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## Can Economic Analysis Contribute to the Current Debate on Access to HIV/AIDS Care in Developing Countries ?

Alan Kirman, Stéphane Luchini et Jean-Paul Moatti

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## Can Economic Analysis Contribute to the Current Debate on Access to HIV/AIDS Care in Developing Countries ?

### Résumé

Cet article étudie le problème économique de l'accès aux traitements du sida dans les pays en développement. Nous suggérons que les calculs coût-bénéfices réalisés jusqu'alors sont inadaptés. Ils n'ont pas intégré le bénéfice du capital humain parce que de nos jours les nouveaux traitements du sida permettent aux patients de mener une vie relativement normale. Dans ces calculs, l'importance que la société accorde au traitement du sida n'est généralement pas pris en considération. Nous discutons également de l'évolution des prix des antirétroviraux et tentons de montrer que le traitement n'est plus inaccessible économiquement pour les pays en voie de développement. Nous examinons les différentes méthodes de financement du traitement et donnons des exemples illustrant les politiques menées dans divers pays. Nous ne nions pas qu'il est légitime, dans ces pays, d'allouer des ressources au traitement d'autres maladies que le sida mais cette décision doit être prise à la lumière d'une

\* Workshop "Economic issues related to HIV/Aids care in developing countries", 27 May 2003, Marseille

évaluation globale des problèmes de santé publique et non en considérant chaque maladie isolément.

**mots clés** : sida, coût bénéfice, traitement, prix des antirétroviraux, utilité sociale, financement

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## Summary

This paper examines the economic problem of providing treatment to AIDS victims in developing countries. We suggest that a number of the cost benefit calculations that have been made are inadequate. They do not take into account the benefit of maintaining human capital nor the fact that with modern treatments patients can now lead a relatively normal life. The weight which society attaches to treating AIDS as opposed to other diseases has also to be considered. We discuss the evolution of the prices of antiretroviral drugs and show that treatment is now no longer beyond economic reach even in developing countries. We examine the various methods of financing treatment and give examples from various countries. We argue that whereas it is legitimate to consider other health programmes rather than devoting resources to the treatment of AIDS, this necessitates an adequate evaluation of the benefits of each programme and requires a global rather than case by case analysis.

**Key words** : AIDS, cost-benefit, treatment, prices of ARV drugs, social utility, financing

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## Introduction

With a great deal of publicity, but without much analytic debate there has been a sea change in the attitude of the world to the AIDS epidemic in developing countries. On September 22, 2003, Dr LEE Jong-wook, the recently appointed Director-General of the World Health Organization (WHO) declared at a meeting of the General Assembly of the United Nations in New-York, that “the failure to deliver antiretroviral drugs (ARVs) for AIDS to the millions of people who need it”

should be declared “a global health emergency”. While WHO and UNAIDS, the UN secretariat in charge of coordinating the fight against the HIV epidemic, currently estimate that some six to nine million people in developing countries have HIV infections that require immediate access to antiretroviral treatment, fewer than 300,000 are being treated. In sub-Saharan Africa, where most of the people in need of treatment live, only 50,000 people are receiving it. WHO, UNAIDS and other international organizations, such as the World Bank and the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFTAM) that was set up in 2002 to help finance the scale-up of programs against HIV/AIDS in developing countries, have committed themselves to meeting the ambitious “3 by 5” target : providing ARVs to an additional three million people by the end of 2005. However, it is currently estimated that with all existing programmes and funding availability, fewer than one million people who need ARVs will receive it by the end of the year 2005.

To an economist, a number of the aspects of this problem are particularly striking. Where once it was recognised that there was a limited health budget and that it had to be allocated to those uses which were most cost effective in terms of the welfare of the country in question, there is now a sentiment that if costly treatment is available to the victims of AIDS it should also be at the disposal of the victims in poorer countries.

A first and very important observation is that AIDS and all the associated problems have been systematically drawn to the attention of the public and hence to that of governments as a result of a well organised campaign. Unlike many problems that affect predominantly poor countries AIDS has also had radical consequences for the inhabitants of the industrialised countries. This has led to the existence of a powerful and articulate lobby aimed at putting the AIDS problem in the public eye. One reaction to this is to say that this should not prevent one from considering the cost effectiveness of AIDS treatments in the same way as one considers the problem of treating other ailments. This would not be correct in economic terms.

This is because what has happened is that society’s preferences have been, for good or ill, influenced by the information about AIDS. There is therefore a willingness to pay for AIDS which is higher than that for other diseases. Thus when considering the benefit of the expenditure of one dollar on AIDS treatment it should be remembered that this might have been only 30 cents if the money had been granted to clean water problems for example. Thus AIDS treatment has to be measured in terms of the monetary gains paid in comparison to the gains from the sum that would have been raised for the treatment of another disease. The social benefit of AIDS treatment has been modified and increased by the information that has been made available and for this reason a simple mechanical cost-benefit analysis would not be appropriate.

As we have suggested, there is little doubt that one of the motivations for the desire to finance the treatment of AIDS is that of redistribution at the global level.

AIDS is seen as affecting the poor in particular and is thus seen as being specially appropriate as a target for funding. In fact, the situation is rather more complicated. Surprisingly, as pointed out by Bloom et al. (2001), the relationship within different continents between poverty and the occurrence of AIDS is far from clear. It seemed that in sub-Saharan Africa, for example, the richest countries such as Botswana and South Africa were the most affected. Yet, if we look across continents things are much clearer. 95% of the HIV infected live in developing countries whilst the latter contain 80% of the world's population. Thus a basic preoccupation with redistribution would provide, at least an a priori, reason for wishing to provide treatment to AIDS victims in developing countries.

The topic that we address in this paper starts from that premise. Yet, at the risk of being considered quite "conservative", it is worth setting the problem in perspective. There are three essential features of the problem. The first is the problem of prevention, the second is the problem of testing and diagnosis and the third is the problem of treatment. Thus, in the long run the overriding concern is with the welfare of the individuals involved and these problems have to be tackled altogether. Indeed, the difficulties with providing care to AIDS victims in poor countries have recently occupied centre stage to such an extent that one now sees arguments which dismiss the other aspects and at least superficially seem to be logically incorrect.

For example, in a recent paper, it was asserted that "improving the access for AIDS victims to adequate care and treatment is necessary to slow the spread of the AIDS pandemic." Yet, how can prolonging the lives of those already infected, which for many reasons we may well want to do, diminish the speed of the diffusion of the disease? It can surely at best not accelerate it and, at worst, speed its spread (see for example, Kremer, 2002). The only obvious case in which it may help is in the treatment of pregnant women with AIDS, since a number of studies ( see, e.g. Conner et al., 1994) show that treatment can reduce the risk of transmission to the child by up to two thirds.<sup>1</sup>

In fact, again the argument is more subtle. Treating an AIDS victim reduces significantly his probability of infecting others, (Chakraborty et al (2001), Taylor et al (2000), Vernazza et al (2000), Hart et al (1999)), however she/he lives longer and remains a source of potential infection for longer. It has been however shown that, even if in certain cases that people increase their sexual activity under treatment, treatment may lead to less risky behaviour : for instance, Sgombich et al. (2003) show in Chile that people under treatment are more likely to use condoms. Similarly, the evaluation of the pilot project for access to treatment in Côte d'Ivoire (Drug Access initiative) by the ANRS team of Moatti et al. (2003) has shown that ART-treated patients were more likely to share their serostatus with partners and

<sup>1</sup> In addition Nevirapine is very cost-effective in preventing mother to child transmission and is estimated by Marseille et al (1999) to cost between \$5 and \$20 per disability adjusted year of life (DALY) saved.



to use condoms than other HIV infected patients seeking care but not benefiting from antiretroviral treatment (Moatti *et al.*, 2003). The balance between these two effects is difficult to establish for the moment but the fact that quality of life of now treated patients is greatly improved and that consequently, they can remain in the workforce longer (Carrieri *et al.*, 2003) militates in favour of the argument that treatment may reduce the effects of the epidemic.

In addition to the fact that individuals remain productive when under treatment thereby preserving their human capital for society there is another important consideration. The removal of an individual from a poor society does not have the same social consequences as in a richer society. There is not the social security net needed to take care of the victim's dependents and the social network may be more fragile. Indeed it is this sort of consideration that has led to warnings of the collapse of the social structure in African countries.

Whether or not these arguments provide sufficient justification, it has become widely accepted that there is a global obligation to treat as many people with AIDS in poor countries as possible and that this is a priority independent of other health considerations.

The ethical grounds for such a position are understandable. As we shall see, the major cost of treatment is that of the drugs. Since those producing the latter are highly profitable it seems only natural to try to redistribute those gains to the victims in poor countries. In particular, this would constitute a direct international transfer of the simplest kind and, indeed, that is what is currently being negotiated. Yet, one could ask, what would poor countries do with the revenues from a tax imposed on the profits in question. It does not seem immediately obvious that they would all be directed to the victims of AIDS.

Few would argue with the basic idea that treatment for AIDS and for other important epidemics should be provided to the poor for sound ethical and simply humanitarian reasons. However, in the case of AIDS the nature of the results of treatment should not be misrepresented. How satisfactory is the living standard of someone who is being treated with the best modern therapies for AIDS? The answer is that in wealthy countries it is rather satisfactory but that the treatment still imposes considerable constraints. Failure to spell this out may lead to the illusion that if only access to treatment could be guaranteed there is little risk from AIDS. Yet there is little evidence in poorer countries that better information about treatment leads to more promiscuous behaviour, if anything the contrary.

Secondly, as we have already mentioned, it now seems that many patients under treatment can continue a normal working life. However, most of the evidence for this comes from developed countries where jobs do not necessarily require a great deal of physical effort. In developing countries this consideration is particularly relevant since the jobs in question are by no means sedentary. Furthermore, in addition to those patients who cannot tolerate treatment there are also the rather

strict conditions necessary for it to be effective. This is particularly true of ARV and as Ammassari et al (2001) and others point out, even in developed countries, adherence to complicated drug regimes is highly imperfect. Once again, the answer is to provide more robust remedies and treatment is now being developed which allows for more tolerance in the way in which it is administered (Ena and Pasquau 2003).

The usual discourse on AIDS points out that the life expectancy in developing countries is being radically reduced by the epidemic. This has tremendous economic consequences as the age group most effected is that which is normally the most productive. If it were the case that treatment can restore the victims to their productivity, access to treatment will have a very significant effect in mitigating the economic impact of the disease. However, this does not mean that we should make the simple equation, cost of the disease in terms of lost economic productivity justifies the same investment in treatment.

Indeed, in the context of the diffusion of ARVs, we should re-evaluate the value of prevention and of testing. Prevention will, by definition, maintain the full living standard and productivity of the potential victims. Then, the question is why are preventive measures not more effective ? It is particularly important to understand this because of the important externality generated by those infected. This means that if one could only increase the effectiveness of preventive measures one would have made a huge step towards reducing the impact of the epidemic. Why is this not happening ? The usual reasons cited are

- i) Ignorance as to the consequences of the disease and even of the mechanism of transmission.
- ii) Cultural rejection of the measures necessary.
- iii) Lack of information as to who amongst potential partners is already infected. (It is estimated that 9 out of 10 seropositive individuals in Sub Saharan Africa are unaware of their status for example, (see Moatti *et al.*, 2003)
- iv) Promiscuity. This is a controversial area but some reflection on the epidemiological process would suggest that diffusion must be more rapid in a society in which individuals have several partners. This, for the obvious reason that there is always a positive probability, however small, that such an individual will transmit the disease to all of his or her partners.
- v) Access to condoms may be very limited, and although unit cost of condoms is cheap, such access has to be organised and the need has to be accepted.

The first point involves a well known economic problem, that of the provision of a public good. Information about AIDS is a public good and it is unlikely that the private sector will do the dissemination necessary. Were insurance against AIDS to be provided by the private sector then there would be strong incentive for insurance companies to provide information. However, for rather obvious reasons

the majority of the cost of the treatment and prevention of AIDS is borne, even in developed countries, by the public sector. Yet, it is almost a knee-jerk reaction for an economist to dismiss publicly administered programmes as necessarily inefficient. This is considered to be a premise rather than an analytical conclusion. Thus, there is no reasoned argument to explain where or why the incentives are wrong in the public sector, nor to explain why it should be intrinsically impossible to make public programmes relatively cost-effective. These arguments are usually compounded when discussing developing countries by reference to the corruption which prevents resources even reaching the programmes whether or not those programmes, are effectively run.

Thus, the argument runs as follows. We have observed systematic failures in the past in publicly administered health programmes in developing countries; therefore, there is little hope that government intervention will be effective. Two things are worth observing here. It is surely worth devoting more time to analysing why public programmes seem to run into difficulties so regularly. In the case of a public good such as information about AIDS there is little alternative to the public sector so, at least here, it is worth trying to make the process as efficient as possible. Secondly, more generally it is worth analysing the cost of the market system which requires a considerable infrastructure and in which costs of enforcement of even the most sophisticated contracts are high. The percentage of GNP spent on legal fees and litigation in the U.S. bears witness to this.

In the light of our experience with the transition countries, it seems that some more caution might be recommended before seeking purely market solutions. A further point, that is worth evoking, here is that large firms in Southern Africa are now financing the treatment of AIDS which suggests that they, at least, must regard such treatment as cost effective (Rosen *et al.*, 2003).

Point (iii) is important here. It underlines the importance of testing. However the problems here are many and a number of questions need to be addressed.

What is the cost of testing and how useful is it ? A certificate is only valid at the time of issue and it may be invalidated by later infection. No programme can envisage high frequency testing even in developed countries. A number of economists have looked at certification schemes but they overlook the limited value of the certificate and also seem to believe that there is a problem of mismatching which would be solved by the appropriate matching, infected individuals matching themselves with other infected individuals and the non-infected remaining apart. The prospect of having relations with someone who is known to be infected would surely be discouraging but the segregation effect is easy to overestimate since in a situation where not everybody is tested, it is easy to hide this information.

Why do individuals, even in developed countries, not have themselves tested more often ? The prevalent explanation is that individuals underestimate the probability that they are at risk. However Caplin and co-author (2003) have suggested that

the problem is a psychological one. People do not wish to know whether they are infected or not since they believe they could not live with the knowledge that they are sero-positive. The curious and contestable conclusion of the authors is that we should make tests less precise so that individuals' fear would be reduced ! There is another explanation which is important in developed countries where the very fact of having taken the test can be prejudicial to job prospects and some firms ask the question directly when hiring. The implicit assumption is that anyone who bothers to be tested must be at risk. Such a situation could be overcome by making testing mandatory in the same way as vaccinations and this would remove any such prejudice. Would this be efficient and socially acceptable ?

A last point here is worth making. It has been observed that preventive measures seem to be more effective in communities in developing countries where treatment is available (Farmer, 2003 ; Meda, N. *et al*, 1999, Mbutlaiteye *et al*, 1998). The psychological reasons for this are easy to understand but the argument runs counter to the traditional economic argument. If treatment is available the cost of being infected is less since life can be prolonged etc. Hence the incentive to prevent infection is diminished. However the gap in the reasoning is there because this does not take into account the fact that in communities where treatment is accessible there is a heightened awareness of the disease and of its consequences.

Before coming to the problem of treatment and its financing one question remains outstanding. Why do even informed people put themselves at risk ? This is similar to asking why people drink too much or smoke. However, there is the basic difference that these phenomena are, at least in part, reversible, which is not the case with AIDS. There is a substantial literature on the underestimation of risk (MacGregor *et al.*, 1999 ; Slovic *et al.*, P., 1999) with different attempts at explanations varying from peoples' incapacity to make simple calculations as to probabilities, (the famous work of Kahneman and Tversky is one example) to peoples' difficulty with evaluating their utility in the future since their preferences will no longer be the same, to the idea that people do not discount the future in the way suggested in standard economic models and give much more weight to events in the very near future. Whatever the reason it seems optimistic to believe that these basic behavioural characteristics can be modified and that this may be an important explanation of the apparent difference between the social cost of AIDS and the implicit cost as deduced from individual behaviour.

## Cost of and access to treatment

Almost no-one argues that the current situation is acceptable. The cost of treatment is high, although declining and the poor in poor countries are essentially excluded. Nevertheless a standard estimate of providing effective care with ARV

in developing countries was still around \$1,100 per head, in 2001 (see Adams et al. (2001)). This was the cost of 10 years of primary education and could have been used on other treatments which would save up to 25 times as many DALY. Even with the radical reductions in drug prices announced recently, it is highly unlikely that the prices will ever be low enough to make such expenditures competitive with others. If one considers expenditure on prevention, for example, this is much lower, though possibly not very effective but has the advantage that it does slow down the speed of the epidemic and reduces future expenditures on treatment. If expenditure on ARV is not to “crowd out” other expenditures essentially 100% of it would have to come from fresh aid which would not have been forthcoming for other health expenditures.

All of this said, as we have already mentioned, there is a common agreement apparently that treatment should be made available and that ways of reducing the cost of drugs should be found. There have been many proposals including :

- i) Allowing the production of generic drugs
- ii) Price discrimination in favour of poorer countries
- iii) Licensing agreements to produce the drugs domestically
- iv) Donation of the drugs by the manufacturers.

There are difficulties with each of these schemes and the standard argument is that R and D will be discouraged by the lowering of prices. In fact the income of poor countries is so low that the profit to be obtained there by direct sales is also very low. If this is the case the pricing policy to these countries will have little impact on the decision of pharmaceutical companies to invest or not in drugs which are used globally. This would be far from the case if governments or international organisations were persuaded to buy the drugs at substantially over marginal cost. The well-known “pull programmes” advocated by Sachs (1999), Batson and Ainsworth (2001) and Kremer (2001) recommend the purchase in advance of a certain quantity of the drug developed if it meets certain technical requirements. They would encourage R and D but suffer from the standard problems of definition and ex post usefulness.

A major question here is how and by whom should products be monitored ? The facile acceptance of drugs which turn out not to be effective shows clearly the difficult incentive problem. Both parties to the contract may have an incentive to overestimate the effectiveness of drugs. Most authorities argue that the task of regulating the quality of drugs should fall on a public body and WHO has recently started an initiative to promote quality control for HIV-related medicines on a voluntary basis by branded and generic manufacturers. ARV drugs that are certified through that quality control process would benefit from international funding mechanisms (such as the GFTAM) and this will also greatly facilitate the work of national regulatory agencies.

Given that there is a commitment to providing ARV treatment to patients in developing country, it is worth examining the evolution of the prices of the drugs involved, over the recent past, and seeing which factors influence the level of those prices. In particular, if one of the principal reasons for wishing to undertake such financing is that of redistribution, then it is of interest to examine the correlation between income level and price. In addition the relationship between purchasing arrangement and prices has to be studied.

There is no doubt that ARVs prices are coming down rapidly and that this may change the structure of the market for drugs. For example at the end of April of this year, GSK announced a second price cut in seven months for their drug Combivir for developing countries. The price is halved and now costs \$0.90 instead of \$1.70. The annual cost per patient is now \$328 and is no longer far from the \$265 charged by Ranbaxy of India, a manufacturer of generic drugs approved by the WHO. The drug in question is a combination of two drugs, Lamivudine and Zidovudine the prices of which have been cut by 45% and 38% respectively. The offer is available to 63 countries including all of sub-Saharan Africa.

Given these encouraging developments, it is worth looking at the situation in developing countries in some detail to see whether we can safely conclude that there is a general decline in prices and what are the factors most associated with that decline.

## Prices of ARVs in developing countries

This section reports the results from the ETAPSUD/ANRS project (Luchini et al, 2003). In 2002, visits were carried out in 13 Sub-Saharan African countries (Benin, Botswana, Burkina-Faso, Burundi, Cameroun, Congo [Rep], Côte d'Ivoire; Gabon, Kenya, Malawi, Mali, Nigeria and Togo) and one South American country (Brazil) to collect retrospective data describing the real transactions for procurement of ARVs that occurred in each country between 1996 and 2002. For each transaction, in each country, a standardised questionnaire was filled out with the help of representatives of the institution which was in charge of buying the drugs (either public pharmacies or Ministries of Health, private wholesalers, or private-not-for profit NGOs). All recorded prices were source prices, in US dollars, at time of the transaction when entering the country, and were standardised using Cost-Insurance and Freight (CIF) prices that include the added costs of freight, insurance, import duties or taxes. Detailed data about each transaction included the price, quantities, dosage, pharmaceutical form and packaging of each individual drug, as well as the supplying firm (which makes it possible to distinguish between brand and generic drugs). It also included precise characteristics of the buying institution and of the process of negotiation associated with the transaction : whether it was carried out

through a tender mechanism (either “restricted” to some manufacturers or “open” to all international potential suppliers) or through bilateral mutual agreement with manufacturers (either supported by the Accelerated Access Initiative<sup>2</sup> -AAI- or not), and whether it was associated or not with donations of additional quantities from the manufacturer. In addition, interviews were carried out with representatives of National AIDS programmes and/or Ministries of Health, as well as representatives of international donor agencies to collect data about the institutional, economic and epidemiological context of procurement, including whether or not national guidelines and recommendations for use of ARVs existed and had been disseminated in the country, as well as information about the national drug patent system and the regulatory procedures for drug market approval. Basic socio-economic indicators, such as the size of the population, GDP and health expenditures per capita, percentage of GDP devoted to public expenditures for health and number of physicians per 100,000 inhabitants, as well as estimations of HIV sero-prevalence in the adult population were obtained through UNAIDS, UNDP and World Bank data bases.

For Brazil, we had access to the exhaustive data base on HIV/AIDS drugs procurement of the Brazilian STD/AIDS Program, which allowed us to obtain similar standardised data about transactions carried out in this country between 1998 and 2002. In addition to immediate availability of data, the choice of Brazil was obviously justified by the fact that it is the only developing country to date which has been able to successfully implement a public policy for universal ART coverage for medically eligible HIV-infected patients.

## ARVs transactions and prices : Some facts

The data collected covers about a total of 1,030 transactions for ARV drugs in the 14 countries, with Brazil and Côte d’Ivoire being the two countries with the highest number of observations. Not surprisingly, Brazil accounts for the majority of total quantities purchased (respectively 94.3% of NRTIs, 91.0% of NNRTIs, 98.6% for PIs and 95.6% for multiple combination drugs). The majority of transactions (64.7%) and more than 90% of the purchased quantities in the African countries

<sup>2</sup> In May 2000, five UN organisations entered into a partnership offered by these same five pharmaceutical companies, joined later by a sixth one. The stated goal of this new *Accelerated Access Initiative* (AAI) was to “*make HIV/AIDS drugs more affordable and accessible in developing countries*” through a “*preferential pricing*” mechanism. The “*AAI model*” was based on *a priori* international price negotiations that set a standard for procurement in all the countries that adhere to the Initiative. As of June 2002, the AAI has been “*used as a framework for dialogue with pharmaceutical companies and has led to successful UN-brokered supply agreements for ARVs in 19 countries*”. In May 2002, two major regional groups of countries, ECOWAS and the Caribbean Community (CARICOM) coalesced to engage negotiations with these pharmaceutical companies through the AAI, and a formal statement of intent was signed with fifteen Caribbean countries in July 2002. In parallel to the AAI, during 2001/2, international manufacturers made selective offers of substantial discounts to governments and non-governmental organisations of the least-developed countries and sub-Saharan African countries.



of our sample were observed in the most recent period (2001-2002). This reflects the major change that has occurred since 2001. Before this date, only Côte d'Ivoire (and Uganda, not included in our sample) had started experimental programmes as early as 1998 in the context of the UNAIDS sponsored Drug Access Initiative (DAI), while Senegal (also not included in our analysis) and Cameroon had also started pilot projects for ART in the public health care sector in 1998 and 2000 respectively. Elsewhere there was no clear commitment of governments to facilitate delivery of ARV drugs, with the exception of their preventive use (either for prevention of mother-to-child transmission or post-exposure prophylaxis). Such a situation still prevails in Kenya which remains typical, as is also the case for South Africa, of exclusive diffusion of ARVs in the private and private-not-for profit health care sectors. In spite of the courageous efforts of some NGOs, these two countries remain archetypal of a priority given to pure market mechanisms for ARV procurement and delivery that was dominant in the whole continent before 2001 and led to what some authors have called "market anarchy". It must however be noted that access through the private sector has led these countries to be in the upper range in Africa for the number of ART-treated patients (respectively 3,000 in Kenya and 20,000 in South Africa). By contrast, in the twelve African countries, other than Kenya, for which we were able to collect data, access to ART is now explicitly included in national strategic plans for the fight against AIDS (or in documents that express a similar level of endorsement by the government such as official country proposals to the GFATM).

Since 2001, 9 out of the 13 African countries in the sample (Benin, Botswana, Burkina-Faso, Burundi, Cameroon, Republic of the Congo, Côte d'Ivoire, Gabon, Mali) have contracted agreements with brand-name pharmaceutical companies in the context of the AAI, and a majority of the total number of observed transactions is related to AAI in these countries with the exception of Burundi, Cameroon and Côte d'Ivoire. In Kenya, although there was no direct involvement of government, the majority of observed transactions also happened in reference to the AAI. Attitudes of countries toward purchasing generic drugs have however been quite contrasted in the period studied. On the one hand, some countries participating in the AAI (Benin, Botswana, Burkina-Faso, Congo, Gabon) have never introduced generic drugs and have strictly followed the "AAI model" that restricted procurement to bilateral negotiations with six brand pharmaceutical companies in the framework of the international agreement they have signed with the UN-organisations at international level. On the other hand, Nigeria and Malawi have systematically carried out negotiations with multiple suppliers ending up with purchases of drugs supplied by Indian generic manufacturers. Interestingly enough, as shown in Table 1, countries with the oldest experience of UN-related ARV procurement, like Côte d'Ivoire, as well as countries which participate in the AAI with the most ambitious plans for scaling up access to ART (Burundi, Cameroon, Mali), have purchased various amounts of generic NRTIs, NNRTIs and multiple combination drugs. Indeed,



these countries have evolved toward a more “hybrid” mechanism of procurement that combines negotiations in the AAI international framework with national tenders or other procurement mechanisms introducing generic competition (Juillet *et al.*, 2001). A similar trend toward such a “hybrid model” of procurement has happened in other countries not included in our sample (Senegal, Uganda) and is in the process of happening in countries like Benin or Burkina-Faso.

In the majority of African countries (Benin, Botswana, Burkina-Faso, Cameroon, Côte d'Ivoire, Gabon, Malawi, Mali, Nigeria) all observed transactions were ARV purchases by public pharmacies or other public authorities in charge of national drug procurement policy. Indeed, in six of these countries (Benin, Botswana, Burkina-Faso, Cameroon, Côte d'Ivoire and Mali), these public agencies have a regulatory monopoly for importing ARV drugs into the country, whereas public purchasers only account for the majority of imports of ARVs in Gabon, Malawi and Nigeria. In Burundi and Togo, the majority of observed transactions were carried out by public pharmacies, although some transactions (20-30%) concerned private buyers in accordance with the global situation of ARV delivery in the country. In Congo, the majority of transactions were actually purchased by the Red Cross (private-not-for-profit) but in close connection with the Ministry of Health. Finally, Kenya is the only example of ARV procurement directly carried out through private and public health centres as well as private wholesalers. Of course, the case of Brazil, whose policy is detailed elsewhere in this book, is quite different : national production of ARV drugs has allowed the country not to depend on imports for the majority of transactions dealing with NRTIs and multiple combination drugs, and to supply a significant amount of NNRTIs and even of PIs.

Figures 1 to 3 (Appendix A) describe the evolution of average unit prices per year and per country of the 2 ARV drug dosages which accounted for the highest number of transactions in each of the three therapeutic categories : Lamivudine 150mg ( $n = 96$ ) for NRTIs; Efavirenz 200mg ( $n = 58$ ) for NNRTIs and Indinavir 400 mg ( $n = 79$ ) for PIs. The selected dosages correspond to usual dosages for adult care and are included in the most used HAART therapies indicated in WHO guidelines. Figures confirm the declining trend of prices for all therapeutic categories as well as a trend for reduction in variability of prices across countries. Figures 4 (Appendix A) compare the evolution of the average and lowest unit prices observed of Lamivudine in each year for both the brand-named drug in the 14 countries and its generic substitutes. This figure show that generic prices have been lower since 1999 (on average since 2000) although the difference between average prices of brand drugs and their generic substitutes has decreased since 2001. It must also be noted that the lowest prices offered by the patent-owner's companies in some countries tend to converge with the lowest deals proposed by generic manufacturers in the last two years (2001/2). Overall, figures suggest that ARV prices have

tended to stabilise in the last two years (2001/2) in parallel to the introduction of the AAI and to this convergence between brand and generic prices.<sup>3</sup>

## Determinants of ARVs prices

One of the purposes of examining the prices of treatment in different countries is to find those factors which contribute positively or negatively to the level of the prices of the drugs in question. Evolution of drug prices per country and per year was described using price per unit. Prices per daily dose were also computed by multiplying the unit price by the number of units required for standard adult dosage<sup>4</sup>. The logarithm<sup>5</sup> of the price per daily dose was used as the dependent variable to conduct multiple linear regressions with characteristics of products and characteristics of the transaction (including year of transaction introduced as a dummy variable) and variables describing its context being the explanatory variables. Results are presented in table 1.

Results shows that higher volumes per transaction correspond to lower prices for the whole period. It also confirms the declining price trend for ARV drugs since 1997, the year Brazil introduced its national programme for supply of generic ARVs. Indeed, the year in which the transaction was made (included as a dummy variable) is significant whatever the date considered. The parameter estimates present a decreasing trend which is nearly linear during the period 1997-2000, with an accelerated decrease for the year 2001, followed by a more limited decrease in 2002. In addition, results of econometric analysis presented in Table 3 show that both generic competition and the introduction of the AAI since 2001 had significant impact on price decreases. However, as we will discuss below, interpretation of this result must take into account the temporal sequence of events that “determined” the price decrease of ARVs. It does not necessarily mean that the two mechanisms (international AAI agreements on the one hand, generic competition on the other hand) had independent effects of similar size on prices. It may alternatively be argued that this result rather suggests that the “philanthropic” attitude of the major brand ARV producers to lower their prices in the context of the AAI has indeed been strategic “political” behaviour reacting to the competitive pressures of generic suppliers as well as international mobilisation of public opinion.

Not surprisingly, prices of PI and NNRTI drugs are statistically higher than those of NRTI drugs, with a larger impact on price for drugs belonging to the PI class

<sup>3</sup> Luchini et al. (2003) provide some more examples (7 representative ARV drug dosages are studied) which confirm the facts emphasised here.

<sup>4</sup> Definition of daily doses (number of tablets, volumes for oral solutions or syrups) were based on adult posology defined in DOROSZ, Ph. Guide Pratique des médicaments, Eds Maloine, Paris, 23<sup>e</sup>Ed., 2003.

<sup>5</sup> Since observed prices are always positive, one must use the logarithm of prices to avoid problems due to the left censoring of the dependent variable.

**Table 1 :** *Multiple linear regression of prices per daily dose of ARV drugs in 13 African countries and Brazil ( $n = 952$  transactions).*

Variable	Parameters	Standard Error	t-Value	P-Value
Intercept	-8.89017	31.67015	-0.28	0.7790
Dates of purchase :				
Year 2001	0.23108	0.06766	3.42	0.0007
Year 2000	0.83678	0.08823	9.48	< .0001
Year 1999	0.95220	0.09751	9.77	< .0001
Year 1998	1.11761	0.11298	9.89	< .0001
Year 1997	1.29211	0.18149	7.12	< .0001
Number of units sold per transaction/per drug	-1.91503E-06	6.603E-9	-2.90	0.0038
PI drugs	1.19256	0.10591	11.26	< .0001
NNRTI drugs	0.55571	0.10561	5.27	< .0001
Date of patent in country of origin	0.00462	0.1595	0.29	0.7720
Patent protection in purchasing country	0.30357	0.07112	4.27	< .0001
AAI-related transactions	-0.84488	0.07857	-10.75	< .0001
Generic drugs	-1.00081	0.08638	-11.59	< .0001
GDP per capita	0.000232	0.000232	1.00	0.3178
HIV/Aids Prevalence	0.01411	0.00422	3.35	0.0009
PI in first-line HAART recommended by national guidelines	0.52665	0.11995	4.39	< .0001
National programme for ARV delivery	-0.31506	0.06786	-4.64	< .0001
Transaction through an intermediary wholesaler	0.28929	0.11414	2.53	0.0114
R-Square	0.59			
Adj R-Sq	0.58			
Error variance	104.29			

than for NNRTI. In addition, older drugs whose original patent was registered earlier in developed countries are associated with lower prices. While socio-economic characteristics which differentiate countries, such as GDP per capita, do not seem to influence the variability of prices in this sample, Table 1 reveals that a higher HIV/AIDS prevalence is associated with price increases. On the other hand, transactions which have occurred in countries which have organised public strategies for ARV delivery are associated with lower prices. Clinical practices, at least as measured through the existence of national guidelines, also seem to influence prices : when guidelines include PI drugs for first-intention HAART therapies, which may

suggest that cost-minimisation is not a priority concern for health care professionals, prices tend to be higher. As expected, transactions in which intermediary wholesalers have intervened between manufacturers and buyers to organise supply end up with higher prices.

Two explanatory variables are of clear importance : the *date of patent in country of origin* and the *patent protection in purchasing country*. The first one is not significant, it has not (statistical) effect on ARVs prices. The second one is highly significant : a drug patented in the purchasing country will have, *ceteris paribus*, a higher price.

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## Conclusion

Our argument is in two steps. Firstly, the concern of any authority must be to improve the welfare of the individuals under their jurisdiction or directly affected by their decisions. This means that we cannot set aside the idea that choices affecting the prevention, diagnosis, or treatment of AIDS must have an impact on what could have been done with the same resources in terms of treating other health problems. Thus it is not reasonable to criticise those countries that wished to concentrate on other programmes for their neglect of AIDS, unless it could be clearly shown that the resources devoted to the AIDS programmes would not have been devoted to these other programmes or would not have been available for those programmes. Countries are faced with a variety of choices concerning their health policies and rethinking their policy towards AIDS means also rethinking their entire policies. In addition this implies integrating a full evaluation of all the effects, direct and indirect, (for example the effect on prevention), of treatment into their considerations. We have however, given a number of reasons which may indicate that the cost effectiveness of the treatment of AIDS has been systematically underestimated in the past. In particular the willingness of the international community to fund AIDS treatment has to be taken into account.

Moreover, if one accepts the fact that there has thus developed a clear commitment at the global level to devote resources to AIDS in developing countries, one has to analyse, within that contest, the cost effectiveness of the programmes and the evolution of their cost over time. In particular in developed countries the cost effectiveness of treatment now seems to be established (Freedberg *et al.*, 2001). This, together with the fact that large firms in developing countries are now providing treatment programmes for their employees, suggests that cost effectiveness must be greater than is often suggested.

In the second part of this paper we show that there is a steady decline in the price of treatment over time and that the treatment of AIDS is becoming rapidly

more cost-effective. There is still a lot of progress to be made but we have isolated some of the factors that seem to yield lower prices and where these are under the control of the authorities in the countries in question they may be useful in reducing the general cost of treatment and help to increase the life-span of victims and to reduce the speed of diffusion of the disease. More precisely, we arrive at the following conclusions for the main factors affecting prices : (1) a large decrease of prices in recent years, (2) GDP is not a significant determinant of prices, (3) both the international focus (the AAI initiative) and the generic competition decrease (statistically) prices and (4) if the drug is patented in the purchasing country, this increases (again statistically) the ARVs' prices.

The latter points should be seen in the light of the fact that it is essential to maintain the durability of treatment, (even if some trials are being run to evaluate the effects of a break in treatment). Here a combination of market and institutional arrangements may be needed. The limits of market arrangements are, by now well known, particularly when information is incomplete and this has to be taken into account, (see e.g. Greenwald and Stiglitz, 1986; Stiglitz, 1979). Another point that is still very much under discussion is the policy towards patents, since we have seen that a patent in the purchasing country reduces the cost effectiveness of treatment. The last point that remains is as to why the AIDS epidemic seems to have attracted so much attention and seems to occupy a special place in the global utility function, Here many political and social considerations enter into play. Given that AIDS is now close to being the first cause of mortality in developing countries the risk of economic and social destabilisation, as a result of the fragility of their social network, is now high. The price of spending too much time on precise evaluations of programmes rather than putting them into practice is, as a result, also likely to be high.

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## Appendix

### A : Evolution of ARVs prices

Figure 1 : Evolution of average unit prices per year and per country of Lamivudine 150mg  
(n = 96)

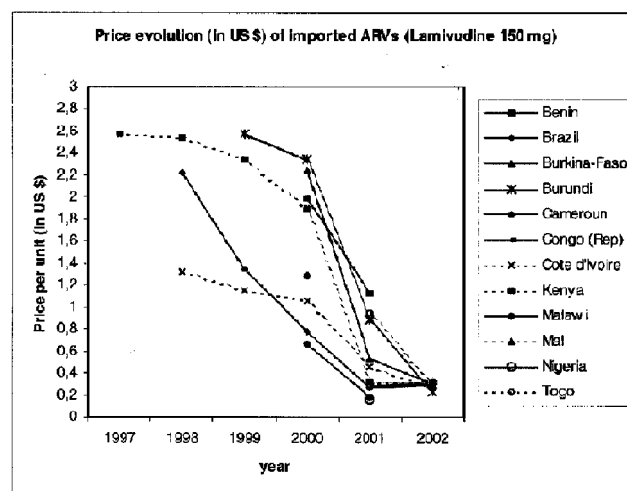


Figure 2 : Evolution of average unit prices per year and per country of Efavirenz 200mg  
(n = 58)

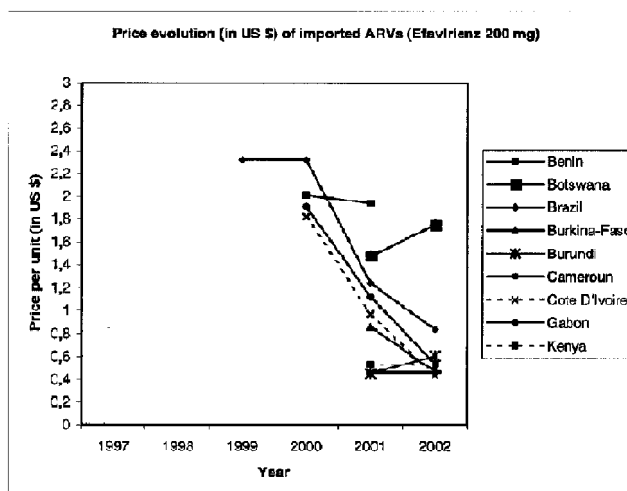




Figure 3 : Evolution of average unit prices per year and per country of Indinavir 400 mg ( $n = 79$ )

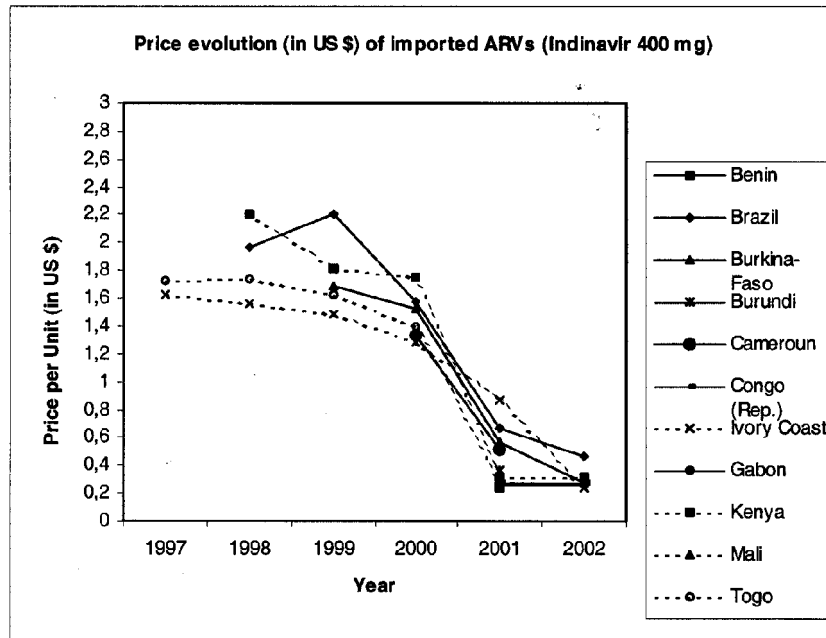
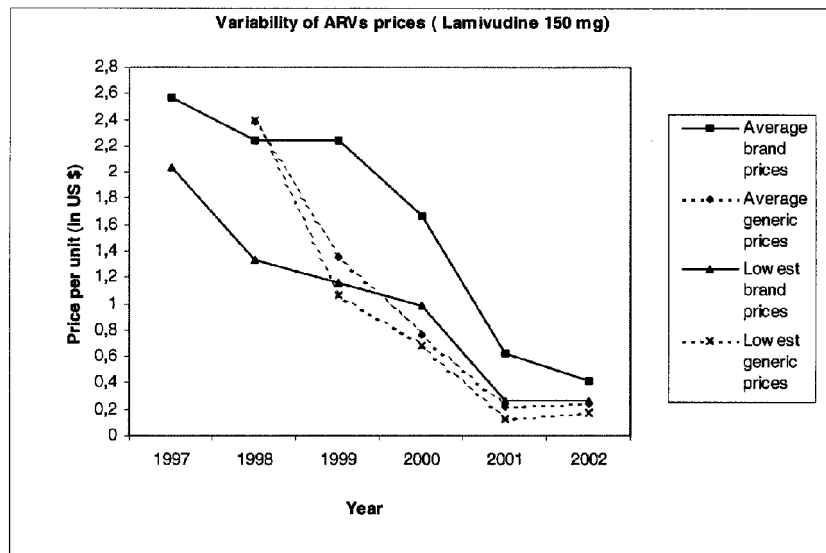


Figure 4 : Comparison of the evolution of the average and lowest unit prices of the brand-named drug and its generic substitutes - Lamivudine 150mg ( $n = 96$ )



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