lower levels of economic activity, while the labour force (and labour supply) will be significantly smaller as a result of increased AIDS mortality, which will see the total population shrink. However, population growth will not turn negative, but the epidemic will see population growth slow, particularly in groups facing high prevalence rates and fertility declines (Ford *et al*., 2002), which again underlines the importance of understanding the mix between HIV prevalence, skill level and labour supply, an area of research that as explained elsewhere remains one of the key gaps in our knowledge about the economic impact of HIV/AIDS. Both the ING Barings (2000) and the BER (2001) models forecast unemployment rates to be lower in the AIDS scenario (see Table 4 for a summary of the modelling results). However, these outputs of the model do little to elucidate other questions about the impact of the HIV/AIDS epidemic on labour markets. So, for example, there is no real evidence as yet as to the impact of the epidemic on the composition of the labour force in terms of skill levels. Nor do we know what particular occupations may be worse affected by the epidemic than others. (Also see discussion elsewhere on criticisms of demographic assumptions underlying the macroeconomic models reviewed in this paper – pages 9 to 13). Furthermore, a greater understanding (and allowance of these impacts in the macroeconomic modelling frameworks) is required of the extent to which the epidemic will in future years impact on the formation of human capital via lower investment in schooling and higher education and the material, emotional and motivational impact on affected children of the loss of a parent (Russell, 2002).

4.4 The impact of HIV/AIDS on poverty and inequality

Poverty is likely to deepen as the epidemic takes its course. The socio-economic impact of HIV/AIDS combine to create a vicious cycle of poverty and HIV/AIDS in which affected households are caught up. As adult members of the household become ill and are forced to give up their jobs, household income will fall. To cope with the change in income and the need to spend more on health care, children are often taken from school to assist in caring for the sick or to work so as to contribute to household income. Because expenditure on food comes under pressures, malnutrition often results, while access to other basic needs such as health care, housing and sanitation also comes under threat. Consequently, the opportunities for children for their physical and mental development are impaired. This acts to further reduce the resistance of household members and children (particularly those that may also be infected) to opportunistic infections, given lower levels of immunity and knowledge, which in turn leads to increased mortality (World Bank, 1998; Bonnel, 2000: 5-6; Wekesa, 2000). Households headed by AIDS widows are also particularly vulnerable, because women have limited economic opportunities and traditional norms and customs may see

them severed from their extended family and denied access to an inheritance (UNDP, 1998). Worrying, more, is that firms are increasingly using contract labour rather than appointing employees on a permanent basis, which increasingly shifts the burden of HIV/AIDS onto households and government (Rosen and Simon, 2002). This also means that HIV/AIDS-affected households (and in particular infected persons) may find it increasingly difficult to find employment and remain in employment, which is crucial for ensuring some kind of economic security at the household level. In many third world situations, therefore, HIV/AIDS exposes already vulnerable, resource-poor households to further shocks (Whiteside, 2001 and 2002).

Both Desmond (2001) and Whiteside (2002) emphasize how complex the relationship between poverty and HIV/AIDS actually is and how many facets it has, e.g. how labour migration induced by rural poverty can contribute to the spread of the disease and how poor, single mothers may be forced to become occasional sex workers in order to survive (Desmond, 2001: 56; Poku, 2001: 195). Gillies *et al*. (1996) and Nyamathi *et al*. (1996), moreover, highlight the importance of homelessness, urban/rural migration patterns, migrant labour practices and the breakdown of social support networks in communities with limited access to social service delivery and in developing countries in increasing the vulnerability of poor people to HIV/AIDS.

Few of the macroeconomic models reviewed in this paper directly investigate the likely impact of the HIV/AIDS epidemic on poverty and inequality, although BER (2001) assumes the income distribution to remain unchanged. Two rare examples of studies that have explored the distributional implications of HIV/AIDS is the work of Greener *et al*. (2000) and Cogneau and Grimm (2003). Greener *et al*. (2000) estimate that the HIV/AIDS epidemic in Botswana will cause poverty to increase and the poor to become poorer, but that income inequality will remain relatively unchanged. In contrast, Cogneau and Grimm (2003) employ a demo-economic micro-simulation model to simulate the impact of AIDS on the income distribution and levels of poverty in the Côte d'Ivoire over a fifteen years period. They estimate that the labour supply effects of the HIV/AIDS epidemic (their model does not account for the effect of the four other main channels of impact on income distribution and poverty) will leave average income per capita, income inequality and income poverty relatively unchanged, although they do emphasize that 'AIDS kills more the poor, but rather the richest of the poor'. Nattrass (2002), based on current evidence from the wider literature on the economic impact of HIV/AIDS in South Africa (and using therefore the type of broad qualitative assessment of the macroeconomic impact of HIV/AIDS referred to by Ford *et al*., 2002), argues that inequality is likely to increase in the face of the epidemic. She argues that,

> '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' (Nattrass, 2002).

Empirical evidence on the impact of HIV/AIDS on poverty in South Africa is equally scarce. Samson (2002), based on a small case study in the Eastern Cape, reports 'a significant number of cases in the Mount area district of the Eastern Cape where poverty and HIV/AIDS interact to undermine the nutritional status of children. He argues that, while the role of HIV/AIDS is difficult to ascertain, poverty is clearly a primary factor responsible for the severe cases of malnutrition documented in the study. A household impact study conducted in Limpopo province of South Africa reports that households affected by HIV/AIDS had lower levels of income compared to non-affected households (Oni *et al*., 2002). To date, one South African study only has specifically explored poverty dynamics in HIV/AIDS-affected households with the aid of panel data. Booysen (2003a and 2003b), using data from a longitudinal impact study, found real average adult equivalent per capita income of affected households that had experienced illness or death in each wave to be substantially lower than was the case in affected households that had experienced illness or death in at least one wave but not in all three waves (R354 compared to R441). Affected households in turn that did not experience any illness or death over the period had a considerably higher income (R894). The incidence, depth and severity of poverty are relatively worse amongst affected households, especially affected households that have suffered illness or death in the recent past. Affected households, particularly those facing a greater burden of morbidity or mortality, are more likely to experience variations in income and to experience chronic poverty (Booysen, 2003a and 2003b). Hence, much work remains to be done to elucidate the nature of the impact of the HIV/AIDS epidemic on poverty and inequality in South Africa.

5. Responses to the HIV/AIDS epidemic by government and business

Recent years have witnessed the role-out of ARV programmes in a number of large companies in South Africa, given the continued decline in the prices of ARV drugs (Stein *et al*., 2002), as well as the growing realisation of firms that the provision of ARV to infected workers make economic sense (Rosen *et al*., 2001). Russel (2002), however, emphasises that research is required to determine the exact nature of this provision by South African employers. However, ARV treatment remains expensive and the majority of those affected by HIV/AIDS are unlikely to afford such treatment, given that only some employers (recent company services all indicate that large proportions of employees are in fact NOT responding to HIV/AIDS) would be able afford these costs, that only a relatively small proportion of the population have access to medical aid that cover such treatment,

and the government will simply not be in a position to afford a national roll-out of ARV treatment (Geffen, 2002)[7]. In addition, government has since 2000, as part of the HIV/AIDS and STD Strategic Plan for South Africa (2000-2005), but also to some extent as a result of pressure by the Treatment Action Campaign's effort to secure expanded access to antiretroviral therapy and added voices from other pressure groups, rolled out an integrated response to the epidemic that includes PMTCT, VCT and CHBC programmes and focuses on improved STD management and condom use in an attempt to address the impacts of the epidemic (Department of Health, 2000; Geffen, 2002). (The recent commitment of government to roll-out treatment with ARV to the entire population of course stands to change the assumptions made here about access to treatment with HAART.)

The demographic models currently employed in informing the macroeconomic modelling predates these developments for the most part and has a limited capability in modelling the impact of multi-dimensional interventions such as ARV, which is likely to impact both on treatment and prevention efforts (Van den Heever, 2003). In fact, the standard ASSA2000 model assumes no ARV treatment, which makes it likely that the existing macroeconomic models is overestimating the impact of the epidemic on the South African economy, given that ARV (given that is the employed in particular that can access such treatment), amongst others, is likely to reduce productivity losses and losses in labour supply, albeit that ARV can also limit behaviour change that is required to curb future infections. However, the change scenario included in the ASSA2000 model and the ASSA2000lite model, amongst others, does allow for the impact on transmission probabilities and AIDS morbidity and mortality of STI treatment, VCT, PMTCT and ARV (ASSA, 2003; Van den Heever, 2003). For this reason, it is necessary that the current macroeconomic models be rerun in order to determine how these alternative demographic scenarios may change the resulting macroeconomic impact estimates. In fact, one important criticism of the existing macroeconomic models is that they present relatively little sensitivity analysis, which is important in reflecting the diverse range of the possible economic impact of the epidemic under different scenarios based on different assumptions. However, it should be pointed out that the resulting interactions between a large number of variables, such as is the case in models of this nature, limits the accuracy of long-term projections (Van den Heever, 2003).

6. Conclusion

[7] The cheapest triple-combination HAART regimen available in South Africa, which is not always a medically appropriate prescription for patients, costs around R684 per month, representing almost half of the median income of the average South African (Geffen, 2002).

Even though the approaches, assumptions and results may vary greatly, the overriding message that these models convey remains the same: the cost of HIV/AIDS to South Africa will be significant in economic, social and human terms. Ford *et al*. (2002) point out that evidence from other countries suggests that the projected dire macroeconomic impacts have not materialised and that some countries have maintained high economic growth rates throughout the epidemic. This paper, however, has highlighted the difficulties in comparing the results of these modelling exercises with actual macroeconomic performance, given that we simply do not know whether other economic developments or policy changes more particularly have negated these envisaged impacts, partly as a result of the difficulty of untangling the simultaneous effect of HIV/AIDS and a myriad of other economic forces on these macroeconomic parameters.

In this study we have reviewed the most recent macroeconomic models that quantify the impact of HIV/AIDS. One problem with these models is that they are highly aggregated. The impact primarily manifests in terms of the demographic and labour market aspects of the HIV/AIDS epidemic. Furthermore, the focus is on the formal sector, and the deductions are then made regarding the rest of the economy and labour force. This impacts negatively on the accuracy of the models as most Africans live and work in the informal sectors, in which market valuation of activities leaves much to be desired. It is expected that the direct modelling approach will become more accurate as demographic projections improve and as necessary micro-level research allows more precise assumptions to be made (Ford *et al*., 2002). In fact, the latter research remains crucial in plugging the various research gaps identified in this paper, research gaps that may translate into assumptions that result in an over- or underestimation of the true macroeconomic impact of the epidemic. Reasons why the economic impact of the epidemic may be overestimated include possible lower HIV prevalence rates, lower costs incurred by employers in coping with morbidity and mortality amongst workers, particularly at higher levels of skill, and overoptimistic assumptions about increases in public health care expenditure and resulting increases in budget deficits. There are also possible reasons as to why the economic impact may be underestimated. These include the exclusion of many indirect, systemic costs from the estimation of costs of HIV/AIDS to the private sector, including the cost of replacing workers, too pessimistic assumptions about the uptake of social grants, and higher than expected HIV prevalence amongst whites. Particular areas of concern as far as empirical evidence is concerned include the cost incurred by companies in different sectors because of HIV/AIDS (although this literature has grown significantly, there are not enough evidence to make generalisations at sector level), changing household consumption and expenditure patterns, estimated government expenditure resulting from the epidemic, and stratified demographic profiles of the epidemic. More work is also required on the impact of the epidemic on specific sectors in the economy, including the mining, construction and financial sectors, small and medium sized enterprises and the informal economy (Ford *et al*., 2002).

In terms of the methodology of macroeconomic modelling, According to Ford *et al*. (2002), Barr and Kantor's (2002) model employed in estimating trends in short-term interest rates and the trade balance and the sensitivity of these to external and internal shocks can also be applied to improve our understanding of the HIV/AIDS epidemic. Macroeconomic modellers in South Africa should also seriously investigate the possibility of using a micro-simulation approach to study the impacts of the HIV/AIDS epidemic on the South African economy. Micro-simulation combines micro- and macro-level data in combination with either CGE of conventional macro model approaches in modelling macroeconomic outcomes (Davies, 2003). An example is the work of Cogneau and Grimm (2003) investigating the impact of the epidemic on poverty and income inequality, which combines data from several household income surveys, a Demographic and Health Survey, a migration survey, a population census, and demographic projections by the United Nations. However, for reasons with regard to empirical gaps mentioned in this paper, the application of such model the modelling the impact of HIV/AIDS can be hampered by the lack of nationally representative micro-level data. Finally, especially macroeconomic, but also the demographic models informing the macroeconomic models, can incorporate greater sensitivity analysis with regard to assumptions to report on the likely range of the impacts of the epidemic on the South African economy (Ford *et al*., 2002).

Finally, macroeconomic modelling on the impact of HIV/AIDS has also to some extent been constrained by a lack of clarity regarding the key question as to how treatment, care and support for HIV/AIDS-affected individuals and households are to be financed (Ford *et al*., 2002). This knowledge informs key assumptions in the demographic and macroeconomic modelling required to elucidate the impact of HIV/AIDS on the South African economy, including amongst others how much money government will spend on health care and social support, how households will finance expenditure on medical care, and what the role of international funding will be in financing the fight against HIV/AIDS.

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