HIV Prevalence and Poverty in Africa: Micro and Macro-Econometric Evidence Applied to Burkina Faso

By

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Abstract

Based on the data of the Demographic and Health Survey, and of the Household Priority Survey, carried out in 2003, the present study examining the factors of HIV prevalence in Burkina Faso, provides two conclusions. Firstly, the fight against poverty is not necessarily a means of reducing simultaneously and drastically HIV/AIDS prevalence, an assertion based on several elements of empirical analysis. First of all, the concentration curve, measuring the « socio-economic » inequality of seroprevalence, is « pro-poor ». Then, the micro-econometric estimates of the probit models suggest a positive relationship between HIV prevalence in adult women and men, and living standards of individuals. At the same time, the probit models highlight a probability of HIV prevalence increasing with : (i) age, and ; (ii) localization in Ouagadougou, the capital, and in a majority of areas in the west and south-west of the country, compared to the other zones. On the other hand, sexual relations with condoms reduce the chances of seroprevalence, a result increasing with the wealth of households. Lastly, the macro-econometric approach reveals the existence of a positive (negative) relationship between, on the one hand, the level of regional HIV prevalence, and, on the other hand, the average monetary provincial standard of living (poverty) of households.

At the same time, the relationship between HIV prevalence and poverty, approximated at the regional level, is not linear. Moreover, the estimate of spatial econometric models indicates an impact of the crisis of Côte d’Ivoire on HIV prevalence in Burkina Faso, consecutively with the massive return – in particular, since 2000 – of a large number of refugees, displaced or repatriated persons originating from Côte d’Ivoire, a country where seroprevalence is, on average, five times higher than in Burkina Faso. Secondly, and correlatively, the relationship between HIV prevalence and poverty is called into question. First of all, some structural factors may contribute to a distortion of the relationship between resources of households and the prevalence of HIV/AIDS. This may be due, on the one hand, to the persistence of cognitive and behavioral factors inherent in a traditional society, in spite of the high rate of economic growth per capita which prevailed over the last two decades, and in particular, to the fact that the social construction of female attributes and roles confers to men a statute of « decision-makers » with regard to sexual intercourse, while the persistence of secular beliefs contributes to minimizing the perception of HIV/SIDA in terms of risk, independently of standards of living. In addition, the two geographical subdivisions where HIV prevalence is higher than the national average, tend to have higher regional averages per capita of expenditure, compared to the other zones. In addition, the enrolment of Burkina Faso required development of road and railway traffic with neighboring countries, in particular Côte d’Ivoire. Therefore, it may be that the structural conditions of the process of development of Burkina Faso, concomitant with significant flows of the exchange of goods, services and labour with a country where the prevalence of the HIV is particularly high, constitute an element of an explanation of the positive relationship between the resources of households and HIV seroprevalence. Also, factors related to the economic situation probably contributed to reinforcing the opposite relationship between HIV seroprevalence and poverty, the macro-econometric analysis highlighting a direct relationship between the massive return of migrants of Côte d’Ivoire and the level of HIV prevalence in Burkina Faso.

Résumé : Prévalence du VIH et pauvreté en Afrique : Evidence micro et macro-économique appliquée au Burkina Faso


Enfin, l’approche macro-économétrique révèle l’existence d’une relation positive (négative) entre, d’une part, le niveau de la prévalence régionale du VIH, et, d’autre part, le niveau de vie monétaire moyen provincial (la pauvreté) des ménages. En même temps, la relation entre la prévalence du VIH et la pauvreté, appréhendée au niveau régional, n’est pas linéaire. En outre, l’estimation des modèles d’économétrie spatiale montre un impact de la criseivoirienne sur la prévalence du VIH/SIDA en Burkina Faso, consécutivement au retour massif des migrants burkinabè de Côte d’Ivoire – notamment, à partir de 2000 –, pays où la séroprévalence est, en moyenne, cinq fois plus élevée qu’au Burkina Faso. Deuxièmement, et corrélativement, la relation entre la prévalence du VIH et la pauvreté est questionnée. Tout d’abord, des facteurs structurels pourraient contribuer à blaser la relation entre les ressources des ménages et la prévalence du VIH/SIDA. D’une part, la persistance des facteurs cognitifs et comportementaux inhérents à la société traditionnelle, malgré le rythme élevé de croissance économique par tète qui a prévalu au cours des deux dernières décennies. En particulier, la construction sociale des attributs et des rôles féminins confère aux hommes un statut de « decision-makers » en ce qui concerne les relations sexuelles, tandis que la persistance des croyances séculaires contribue à minimiser la perception du VIH/SIDA en termes de risques, indépendamment du niveau de vie. D’autre part, les deux sous-ensembles géographiques où la prévalence du VIH est plus élevée que la moyenne nationale, tendent à exhiber des moyennes régionales des dépenses par tête plus élevées, comparativement aux autres zones. Par ailleurs, l’enclavement du Burkina Faso a exigé un développement du trafic routier et ferroviaire avec les pays limitrophes, notamment la Côte d’Ivoire. De ce fait, il se peut que les conditions structurelles du processus de développement burkinabè, concomitantes avec d’importants flux d’échange de biens, de services et de main-d’œuvre avec un pays où la prévalence du VIH est particulièrement élevée, constituent un élément d’explication de la relation positive entre les ressources des ménages et la séroprévalence. Ensuite, des facteurs conjoncturels ont probablement contribué à renforcer la relation inverse entre la prévalence du VIH et la pauvreté, l’analyse macro-économétrique mettant en évidence une relation directe entre le retour massif des migrants de Côte d’Ivoire et le niveau de prévalence du VIH au Burkina Faso.

Keywords : Poverty ; Socio-economic Inequality ; HIV/AIDS ; Burkina Faso
Mots-clés : Pauvreté ; Inégalité socio-économique ; VIH/SIDA ; Burkina Faso
JEL classification : I12, I32
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1. Introduction

Over the last two decades, the impact of HIV has been devastating in many developing countries. In particular, sub-Saharan Africa remains the area hardest hit – at the end of 2004, 25.4 million people were living with HIV, that is to say about two thirds of all the infected individuals, and approximately three quarters of all the women living with the virus (UNAIDS/WHO, 2004). Although the African epidemics are in the process of stabilization, this alarming situation probably explains the diversification of the solutions under consideration with regard to this medical problem in recent years, the identification of individual risk behaviour and the prevention of the new infections being gradually associated within the economic, social and cultural environment, and access to treatment. In fact, in Africa, one of the major questions, in terms of optimization of the actions against the epidemic, resides in the capacity to appreciate whether HIV prevalence is a simple medical or behavioural problem, or whether it is rather a symptom of under-development.

In this context, poverty is often perceived as a factor likely to contribute to the progression of HIV, and to affect efforts for prevention, an assertion based on two types of arguments. On the one hand, at the empirical level, one observes that 95 percent of the world population infected by HIV is localized in transitional or developing countries, when the latter include 85 percent of the inhabitants of the planet. Under these conditions, the macro-economic empirical evidence suggests a statistically robust association between high HIV prevalence and the weak socio-economic performance, in terms of income per capita, inequality, monetary poverty or human development (Bloom, River Path Associates, Sevilla, 2002). Moreover, although the micro-economic evidence is less clear, several studies, in particular in Asia, tend to show that the poorest and the least educated individuals have a greater susceptibility to HIV infection (Bloom, Goodwin, 1997). In addition, the association between poverty and HIV prevalence is based on several explanations. First of all, poverty increases the biological susceptibility to HIV, in the same way as all other infectious diseases or deficiencies. For example, malnutrition, parasitosis and lack of access to health facilities among the poor constitute factors which undermine the epithelial immunity and integrity, and increase the likelihood of having other untreated sexually transmitted infections, a situation which increases the predisposition and the propagation of HIV (Farmer, 1999; Stillwaggon, 2002; Bates et al., 2004). Again, whereas the absence of instruction is a handicap for the efficiency of HIV prevention, the lack of financial resources raises the cost of this action, insofar as the poorest groups do not have the necessary resources to acquire condoms, for example. At the same time, the survival of the poorest households generates high-risk behaviours which bolster the propensity to the diffusion of HIV, in particular labour migrations and prostitution (Collins, Rau, 2000). It is also true that the better educated and richer population can adapt their behaviour better, as it is better informed of the causes and attitudes which increase the risk of
infection among the population. Lastly, more generally, the poor can have difficulty in perceiving long term risk management as the question of immediate survival is their principal problem.

In fact, the link between poverty and HIV prevalence is not established. Thus, the macro-economic empirical evidence in sub-Saharan Africa shows, for 40 countries at the end of the years 1990's, a weak correlation between the incidence of HIV and the GDP per capita, and the latter disappears when the analysis is limited to the countries having living standards lower than 1,000 dollars U.S. (O'Farrell, 2001). Moreover, in the two countries with the highest GDP per capita – Botswana and South Africa –, HIV prevalence is highest. In the same manner, in Asia, no correlation exists between the incidence of HIV and the national income per capita (Bloom, Mahal, Rosenberg, Sevilla, Steven, Weston, 2004). Admittedly, this lack of macro-economic association can mask several phenomena: (i) the existence of inequalities within an economy, and the fact that the poorest are still affected by the virus; (ii) the exercise of activities generating social mobility, increasing the susceptibility to HIV; (iii) the growing access of the richest – with the propagation of the virus –, to prevention and the capacity to use the means available, generating an unfavourable configuration of the infection for the poor. However, some studies relating to Africa showed a positive relationship between HIV infection and the socio-economic status of individuals (Ainsworth, Semali, 1997). One can also argue, that in the absence of financial constraints, the rich even with a certain educational level, continue to adopt high-risk behaviour.

Thus, the relationship between poverty and seroprevalence is complex. Some factors of HIV risk prevail more among the poor, while others exist more frequently in the rich groups. At the same time, the relationship between deprivation and HIV is probably « bidirectional », insofar as whereas poverty can exacerbate the prevalence of the epidemic, the latter is likely to intensify the incidence of poverty. Lastly, in Africa, the multiplicity of the factors at the origin of the weak rhythm of development makes the identification of the relationship between poverty and seroprevalence more difficult. Analysis of this relationship is of especial importance in terms of economic policies, in particular when the reduction of poverty constitutes the central objective of the strategies of development.

The present study is in relation to this prospect, while proposing to examine the factors of HIV prevalence in Burkina Faso in 2003. Research mobilizes the data of the Demographic and Health Survey of 2003 – EDSBF 2003 –, like those of the Priority Survey carried out the same year – EBCVM 2003. Accordingly, it is suggested to apprehend the relationship between poverty and HIV prevalence using two econometric tests, one at the micro-economic level, based on information of EDSBF 2003, the other, macro-economic, combining the latter and that of EBCVM 2003 within the framework of spatial econometric modelling. After having specified the method of analysis and the statistical sources – second part –, a descriptive approach of the relationship between the incidence of HIV, non-monetary
poverty and socio-economic inequality is expounded – third part. Thereafter, the micro and macro-econometric modelling of the prevalence of HIV is analysed in the fourth part.

2. Method of Analysis and Statistical Sources

After having specified the various econometric options implemented in the study, the statistical sources used will be presented.

1. Econometric Options

The study suggests apprehending the relationship between HIV prevalence and poverty using two types of econometric investigations.

First of all, a micro-econometric approach is proposed, using information of EDSBF2003. In this respect, this analytical option elicits several observations. Firstly, EDSBF 2003 including a test of HIV prevalence for a sub-sample of men and women, representative at the national level, the study suggests estimating the probability of prevalence of the virus among individuals using a binary probit model. In fact, the response rate of HIV was only 89.3 percent of the population of the sub-sample. In addition, this response rate is higher in rural areas than in urban zones – 93.0 and 78.6 percent, respectively –, and for women, compared to men – 92.3 and 85.8 percent, respectively. Under these conditions, it is important to take into account the possible selection bias which would result from non-response with the seroprevalence test. So, previously, a first probit model was estimated in order to determine the factors explaining the absence of HIV testing for part of the population, and to generate the lambda of Mills to be included as a regressor in the second probit model. This coefficient represents the covariance between the random errors of the choice equation – decision of nonacceptance of the HIV test – and random errors in the probit model concerning the people having undergone the HIV test. In other words, it is necessary to check if non-observable characteristics of the individuals, which increase the propensity not to accept the HIV test, also contribute to increasing the probability of HIV prevalence. The variables taken into account in the selection equation are the years of instruction, age, sex, ethnicity, labour market status and spatial localization.

Secondly, EDSBF 2003 having collected no information on the monetary aspects of the living standard, the present study tries to apprehend the latter using a categorical principal components analysis, based on some households’ physical assets. In this respect, the physical assets of households relate to two elements: characteristics of the dwelling and the availability of durable goods. The elements relating to the habitat and comfort, taken into account by EDSBF 2003, relate to several
aspects, structured as follows: (i) a main floor – earth and other materials; tiles, vinyl and other materials; cement, carpet; (ii) type of cooking fuel: firewood and another energy; charcoal and another energy; electricity and another energy; (iii) a source of drinking water – river, stream, pond, lake, other; a protected public well; a protected internal well; open well; a public tap; piped into yard/plot; piped into dwelling; (iv) type of toilet facility – no facility; a ventilated latrine; traditional pit toilet; flush toilet; (v) bednet for sleeping. The study considers a limited number of functional goods of the household, dependent on transport, dwelling or communication: refrigerator, television, radio, electricity, car, bicycle, motorcycle/scooter, telephone. Taking into account the assets previously specified elicits several observations. First of all, contrary to the DHS of 1992-93 and 1998-99, the data do not make it possible to take into account the nature of the roof and walls, the number of people per room, and the mode of evacuation of refuse. Then, there is an uncertainty regarding the specification of certain household assets. Indeed, the investigation indicates the existence of the assets, but does not specify the quantities. Consequently, the study implicitly implies that only one listed asset is available per household.

In this context, research uses the categorical principal components analysis – nonlinear – to build – an index of households’ welfare, based on the assets previously indicated. The categorical principal components analysis with optimal coding quantifies the objects – cases, households or individuals – by assigning each one a specific value, a score. Usually, the object scores – co-ordinates of the variables – are standardized so as to have a mean of zero and unit variance. Consequently, standardization identifies the scores of the variables as the correlations between the variables and dimensions of space inherent in the objects. In this context, the proportion of variance explained – represented by the co-ordinates of the barycenter, the co-ordinates vectorial and the total – by each dimension, correlations between principal components – dimensions – and initial variables, and the graph of the factorial co-ordinates of the assets, make it possible to have an appreciation of the validity of the model.17 In the study, the households’ welfare index, generated by the categorical principal components analysis, is based on a factor of economies of scale equal to zero – zero marginal cost of all the additional members beyond the first – i.e., by supposing that all the parameters of access of the assets refer to the household. So, all the variables are ordinal. This analytical option induced an explained variance of 37.2 and 10.3 percent, respectively, for dimensions one and two – see table A1, in appendices. Table A1 shows almost all positive relations between the first component and the variables.

Thirdly, the estimate of the probit model is based on the idea that the following variables are able to affect the probability of seroprevalence – women aged 15-49 years, and men aged 15-59 years. First of all, demographic and social characteristics of the individuals or the households: instruction, age, sex, matrimonial status, ethnic membership, religion, size of the families, and geographical localization.
In theory, HIV prevalence should decrease with the educational level, increase with age, and be more significant for women compared to men and single individuals. In the same way, religion or ethnic membership can influence the incidence of HIV— for example, it seems that circumcision, rather widespread among Moslems, is negatively related to seroprevalence. Moreover, the geographical localization, in relation to the migratory process or the proximity of borders, can affect the importance of HIV prevalence. Then, the living standards of households, apprehended by their index of physical assets, are likely to affect the propensity for contamination by the virus. However, as previously indicated, the direction of the effect is currently questioned and is a central concern of the present study. It is to be noticed that research successively uses two alternatives of this parameter: the value of the assets index, and wealth levels determined by the latter – « poor », « middle », and « rich ». Lastly, several elements of the individuals’ behaviour are taken into account in the model: the existence of only one sexual partner during the last 12 months; (ii) the knowledge of HIV; (iii) the use of condoms for sexual intercourse during the last 12 months; (iv) the existence of high-risk sexual intercourse during the last 12 months with a non-marital and non-cohabiting partner. Table 2 indicates the various parameters of the model.

In the second place, a macro-econometric approach is also presented, using the data of the third Priority Survey of 2003 – EBCVM 2003. Indeed, insofar as EDSBF 2003 makes it possible to apprehend only non-monetary poverty, it can be convenient to test the relationship between HIV prevalence and monetary deprivation of households. Research considers that this approach is possible insofar as EBCVM 2003 was carried out in the same year as EDSBF 2003 – respectively, in April-July 2003, and June-November 2003. Nevertheless, this analytical option limits the investigations to a macro-economic level, and the study proposes an approach in terms of spatial econometrics. Thus, the relationship between HIV prevalence and monetary poverty is apprehended on the level of the 45 provinces, the administrative units in Burkina Faso. Monetary poverty is measured by FGT indices, using the households’ expenditure per capita and a poverty line of 82,672 F.Cfa per capita and per annum.

In this context, on an econometric level, the configuration of the data cannot exclude the spatial dependence from the observations within the two samples, i.e., the fact that an observation located in a province « p » depends on other observations inherent in the provinces « k≠p ». Indeed, on the one hand, the collected information, associated with the spatial units – provinces – can reflect errors of measurement, the administrative limits not really reflecting the processes likely to be apprehended. For example, the HIV prevalence of a region « p » can be related to that of another region « k », if the employed members of the households residing within the place of collection of information « p » migrate temporarily in « k » where the epidemic is significant. In addition, the spatial dimension of the economic activities can be a significant aspect of modelling, when spatial interaction effects, hierarchies
of localization and spatial externalities predominate. Thus, the economic dynamism of one town in province can be explained by the proximity of another province including a significant urban centre. When these situations prevail, the coefficients of the least-squares estimates are biased and inconsistent, and two important alternative models can be considered. So, the study implements several approaches – the spatial lag model, and the spatial error model (Anselin, 1988; LeSage, 1998)\(^2\) –, trying to explain the relationship which prevails between, on the one hand, HIV regional incidence – mean level – and, on the other hand, a gathering of regional independent variables, in particular: monetary poverty of households – incidence, intensity and inequality –, living standards – expenditure per capita or assets index of households\(^3\) –, urbanization rate, inequality of expenditure or assets – Gini –, and average percentage of households having had one or more members who resided in Côte d’Ivoire during the last 12 months.\(^4\) Table 3 indicates the parameters of these models.

2. ** Statistical Sources

The modelling of HIV prevalence – probability and level – mobilizes two types of national household surveys, carried out during the year 2003.

Firstly, the Demographic and Health Survey – EDSBF 2003 –, conducted by the Institut National de la Statistique et de la Démographie, with the technical aid of ORC Macro. Like the majority of the DHS, the objectives required are multiple and known, but in the context of this study, it is convenient to underline several characteristics of EDSBF 2003, i.e.: collected data – on a national scale, representative according to the rural and urban zones – on knowledge, the opinions and attitudes of women and men with respect to sexually transmitted diseases and AIDS; on the level of knowledge, the opinions and attitudes of women with respect to the practice of excision, and men with regard to circumcision; to know the rate of HIV prevalence for women aged 15-49 years and men aged 15-59 years (INSD/ORC Macro, 2004).

The investigation was conducted from June 15 till November 16, 2003, with a stratified sample, weighted and representative nationally and in respect of zones of residence. Altogether over the whole of the zones of enumeration, the investigation related to 9,097 households and 12,477 women aged between 15 and 49 years old. In addition, a sub-sample of a third of the households was selected in which all men aged 15-59 years were interviewed – i.e., 3,179 men. It is also in this sub-sample of households, representative at a national level, that the blood test was carried out on women and men for anaemia and HIV.\(^5\) Finally, among the 8,559 individuals – 4,575 women and 3,984 men –, 89.3 percent of them were tested – respectively, 92.3 and 85.8 percent of women and men.\(^6\)

It is to be noticed that, in spite of the abundance of information inherent in the DHS, its use generates some analytical constraints. In this case, two of them must be underlined. First of all, EDSBF
2003 does not collect information on the expenditure or incomes of households. So, in the present research, an estimate of the living standards of the households was based on some physical assets. This procedure was clarified above. Secondly, the adequacy of this type of investigation to apprehend HIV prevalence can be questioned. Indeed, in the majority of developing countries with a generalized epidemic, estimates of HIV incidence are primarily based on blood samples remaining from syphilis tests of pregnant women in antenatal consultations – «sentinel surveillance». The two approaches have advantages and disadvantages. Antenatal clinics are most frequently located in an urban or peri-urban environment – accessibility –, which reduces investigations in rural zones, and often have a limited geographic coverage. Moreover, antenatal consultations provide information on a HIV prevalence that depends on a set of assumptions that may not necessarily apply to all countries and at all stages of the epidemic. The validity of national population-based surveys, although they provide a wider representation of the whole of the population, in a certain manner, varies according to the non-response rates. However, in the burkinabè investigation, the non-response rate of 10.7 percent represents an acceptable quality of information. In addition, the econometric estimate makes it possible to predict HIV prevalence for people not having answered, because the basic characteristics of the non-responders can be discerned – provided the failures to reply do not indicate a stronger probability of prevalence. Consequently, the study is able to propose adjusted estimates.

Secondly, the study also mobilizes information of the Priority Survey, collected between April and July 2003, on 8,500 households. This investigation allows an apprehension of the monetary dimension of poverty, articulated with the «space of the utility», as well as a non-monetary approach in terms of capabilities. In fact, research especially uses the first approach within the framework of spatial econometric models. In this respect, such an analytical orientation requires conceptual and methodological choices, likely to appreciably influence the extent of the measured deprivations. In this case, the latter were based on the following assumptions. First of all, the measurement of welfare refers to the total expenditure of consumption, the latter being the sum of all the monetary expenditure of the household, consumption of home-produced food and non-food items, the use value of the services coming from housing and the remittances paid out. Then, the poverty line, calculated by the Institut National de la Statistique et de la Démographie, was estimated according to the method of the cost of basic needs – nutritional anchoring corresponding to 2,300 calories per day and per individual, allowing an estimate of the line of food poverty, and determination of the line of non-food poverty –, and amounts to 82,672 F.Cfa per capita and per annum for 2003. It is to be noticed that the measurement of the welfare of individuals in general requires the use of equivalence scales. Nevertheless, the study excludes the reference to equivalence scales. Lastly, measurements of poverty implement additive and decomposable indices, making it possible to estimate not only the proportion of the poor, but also their situation compared to the poverty line – intensity and inequality.
3. HIV Incidence, Poverty and Inequality: Descriptive Analysis

The descriptive statistics and the socio-economic inequality of HIV prevalence are successively presented.

1. Descriptive Statistics

Table 1 shows the descriptive statistics relating to HIV prevalence according to sex, education, zones, regions and living standards. In this respect, several comments can be formulated.

In the first place, in 2003, HIV prevalence was 1.9 percent for adults aged 15-59 years –15-49 years for women. This estimate is appreciably less than that which prevailed in sub-Saharan Africa – 7.4 percent in 2004 –, in certain bordering countries, in particular Côte d’Ivoire – approximately 10 percent in sentinel surveillance –, and in the countries of Southern Africa – 25 percent. On the other hand, this average level of seroprevalence is very comparable with the extent of the epidemic which prevails in other nearby countries, like Mali, Niger or Ghana (UNAIDS/WHO, 2004). In this respect, table 1 also shows a small differentiation of the infection rates according to sex, since the national HIV prevalence for women aged 15-49 years and men aged 15-59 years is, respectively, 1.8 and 1.9 percent. It is to be noticed that the evaluation of HIV incidence for the women, based on the national survey, diverges somewhat from the estimates inherent in the sentinel surveillance. Indeed, in 2002, the average HIV prevalence, based on the antenatal consultations of women 15-49 years old from five private clinics, was 4.6 percent (Asamoah-Odei, García-Caldeja, Boerma, 2004).

In the second place, HIV incidence seems conversely correlated to the educational level, since it is 1.6 and 6.8 percent, respectively, for people without instruction and those having had access to higher education – primarily men. In fact, this tendency seems more marked for men than for women, the ratio of seroprevalence between women having pursued secondary education and those without instruction being two, compared to more than five for men, when, for the latter, the highest educational level is tertiary education. This result is likely to question the potential effectiveness of prevention programs.

In the third place, significant disparities prevail according to the type of place of residence and region. HIV prevalence is three times higher in cities, compared to countryside – respectively, 3.8 and 1.3 percent. This tendency prevails whatever the sex, although the incidence of the virus is higher for women living in towns, compared to those living in rural areas, contrary to men. In addition, table 1 shows that HIV prevalence is higher than the national average in four areas – Boucle du Mouhoun,
Table 1: Descriptive statistics and socio-economic inequality of HIV prevalence, and households’ monetary living standards – women aged 15-49 years, men aged 15-59 years – Burkina Faso 2003

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sex</th>
<th>HIV prevalence – % &amp; socio-economic inequality</th>
<th>N (individuals)</th>
<th>Households’ monetary indicators</th>
<th>Poverty ratio PO – individuals</th>
<th>N (households)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men – 15-59 years</td>
<td>Women – 15-49 years</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean (standard deviation)</td>
<td>concentration index (standard deviation)</td>
<td>Mean (standard deviation)</td>
<td>concentration index (standard deviation)</td>
<td>Mean (standard deviation)</td>
<td>concentration index (standard deviation)</td>
</tr>
<tr>
<td>Education¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>1.7 (0.1)</td>
<td>-0.079 (0.088)</td>
<td>1.5 (0.1)</td>
<td>0.224 (0.087)</td>
<td>1.6 (0.1)</td>
<td>0.090 (0.066)</td>
</tr>
<tr>
<td>Primary</td>
<td>1.9 (0.1)</td>
<td>0.391 (0.161)</td>
<td>3.0 (0.2)</td>
<td>0.397 (0.127)</td>
<td>2.4 (0.1)</td>
<td>0.411 (0.106)</td>
</tr>
<tr>
<td>Secondary</td>
<td>1.8 (0.1)</td>
<td>0.350 (0.150)</td>
<td>3.0 (0.2)</td>
<td>-0.077 (0.275)</td>
<td>2.3 (0.1)</td>
<td>0.130 (0.159)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>9.1 (0.3)</td>
<td>0.231 (0.169)</td>
<td>0.0 (0.0)</td>
<td>-</td>
<td>6.8 (0.2)</td>
<td>0.002 (0.165)</td>
</tr>
<tr>
<td>Zones</td>
<td></td>
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<tr>
<td>Rural</td>
<td>1.4 (0.1)</td>
<td>-0.170 (0.086)</td>
<td>1.2 (0.1)</td>
<td>0.088 (0.087)</td>
<td>1.3 (0.1)</td>
<td>-0.038 (0.064)</td>
</tr>
<tr>
<td>Urban</td>
<td>3.6 (0.2)</td>
<td>0.120 (0.145)</td>
<td>4.0 (0.2)</td>
<td>0.003 (0.117)</td>
<td>3.8 (0.2)</td>
<td>0.054 (0.096)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
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</tr>
<tr>
<td>Ouagadougou</td>
<td>4.5 (0.2)</td>
<td>0.302 (0.179)</td>
<td>4.3 (0.2)</td>
<td>0.118 (0.177)</td>
<td>4.4 (0.2)</td>
<td>0.189 (0.119)</td>
</tr>
<tr>
<td>Boucle du Mouhoun</td>
<td>2.6 (0.2)</td>
<td>0.028 (0.272)</td>
<td>2.2 (0.1)</td>
<td>0.311 (0.186)</td>
<td>2.4 (0.1)</td>
<td>0.169 (0.185)</td>
</tr>
<tr>
<td>Centre – cepp. Ouaga.</td>
<td>0.0 (0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre-Sud</td>
<td>0.4 (0.1)</td>
<td>-0.292 (0.051)</td>
<td>0.7 (0.1)</td>
<td>0.112 (0.318)</td>
<td>0.6 (0.1)</td>
<td>-0.015 (0.237)</td>
</tr>
<tr>
<td>Plateau Central</td>
<td>0.8 (0.1)</td>
<td>-0.037 (0.058)</td>
<td>1.3 (0.1)</td>
<td>-0.025 (0.271)</td>
<td>1.1 (0.1)</td>
<td>-0.032 (0.183)</td>
</tr>
<tr>
<td>Centre-Est</td>
<td>0.8 (0.1)</td>
<td>0.119 (0.202)</td>
<td>1.6 (0.1)</td>
<td>0.025 (0.264)</td>
<td>1.2 (0.1)</td>
<td>-0.001 (0.192)</td>
</tr>
<tr>
<td>Centre-Nord</td>
<td>0.1 (0.1)</td>
<td>-0.375 (0.347)</td>
<td>0.6 (0.1)</td>
<td>0.134 (0.150)</td>
<td>0.8 (0.1)</td>
<td>-0.146 (0.282)</td>
</tr>
<tr>
<td>Centre-Ouest</td>
<td>3.0 (0.2)</td>
<td>0.033 (0.197)</td>
<td>1.9 (0.1)</td>
<td>0.357 (0.139)</td>
<td>2.2 (0.1)</td>
<td>0.184 (0.129)</td>
</tr>
<tr>
<td>Est</td>
<td>3.5 (0.2)</td>
<td>0.070 (0.223)</td>
<td>0.5 (0.1)</td>
<td>0.279 (0.056)</td>
<td>1.9 (0.1)</td>
<td>0.121 (0.190)</td>
</tr>
<tr>
<td>Nord</td>
<td>1.4 (0.1)</td>
<td>-0.164 (0.246)</td>
<td>1.0 (0.1)</td>
<td>0.171 (0.374)</td>
<td>1.2 (0.1)</td>
<td>0.006 (0.234)</td>
</tr>
<tr>
<td>Cascades</td>
<td>2.1 (0.1)</td>
<td>0.061 (0.265)</td>
<td>2.8 (0.2)</td>
<td>0.122 (0.224)</td>
<td>2.4 (0.1)</td>
<td>0.098 (0.150)</td>
</tr>
<tr>
<td>Hauts Bassins</td>
<td>1.0 (0.1)</td>
<td>0.316 (0.272)</td>
<td>2.2 (0.1)</td>
<td>-0.088 (0.185)</td>
<td>1.6 (0.1)</td>
<td>0.045 (0.166)</td>
</tr>
<tr>
<td>Sahel</td>
<td>0.0 (0.0)</td>
<td></td>
<td></td>
<td>-0.877 (0.145)</td>
<td>0.1 (0.0)</td>
<td>-0.837 (0.053)</td>
</tr>
<tr>
<td>Sud-Ouest</td>
<td>3.8 (0.2)</td>
<td>-0.170 (0.153)</td>
<td>3.7 (0.2)</td>
<td>0.163 (0.202)</td>
<td>3.8 (0.2)</td>
<td>0.003 (0.133)</td>
</tr>
</tbody>
</table>

(1) The concentration index is related to households’ assets – see the text; (2) EBCVM 2003; (3) ED SBF 2003; (4) With regard to monetary indicators, the level of education is that of the household head, whatever the age; (5) Non-applicable.


Centre-Ouest, Sud-Ouest and Cascades – and, especially, in the chief town. This situation is observed independently of the sex of the people. In this respect, it should be noted that almost all these areas are located in the west of the country and near the border with Côte d’Ivoire, a country where HIV prevalence is particularly high – figure A1, in the appendixes. However, in recent years, in particular since October 2000, the political disturbances of Côte d’Ivoire have involved a significant return of burkinabè migrants working in this country (Lachaud, 2004). In addition, before these events, the enclavement of Burkina Faso had induced an intense road traffic with Côte d’Ivoire, partly now compensated for by a diversion of the exchanges in favour of the other neighbouring countries. The fact that the greatest vulnerability with regard to HIV is higher close to borders or in the presence of migrations, to conflicts and massive repatriations, has also been observed in Asia (Bates et al., 2004).³²

Lastly, table 1 suggests that HIV prevalence is directly correlated with the living standards of households, although the relationship is not clearly established. Admittedly, individuals in rich households have a HIV prevalence twice as high as those living in very poor families – respectively, 3.0 and 1.4 percent. In addition, the right hand portion of table 1 would tend to show that the average
regional HIV prevalence is all the more frequent as the regional average of expenditure per capita is high, and, to a lesser extent, as the rate of poverty is low. Indeed, in the chief town – Ouagadougou – and the areas where the rate of infection is higher than the national average – except in the Boucle du Mouhoun –, the regional annual expenditure per capita tends to be at least equal to the national average. In the same way, in the capital and two areas where HIV prevalence is significant – Cascades and Centre-Ouest –, the regional ratio of poverty is lower than the national rate. Nevertheless, the descriptive analysis shows that association on the micro and macro-economic levels between HIV incidence and the living standard is imperfect. For example, the rates of infection of people belonging to the groups ranging between the 61th and 80th percentiles of the living standard is quasi-equivalent to that of individuals living in households in the poorest 20 percent – respectively, 1.5 and 1.4 percent. This uncertainty justifies additional checks.

2. **Socio-economic Inequality**

The preceding observations suggest a preliminary investigation of the socio-economic disparities of HIV prevalence using several indicators.

First of all, the seroprevalence concentration curve, noted L(s), associates the cumulative proportion of HIV prevalence – on the y-axis – against the cumulative proportion of individuals, ranked in ascending order of the percentiles of the living standard of households in terms of assets – on the x-axis. For example, figure 1, further on in this study, provides the seroprevalence concentration curve for adults in Burkina Faso for 2003 at national level and according to sex. Thus, the y-axis refers to the cumulative proportion of infected individuals, while the x-axis indicates the cumulative proportion of people, ranked in ascending order of the households’ welfare to which they belong, the latter being given in terms of assets. It is to be noticed that the curve which is reproduced on figure 1 presents similarities with the Lorenz curve. However, it is important to bear in mind that we are looking at the distribution of HIV incidence, not across percentiles of HIV prevalence, but rather across percentiles of the assets index of households. In other words, figure 1 is not based on the ranking of the variable whose distribution is investigated – the seroprevalence of adults –, but compared to the economic status of households. The interpretation of the concentration curve is quite simple. When L(s) coincides with the diagonal, all individuals, irrespective of their economic status, enjoy the same HIV prevalence rates. As figure 1 shows, for Burkina Faso, L(s) lies below the diagonal, which implies inequalities in seroprevalence disadvantages the better-off individuals – 15-49 years old for women and 15-59 years
old for men. This situation, which prevails whatever the sex, could be described as inequality «pro-poor»—especially for women. On the other hand, when L(s) lies above the diagonal, inequalities in HIV prevalence favour the richest—inequality «pro-rich». Naturally, the further the concentration curve lies from the diagonal, the greater the degree of inequality in HIV incidence across percentiles of economic status, which is the case for women, compared to men.34

In fact, in spite of the interest of the concentration curves, the measure of inequalities in health using an index remains relevant, in particular when the curves cross. For example, figure A2, in the appendices, shows that the concentration curves of HIV prevalence for rural and urban sectors cross each other, and even cross the diagonal. In this respect, the two most used indices in the studies relating to inequalities in health are, on the one hand, the relative index of inequality – RII—, and, on the other hand, the concentration index – C. Research refers to the latter.35 Thus, it appears that C makes clear the sensitivity to the socio-economic dimension of households to inequality of HIV prevalence.

Table 1 shows the concentration indices and standard deviation according to sex and various parameters. At national level, the concentration index of HIV prevalence is 0.204, and confirms the configuration of the concentration curve. In other words, the richest people are also those most affected unfavourably with HIV prevalence. In this respect, it is observable that this situation prevails whatever the sex of the individuals, although socio-economic inequality in terms of seroprevalence is greater for women aged 15-49 years than for men aged 15-59 years—the concentration indices being, respectively, 0.262 and 0.141. Table 1 also shows that if the socio-economic inequality for HIV prevalence is
«pro-poor» in urban areas, the reverse prevails in rural zones, primarily for men. In addition, it appears that in the capital and areas where infection rates are higher than average, the concentration indices are positive. This result could reinforce the positive relationship which tends to be observed between HIV infection rate and living standards of households. The econometric investigations which follow confirm this assertion.

4. HIV Prevalence and Poverty: Econometric Analysis

The apprehension of the relation between HIV prevalence and households poverty is successively carried out using micro and macro-econometric approaches.

1. Micro-Econometric Approach

Table 2 shows the coefficients and marginal effects of various probit estimates, and gives rise to several remarks.

In the first place, one observes that in all the models, the lambda of Mills is not significant, which means that the non-observable characteristics of adult individuals, which increase their propensity not to accept HIV tests, do not contribute to an increase in the probability of HIV prevalence. Indeed, one points out the existence of some non-responses for the HIV test, and, consequently, the need for estimating beforehand a probit model, so as to specify the factors at the origin of the absence of HIV tests for part of the population, and to generate the lambda of Mills – covariance between the errors of the choice equation (refusal of the HIV test) and the errors of the probit model concerning the people having undergone the HIV test –, as an additional explanatory variable in the final probit model. This result is coherent with the fact that the analysis of the participation rates according to various socio-demographic parameters suggests the absence of any relationship between non-participation in the test and the variables associated with high levels of HIV infection (INSD/ORC Macro, 2004).

In this respect, the preliminary econometric estimate of the choice equations – not reproduced – shows, whatever the model considered, a probability of acceptance of the test:36 (i) decreasing with the years of education, but a significant quadratic effect generates a reversal of the tendency in the 5th year; (ii) decreasing for men, relative to women; (iii) lower in urban areas compared to rural zones; (iv) less significant for the Peuhl group, compared to Dioula and assimilated, and Mossi and assimilated; (v) greater for semi-qualified employees, informal workers, and the farmers, compared to senior executives.
In the second place, table 2 suggests, independently of the estimated model, a positive relationship between HIV prevalence of adult women and men and the living standards of individuals.
All the coefficients and the marginal effects are positive and significant, even if for the model (1) the level of significance relating to the segment of the living standards of families ranging between the 41th and 80th percentile is only 8.2 percent. Thus, the fact for individuals living in households belonging to the richest 20 percent of the distribution of assets of the groups, rather than the poorest 40 percent, induces, all other things remaining equal, a variation of the probability of HIV prevalence in the adult population of 0.01. In the same way, the marginal effect of the assets index is 0.001 – model (2). In this respect, it is to be noticed that, contrary to the information reported in table 1, in all the models the impact of the education of individuals is not significant, an effect probably picked up by the living standards of households.

Taking into consideration these results, it is possible to predict HIV prevalence for the whole of the sample selected beforehand. Figure 2 clearly highlights the positive relationship between the assets index of households and the seroprevalence of adults. Indeed, the predicted HIV prevalence varies from 1.2 to 2.9 percent, respectively, for the very poor – the bottom 20 percent – and the rich – the top 20 percent. In relative terms, the information of EDSBF 2003, reported by the concentration curve – figure 1 –, shows that the poorest 40 percent include only 26.0 percent of the infected people, against 35.0 and 39.0 percent, respectively, for the middle 40 percent and the richest 20 percent. In addition, the figures A3 and A4, in the appendices, present the predicted HIV prevalence, respectively, according to urban and rural areas, and sex. In this respect, one also observes, independently of areas...
and sex, a positive relationship between the assets index of families and HIV prevalence. But, as suggested by table 1, significant disparities of predicted seroprevalence appear between cities and countryside, whereas the reverse prevails for sex.

In the third place, the estimates of the nonlinear models show the interference of other factors of seroprevalence. First of all, demographic factors. Table 2 indicates that the sex, the matrimonial status and the ethnic membership of individuals do not influence the prevalence of the virus, all other parameters remaining constant. To a certain extent, this result was unexpected, since in Africa, approximately 57 percent of the people living with HIV are women aged 15-49 years (UNAIDS/WHO, 2004). In the same way, according to EDSBFS 2003, 56.4 percent of infected adults of 15-49 years are women. But, the econometric analysis controls by all the other parameters and the average HIV incidence is slightly weaker for women – table 1. In fact, the probit models suggest a significant influence of age. Indeed, the coefficients and the marginal effects relating to age in models (1) to (3) are positive and significant, while those inherent in the age squared are negative. So the probability of HIV prevalence grows with age, the maximum being reached around 37 years. Table 2 also states that, contrary to what might be expected, all other things remaining equal, the fact of being Moslem, compared to being an animist or without religion, the probability of seroprevalence is rising, although the level of significance of the coefficients and marginal effects is higher than 5 percent. Indeed, in Burkina Faso, where the Islamic religion is predominant, 89 percent of men aged 15-59 years are circumcised, and the seroprevalence of the latter is a little lower than those of the men not circumcised – 2.9 against 1.8 percent. It may be that other factors interfere at this level, for example, the impact of polygamy. In addition, it will be noted that when a check is made using the other parameters, in particular the living standard, the risk of HIV prevalence is conversely connected to the size of the household.

In addition, among the risky individual behaviour taken into account by the models – knowledge of HIV, numbers of sexual partners, use of condoms, and high-risk sexual intercourse –, it appears that only the fact of using condoms during the last 12 months reduces the chances of seroprevalence. In this respect, it is interesting to examine the effect of the interaction term [assets index*condoms] on seroprevalence – model (3). Let us note that the coefficient and the marginal effect of this term are negative and significant, while that relating to condoms is significant to the extend of only 13 percent. Consequently, all other things remaining equal, the effect of the use of condoms on HIV prevalence increases when the wealth of the households grows. These results would tend to reinforce the prevention policies centred on the diffusion and the use of condoms, in particular for the poorest, contrary to the ill-advised recommendations of certain churches. In spite of this, model (3) shows that a greater HIV probability is associated with an improving living standard.
Lastly, there is a relative specificity of the HIV epidemic according to areas and regions. The coefficients of the models (1) to (3), reported in table 2, show quite clearly that, all other things remaining equal, the probability of seroprevalence is strongest in two geographical areas: on the one hand, the capital, Ouagadougou, and, on the other hand, almost all the areas of the west and the south-west of the country: Centre-Ouest, Sud-Ouest, Cascades and, to a lesser extent, Boucle du Mouhoun. Figure A1 in the appendices highlights this situation, and shows that all these areas have a common border with Côte d’Ivoire or are close to this country where HIV prevalence is very high – approximately 10 percent. However, the recent political events in Côte d’Ivoire have induced a massive return of burkinabè migrants to their country, in particular since 2000. At the same time, Burkina Faso being a landlocked country, road and railway traffic was very intense on the highway connecting the towns of Bouaké (Côte d’Ivoire) - Banfora (Cascades) - Bobo-Dioulasso (Hauts Bassins) - Koudougou (Center-Ouest) - Ouagadougou. Also, it must be pointed out that in these areas of the west – Cascades and Hauts Bassins –, economic activities are relatively diversified – importance of cotton, in particular in Houet, of niébé in Poni and Bougouriba, and of groundnuts in Comoé. Indeed, approximately three heads of household out of five are commercial farmers, although subsistence farming occupies even more than one quarter of them, and that wage-earning has a certain incidence. For this reason, a cereal surplus is frequent, as in 1998. In Centre-Ouest, Sud-Ouest and Boucle du Mouhoun, subsistence farming dominates – especially niébé in the province of Mouhoun –, but groundnuts and cotton growing are present in some zones. These economic conditions probably explain why average regional HIV prevalence is more significant when the regional average of expenditure per capita is high, and, to a lesser extent, that the level of poverty is low.

2. Macro-Econometric Approach

The spatial macro-econometric approach makes it possible to check the robustness of some elements previously highlighted. Table 3 provides the coefficients of the testing of the spatial lag models for the 45 provinces, with the relationship between, on the one hand, the regional level of HIV prevalence resulting from EDSBF 2003 and, on the other hand, all of the parameters generated by EBCVM 2003: measurements of poverty or living standards (expenditure per capita or assets of households); inequality of monetary resources or assets index of families; urbanization rate; provincial average percentage of households having had one or more adult members who resided in Côte d’Ivoire during the previous 12 months, a variable likely to assess the impact of the Côte d’Ivoire crisis on the propagation of the epidemic in Burkina Faso. Several comments can be formulated.

Firstly, on a purely econometric level, table 3 highlights the absence of spatial autocorrelation, the coefficient of the spatially lagged dependent variable being significant in none of the models. In the
same way, the likelihood ratios LR (lag) are not statistically significant. In addition, the Breusch-Pagan tests indicate the absence of heteroscedasticity at the level of one percent. In other words taking into account spatial econometric models is not really justified.\(^3\) In the same manner, table A2, in the appendices, shows that spatial error models are inappropriate, the coefficients and the values of the likelihood ratios LR (error) – and LM (error) in table 3 – being insignificant. Moreover, in all the cases, the Wald test of the common factor hypothesis is not significant, and so the absence of inconsistency of this type of model, and consequently its character not necessarily unsuited.

Secondly, table 3 shows the existence of a positive relationship between, on the one hand, the level of regional HIV prevalence, and, on the other hand, the provincial average living standard of households. All the coefficients relating to provincial monetary poverty – incidence, intensity and inequality – are negative and significant – models (1) to (4) –, while those inherent in the household expenditures per capita or the assets index of families, expressed on a provincial basis, are positive and significant – models (5) and (6). Consequently, the level of seroprevalence is increasing when cardinal measurements of poverty decrease, or when the values of the expenditure or the assets index of households are rising. This result confirms those inherent in the micro-econometric analysis.

### Table 3: Regression coefficients of the determinants of provincial HIV prevalence – women aged 15-49 years, men aged 15-59 years – Burkina Faso 2003

<table>
<thead>
<tr>
<th>Parameter</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.046</td>
<td>2.317*</td>
<td>0.039</td>
<td>2.052*</td>
<td>0.027</td>
<td>1.574</td>
<td>0.018</td>
</tr>
<tr>
<td>Poverty – P0</td>
<td>-0.199</td>
<td>-2.346*</td>
<td>-0.182</td>
<td>-2.276*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Poverty – P0)²</td>
<td>0.222</td>
<td>2.026*</td>
<td>0.196</td>
<td>1.895**</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Poverty – P1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.428</td>
<td>-2.582*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Poverty – P1)²</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.353</td>
<td>2.118*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Poverty – P2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Poverty – P2)²</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.742</td>
<td>1.890**</td>
<td>-</td>
</tr>
<tr>
<td>Gini expenditure/per capita</td>
<td>0.040</td>
<td>0.976</td>
<td>0.029</td>
<td>0.759</td>
<td>0.029</td>
<td>0.760</td>
<td>0.026</td>
</tr>
<tr>
<td>Gini assets households (^4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Urbanization rate (^5)</td>
<td>-0.035</td>
<td>-1.784***</td>
<td>-0.037</td>
<td>-2.024</td>
<td>-0.034</td>
<td>-1.858**</td>
<td>-0.034</td>
</tr>
<tr>
<td>Migration Côte d’Ivoire (^6)</td>
<td>-</td>
<td>0.558</td>
<td>2.415*</td>
<td>0.635</td>
<td>2.761*</td>
<td>0.659</td>
<td>2.773*</td>
</tr>
<tr>
<td>Expenditure/per capita hhd.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Assets index households</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Migration Cîle Exp./per. cap.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(\beta)²</td>
<td>0.034</td>
<td>0.160</td>
<td>0.044</td>
<td>0.216</td>
<td>0.071</td>
<td>0.355</td>
<td>0.029</td>
</tr>
</tbody>
</table>

Log likelihood 117.02 | 120.11 | 120.00 | 115.31 | 118.61 | 119.42 | 118.75 |
Adjusted R²/Schwarz 0.172/211.21 | 0.278/209.77 | 0.274/209.54 | 0.106/267.84 | 0.228/210.37 | 0.235/212.19 | 0.233/207.06 |
Heteroscedasticity: Breusch-Pagan spatial 10.10 | 0.039 | 11.72 | 0.068 | 5.25 | 0.512 | 6.34 | 0.175 | 10.29 | 0.067 | 7.93 | 0.159 | 9.52 | 0.146 |
Spatial dependence: LM (error)² 0.49 | 0.485 | 0.04 | 0.833 | 2.62 | 0.105 | 2.95 | 0.085 | 0.48 | 0.486 | 0.19 | 0.461 | 0.62 | 0.433 |
LR (lag)² 0.02 | 0.876 | 0.02 | 0.462 | 0.11 | 0.738 | 0.01 | 0.958 | 0.02 | 0.900 | 0.03 | 0.777 | 0.01 | 0.935 |
N (provinces) 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |

(1) Two-tailed probability that the coefficient is equal to zero. The \(t\) is the ratio between \(\beta\) and the standard error; (2) The models (1) to (7) are the spatial lag models – with a spatially lagged dependent variable; (3) Ratio of the urban population to total population of a province; (4) Gini coefficient of the expenditures per capita for a province; (5) \(\beta\) is the coefficient of \(W *\) VIH; (6) Gini coefficient of households’ assets for a province; (7) Schwartz criteria for correction of the maximum likelihood – the best model has the lowest value. In addition, in the case of spatial dependence models, \(R^2\) is a pseudo \(R^2\); (8) Spatial error dependence test; (9) Spatial lag dependence test; (10) Average provincial percentage of households having had one or more adults members who resided in Côte d’Ivoire during the last 12 months.

Note: * = significant at 0.01 percent level; ** = significant at 0.05 percent level.

As a matter of fact, the relationship between HIV prevalence and poverty, apprehended at the regional level, is not linear. The coefficients of the quadratic term of the models (1) to (4) are positive and significant, which suggests the existence of a threshold beyond which the seroprevalence of individuals and poverty move in the same direction. When taking into account the coefficients of the models (1) and (2), reported in table 3, the minimal value of the HIV prevalence rate prevails for a provincial poverty ratio of households of about 45 percent. The spatial econometric models (1) and (2) of table A2, in the appendices, provide identical information. For the intensity and inequality of poverty, the points of reversal are, respectively, of 15.8 and 9.2 percent – table 3, models (3) and (4). Figure 3, based on the predicted values of the model (1) of table 3, highlights the nonlinear relationship between HIV prevalence and poverty. Thus, the identified turning-points correspond to measurements of poverty largely higher than the national average – estimated at 37.5 percent of the households (Lachaud, 2003). Nevertheless, the confrontation of the data of EDSBF 2003 and EBCVM 2003 seems to suggest a direct macro-econometric relationship between monetary poverty and the level of HIV prevalence, since the deprivation rates are rather high. On the other hand, the micro-econometric analysis, based on the stratification of the assets index of households, does not confirm this result – table 2 –, just like the micro and macro-econometric relationship incorporating the monetary or non-monetary values of the living standards of households or provinces – table 3. The figures A5 and A6, in the appendices,
illustrate this assertion using the monetary expenditure per capita of households and the assets index, two indicators evaluated on a regional basis.

Thirdly, the estimate of the spatial econometric models confirms the impact of the crisis of Côte d’Ivoire on HIV prevalence in Burkina Faso. Indeed, the coefficient of the variable relating to migration — the percentage of households having had one or more adult members who resided in Côte d'Ivoire during the last 12 months — is positive and significant in almost all the models — (2) to (5). In addition, a nonlinear relationship also prevails, the coefficients of the squares of the variable of migration being negative and significant. In fact, the turning-point beyond which the effect of the migration from Côte d’Ivoire ceases is located at approximately 7 percent, a threshold rather higher than the average value of 3.2 percent. In addition, the tests for simultaneity of the variable relating to migration is performed successfully, while the assumption, a priori plausible, that the impact of the living standard on seroprevalence also depends on the migration from Côte d’Ivoire is rejected. Indeed, the interaction variable [migration*expenditure per capita], introduced into the model (7), is not significant, and makes the variables relating expenditure and migration also insignificant. Under these conditions, the impact of the massive return of burkinabè migrants from Côte d’Ivoire — a country where HIV prevalence is extremely high — on the level of seroprevalence in Burkina Faso, in particular since 2000, consecutively to the political crisis of Côte d’Ivoire, is a possibility not to be excluded.

Fourthly, the other variables of the spatial econometric models prompt some additional observations. On the one hand, the inequality of the monetary or non-monetary resources, apprehended by the Gini coefficient, does not have any impact on the level of HIV prevalence, all other things remaining equal. In addition, in all the models, when checked by the living standard, the inequality of resources and the presence of migrants from Côte d’Ivoire, the urbanization rate is conversely correlated with the level of HIV prevalence. This result can appear paradoxical. In fact, many of the provinces of the west and south-west, having null urbanization rates, have at the same time high seroprevalence rates. For example, in the area of Sud-Ouest where HIV incidence is 3.8 percent, three provinces out of four have an urbanization rate equal to zero. The same is true of Centre-Ouest, Cascades and Boucle du Mouhoun where urbanization is absent from half of the provinces.

3. **Seroprevalence and Poverty: A Questioned Relationship**

The preceding econometric investigations raises several questions, among which two will be evoked in the present study.

In the first place, is the fight against poverty at the same time a means of drastically reducing the prevalence of HIV? This question is central insofar as in Africa in general and in Burkina Faso in particular it is difficult to dissociate the « strategies of development » from the « strategies of the fight
against poverty. At the same time, the HIV epidemic, a complex reality involving economic, social, cultural and medical aspects, is not a short term phenomenon. Under these conditions, the identification of the relative importance of the various determinants and their interactions is crucial. In other words, the effectiveness of the fight against the epidemic mainly depends on the perception which is made of the phenomena, i.e., whether it is a health or behavioural problem, or a consequence of an insufficient rate of development.

The result of our research contrasts somewhat with the idea that « poverty is the major reason why individuals, including women, knowingly engage in high-risk behaviour that facilitates the spread of HIV » (Akukwe, 2005, p.3). The micro and macro-econometric estimates tend to highlight a positive relationship between the living standard and HIV prevalence. Consequently, in the case of Burkina Faso, to exclusively interpret the spread of HIV as the consequence of under-development, is a dangerous assumption in terms of optimizing policies for the fight against the epidemic. Obviously that does not imply an absence of an impact of poverty on the propensity to seroprevalence. First of all, the macro-econometric estimate indicates a nonlinear relationship and the existence of a turning-point beyond which a positive association between HIV prevalence and poverty of households prevails, since the ratio of the latter reaches 45 percent. It may be that the effect of living standards on seroprevalence is really effective only beyond a certain critical deprivation point. Also, poverty in monetary and non-monetary terms — precarious habitats, poor access to drinking water, rudimentary sanitary arrangements, the absence of impregnated mosquito nets, etc. — probably contributes to the development of malnutrition, parasitosis, malaria and tuberculosis, and indirectly increases the predisposition to the spread of HIV. Lastly, in Africa, many women are encouraged to engage in high-risk sexual activities, through their economic and social dependence related to the socio-cultural standards favourable to men and the insufficient access to land, credit, employment, and education. For example, a study relating to Senegal showed that half of the women with HIV lived in monogamist households (Whelan, 1999). In the same manner, the impact of the economic crisis on the development of prostitution in Africa is well documented (Marcus, 1993).

In the second place, how can one explain the positive (negative) relationship between HIV prevalence and living standards (poverty) of households? The elements of analysis highlighted by the study, as well as other information, would tend to emphasize two series of factors.

Firstly, certain structural factors may contribute to distorting the relationship between resources of households and HIV prevalence. First of all, on should note the persistence of cognitive and behavioural factors inherent in the traditional social system in spite of the high rate of economic growth per capita which prevailed over the last two decades (World Bank, 2005).\footnote{Indeed, in the social system of Burkina Faso, the conditions of acquisition of political, economic and social power show an inequality of opportunities prejudicial to women. At the same time, the social construction of female}
attributes and roles is such that men often appear as « decision-makers » with regard to sexual intercourse, while the persistence of secular, traditional or religious beliefs contributes to minimizing the perception of HIV in terms of risk independently of living standards. The progressive access to anti-retroviral therapy could even reinforce the high-risk behaviour of favoured segments of the population, whereas the use of condoms has a negative effect on seroprevalence, as was shown in the study. In other words, it may be that particular socio-cultural contexts and circumstances with regard to the epidemic induce specific sexual behaviour facilitated by the rise of living standards of part of the population, and the strong rate of illiteracy of adult women.

In addition, it was previously shown that HIV prevalence is higher than the national average in two geographical zones: on the one hand, in four areas – Boucle du Mouhoun, Centre-Ouest, Sud-Ouest and Cascades – and, on the other hand, in the capital – table 1, and figure A1, in the appendices. However, at the same time, these two geographical divisions have higher regional averages of expenditure per capita, and, to a lesser extent, lower poverty rates compared to the other zones. Indeed, in the capital, the preeminence of administrative, industrial and services activities mainly explains the existence of living standards higher than those which prevail in the rest of the country, while in the four areas previously indicated, the presence of cotton and groundnuts agriculture is, in general, a source of substantial income. Moreover, these areas are near the second urban centre of the country, Bobo-Dioulasso, where HIV prevalence is very high. In addition, the fact that Burkina Faso is a landlocked country required development of road and railway traffic with neighbouring countries, in particular Côte d’Ivoire, on the highway connecting the towns of Bouaké (Côte d’Ivoire) - Banfora (Cascades) - Bobo-Dioulasso (Hauts Bassins) - Koudougou (Centre-Ouest) - Ouagadougou. At the same time, the presence of many burkinabè migrants from Côte d’Ivoire generated displacements of population between this country and the two geographical subdivisions of Burkina Faso, the capital and the areas of the west and south-west. Consequently, it may be that the structural conditions of the processes of development in Burkina Faso, concomitant with significant flows of exchange of goods, services and labour with a country where HIV prevalence is particularly high, constitute a partial explanation of the positive relationship between the resources of households and seroprevalence.

Secondly, factors related to the economic situation probably contributed to reinforcing the negative relationship between HIV prevalence and poverty. Indeed, the considerable flows of emigration from some sub-Saharan African countries – Burkina Faso, Mali and Niger, in particular – towards the neighbouring countries – Côte d’Ivoire and Ghana, in particular – until recently contained the acceleration of demographic growth while safeguarding the significant financial resources of these countries. However, in sub-Saharan Africa, the « crisis of Côte d’Ivoire » considerably disturbed this process of integration. Indeed, over the last ten years, Côte d’Ivoire, the country with the highest rate of immigration in West Africa – 26 percent from abroad in 1998 –, has been undergoing a political,
economic and social crisis without precedent throughout its history. The reduction of free enterprise of a model based mainly on the distribution of the agricultural revenue,\textsuperscript{51} consecutively with the shocks of external events\textsuperscript{52} and the implementation of structural adjustment programs,\textsuperscript{53} as well as the dysfunction of the country’s political institutions\textsuperscript{54} – accentuating the bad governance\textsuperscript{55} –, generated a political and economic destabilisation of the country,\textsuperscript{56} implying geographical partition and an aggravation of the conflict between North and South.\textsuperscript{57} This context, crystallized by the ideology of political exclusion and a recrudescence of nationalism,\textsuperscript{58} in particular with respect to nationals of the North, led to a major inversion of migratory flows in the neighbouring countries, in particular in Burkina Faso during the period 2000-2003. This new situation was not only at the origin of a major fall of remittances in the direction of Burkina Faso (Lachaud, 2004), but also questions the potential impact of the inversion of labour flows as well as the situation of conflict near the border on the seroprevalence of the country of emigration. In this respect, the macro-econometric analysis would tend to highlight a direct relationship between the proportion of households having had one or more members who resided in Côte d’Ivoire – a country where seroprevalence is, on average, five times higher than in Burkina Faso – during the previous 12 months and the level of HIV prevalence. Moreover, such a result is not specific to Africa. In Asia, greater HIV prevalence was observed close to borders or in the presence of migrations, conflicts and significant repatriations of populations (Bates et al., 2004). As it is, this erosion of African integration complicates the scenarios for the evolution of AIDS on the continent from 2025 onwards (UNAIDS, 2005).

5. Conclusion

Based on the data of the Demographic and Health Survey and of the Priority Survey carried out in 2003, the present study examines the factors of HIV prevalence in Burkina Faso. It reaches two conclusions.

Firstly, to apprehend the spread of HIV exclusively as the consequence of under-development, constitutes a dangerous assumption in terms of optimizing policies of the fight against the epidemic. The fight against poverty is not necessarily a means of reducing simultaneously and drastically the prevalence of HIV. This assertion is based on several elements of empirical analysis.

First of all, the seroprevalence concentration curve is « pro-poor » – especially for women –, which implies that inequalities in seroprevalence disadvantage wealthier individuals – 15-49 years for women and 15-59 years for men.

In addition, the micro-econometric estimates of the probit models suggest a positive relationship between HIV prevalence among adult women and men and living standards of individuals. Thus, the fact for individuals of being localized in households belonging to the richest 20 percent of the
distribution of the assets of the groups, rather than belonging to the poorest 40 percent, induced, all:
other things remaining equal, a variation of probability of HIV prevalence of the adult population of
0.01. At the same time, the probit models highlight a probability of prevalence increasing with:
(i) age – the maximum being reached around 37 years; (ii) membership of the Islamic religion, compared to
animist and those without religion; (iii) the fact of being localized in two geographical areas: on the one
hand, the capital, Ouagadougou, and, on the other hand, near almost all the areas of the west and the
south-west of the country: Centre-Ouest, Sud-Ouest, Cascades and, to a lesser extent, Boucle du
Mouhoun – that does not exclude that in certain provinces of the east (Kompienga and Tapoa, for
example) bordering on other countries (Benin), HIV incidence is not higher than the national average.
On the other hand, among individual high-risk behaviour taken into account by the models, it appears
that only the fact of using condoms during the previous 12 months reduces the chances of
seroprevalence, and the effect increases with the wealth of households – a result which would tend to
reinforce the prevention policies based on the diffusion and use of condoms, in particular for the poorest
part of the population. In addition, it should be noted that when a check is made using the other
parameters, in particular living standards, the risk of HIV prevalence is conversely connected to the size
of the household, and the variables relating to sex and education are not significant – an effect probably
picked up by the living standards of families.

Lastly, the macro-econometric approach highlights the existence of a positive relationship
between, on the one hand, the level of regional HIV prevalence, and, on the other hand, the average
provincial monetary welfare of households. Consequently, the level of seroprevalence increases when
cardinal measurements of poverty decrease, or when the values of expenditure or the assets index of
households rise. At the same time, the relationship between HIV prevalence and poverty, apprehended
at the regional level, is not linear, and a minimal value of the HIV prevalence rate prevails for a
provincial poverty ratio of households of about 45 percent. Moreover, the estimate of spatial
econometric models seems to suggest an impact of the crisis in Côte d’Ivoire on HIV prevalence in
Burkina Faso, consecutively with the massive return of burkinabè migrants from Côte d’Ivoire – in
particular, since 2000 –, a country where seroprevalence is extremely high. Indeed, the coefficient of
the variable relating to migration – the percentage of households having had one or more adult members
who resided in Côte d’Ivoire during the previous 12 months – is positive and significant in almost all
the models.

Secondly, and correlatively, the relationship between HIV prevalence and poverty is called into
question. In the study, two series of factors are put forward to explain the positive (negative)
relationship between HIV prevalence and living standards (poverty) of households. First of all,
structural factors may affect the relationship between the resources of households and HIV prevalence.
On the one hand, the persistence of cognitive and behavioural factors inherent in the traditional social
system, in spite of the high rate of economic growth per capita which prevailed over the last two decades. In particular, the social construction of females’ attributes and roles is such that men often appear as « decision-makers » with regard to sexual intercourse, while the persistence of secular beliefs contributes to minimizing the perception of HIV in terms of risk, independently of living standards. In addition, the two geographical subdivisions where HIV prevalence is higher than the national average, have higher regional averages of expenditure per capita, and, to a lesser extent, lower poverty rates, compared to the other zones. Also, the landlocked specificity of Burkina Faso required development of road and railway traffic with neighbouring countries, in particular Côte d’Ivoire. So it is possible that the structural conditions of the processes of development, concomitant with significant flows of the exchange of goods, services and labour with a country where HIV prevalence is particularly high, constitute an element of explanation of the positive relationship between the resources of households and seroprevalence. Also, some factors related to the economic situation probably contributed to the reinforcement of the opposite relationship between HIV prevalence and poverty. Indeed, the macro-econometric analysis shows a direct relationship between the massive return of migrants from Côte d’Ivoire during the last 12 months – a country where seroprevalence is, on average, five times higher than in Burkina Faso –, and the level of HIV prevalence. In other words, the erosion of regional integration could increase the spatial diffusion of seroprevalence, a situation which is not specific to Africa.

Reference


HIV PREVALENCE AND POVERTY IN BURKINA FASO: ECONOMETRIC EVIDENCE


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–. 2004. Crise ivoirienne, envois de fonds et pauvreté au Burkina Faso, Bordeaux, Document de travail 90, Centre d’économie du développement, Université Montesquieu-Bordeaux IV.

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## Appendices

### Table A1: Statistics of the categorical principal components analysis based on the physical assets of households – Burkina Faso 2003

<table>
<thead>
<tr>
<th>Year</th>
<th>EDSBF 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Dimension</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

**Correlation between components and initial variables**

(i) **Dwelling**
- Main floor
- Type of toilet facility
- Source of drinking water
- Type of cooking fuel
- Electricity
- Betnet for sleeping

(ii) **Durable goods**
- Refrigerator
- Television
- Radio
- Bicycle
- Motorcycle/scooter
- Car
- Telephone

### Table A2: Regression coefficients of the determinants of HIV provincial prevalence – women aged 15-49 years, men aged 15-59 years – Burkina Faso 2003

<table>
<thead>
<tr>
<th>Model</th>
<th>Spatial error model – Dependent variable: HIV provincial incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Parameter</td>
<td>β</td>
</tr>
<tr>
<td>Constant</td>
<td>0.048</td>
</tr>
<tr>
<td>Poverty – P0</td>
<td>-0.199</td>
</tr>
<tr>
<td>Poverty – P0y</td>
<td>0.228</td>
</tr>
<tr>
<td>Poverty – P1</td>
<td>-</td>
</tr>
<tr>
<td>Poverty – P1y</td>
<td>-</td>
</tr>
<tr>
<td>Poverty – P2</td>
<td>-</td>
</tr>
<tr>
<td>Poverty – P2y</td>
<td>-</td>
</tr>
<tr>
<td>Gini expenditure/per capita²</td>
<td>0.038</td>
</tr>
<tr>
<td>Gini assets household²</td>
<td>0.007</td>
</tr>
<tr>
<td>Urbanization rate³</td>
<td>-0.034</td>
</tr>
<tr>
<td>Migration Côte d'Ivoire¹¹</td>
<td>-</td>
</tr>
<tr>
<td>Migration Côte d'Ivoirey¹¹</td>
<td>-</td>
</tr>
<tr>
<td>Expenditure/capita ha.</td>
<td>-</td>
</tr>
<tr>
<td>Assets index households</td>
<td>-</td>
</tr>
</tbody>
</table>

**Coefficients**

- Log likelihood: 118.07
- Adjusted R²: 0.176/271.71
- Heteroskedasticity: 0.890
- Breusch-Pagan spatial dependence: 9.89
- LR (error)²: 2.11
- LM (lag)²: 0.49
- Common factor test: 1.95

**Note:**
- * = significant at 0.01 percent level;
- ** = significant at 0.05 percent level.

Figure A1: Burkina Faso: Regions, provinces and HIV prevalence – 2003

Figure A2: Concentration curves of HIV prevalence of adults according to zones – Burkina Faso 2003
Figure A3: Predicted probability of HIV prevalence of men and women according to zones – Burkina Faso 2003

Figure A4: Predicted probability of HIV prevalence of adults according to sex – Burkina Faso 2003
Figure A5: Predicted provincial HIV prevalence – EDSBF 2003 – and provincial annual expenditure per capita – EBCVM 2003 – Burkina Faso

Figure A6: Predicted provincial HIV prevalence – EDSBF 2003 – and assets index of households – EBCVM 2003 – Burkina Faso
Notes

1. HIV is the Human Immunodeficiency Virus. AIDS is the Acquired Immunodeficiency Syndrome.

2. On a world level, in 2004, 39.4 million people lived with HIV – 36.6 million in 2002 –, a figure which includes the 4.9 million people recently infected during the year. In sub-Saharan Africa, in 2002, 24.4 million people were infected – 3.1 million new cases in 2004. In 2004, the prevalence of HIV was 7.4 percent in sub-Saharan Africa, against 1.1 percent on a world level (UNAIDS/WHO, 2004).

3. But, that hides disparities: the number of people contracting a new infection practically quasi-identical to the number of people who die of AIDS; variation of the spread and rhythm of infection according to zones, etc.

4. At the same time, many studies analyze the impact of the epidemic on development (Anand, Pandav, Nath, 1999; Were, Nafula, 2003; Moati, Coriat, Souteyrand, Barnett, Dumoulin, Flori, 2003; Neumayer, 2004).

5. The speeches of the President of South Africa, Thabo Mbeki, at the 13th international Conference on AIDS in Durban in 1999, fall into this context: « The world’s biggest killer and the greatest causes of ill health and suffering across the globe, including South Africa, is extreme poverty » (Horton, 2000).


7. Epithelial refers to the epithelium, i.e., the tissue formed of one or more layers of cells, and which covers the body – skin –, the internal cavities – mucous – or constitutes glands.

8. For example, individuals having a certain level of education have probably a greater capacity to understand the effectiveness of certain types of protective behaviour, like the use of condoms, the absence of contacts with prostitutes, and prudence with blood transfusions. This argument, and the fact that HIV arrived later in Asia than in Africa, explain the specificity of the epidemic in the former continent. In Asia, the wealthiest segments of the population were informed earlier of the risks, and had more time to protected themselves, compared to Africa.

9. The coefficient of Pearson is 0.29 (p = 0.07).

10. The sample is restricted to 32 countries, and the coefficient of Pearson is 0.04 (p = 0.82).

11. The principal characteristics of the latter are indicated hereafter.

12. There are some differences between information resulting from the file provided by ORC Macro and the publication by the INSD/ORC Macro (INSD/ORC Macro, 2004). In fact, the file provided by ORC Macro contains 8,969 cases, of which 86.9 percent were tested – 7,790. However, the publication of the INSD/ORC Macro indicates 8,559 cases. So the file of ORC Macro generates slightly different answer rates: 91.1 and 75.2 percent, respectively, in rural and urban areas, and 90.0 and 83.3 percent, respectively, for women and men.

13. Data are not reproduced, but comments will be presented later on.

14. Data bases of EDSBF 2003 provide an assets index elaborated according to the same procedure. However, in the absence of information concerning this index, it was decided to build another one. Let us indicate that the comparison of the two indices does not lead to major variations, except, to a lesser extent, for the poorest.

15. The determination of the assets index is carried out using the file relating to households.

16. For each asset, the enumeration of the categories follows an order of decreasing precariousness.

17. The analysis in nonlinear principal components is carried out with SPSS which is based on the use of the program worked out by the Dated Theory Scaling System Group from the Leiden University in the Netherlands. Moreover, the method of standardization optimizes the range of the variables.

18. The group of the « poor » is made up of the first 40 percentiles of the distribution of households’ assets, while that of the « middle » includes the distribution of the 41th to the 80th percentile.

19. The principal characteristics of the latter are indicated hereafter.

20. The fact that EBCVM 2003 was carried out in a pre-harvest period, and EDSBF 2003, partly, in a post-harvest period, do not seem to have, a priori, any incidence on the validity of the results of this study.

21. Indices of the Foster, Greer and Thorbecke class – incidence, intensity and inequality. In 2003, national poverty rates were 37.5 and 46.4 percent, respectively, for households and individuals. See Lachaud (2003) for an analysis of Priority Surveys II (1998) and III (2003).

22. For an application of these models in the case of Burkina Faso, see Lachaud (2003).

23. In this case, the assets index is elaborated with the data of EBCVM 2003.

24. The latter variable makes it possible to test the impact of the crisis of Côte d’Ivoire on HIV in Burkina Faso. Indeed, HIV incidence being 10 percent in Côte d’Ivoire, the return of migrants may have an effect on the prevalence of the virus in the neighbouring country.

25. A pilot survey was carried out beforehand in Ouagadougou. Moreover, the result of the HIV test was anonymous and was not communicated in the field. The formation, the work in the field and the procedures of the laboratory are described in INSD/ORC Macro (2004).

26. As previously indicated, there are some differences between the files provided by ORC Macro and what is indicated in INSD/ORC Macro (2004).

27. For example, the following assumptions are made: same prevalence ratios for all women, pregnant or not; a ratio of 1.3 women infected for one man; time of survival of adults of approximately nine years (UNAIDS/WHO, 2004).

28. Non-response rates vary between 24 and 42 percent, according to UNAIDS/WHO (2004), which is much higher than in the case of Burkina Faso.

29. Nutritional anchoring is carried in respect of four essential products: millet, sorghum, corn and rice. That means that the basket of goods was not given according to the food expenditure of the reference household.

30. In this case, the non-food poverty line was not carried out by the estimate of an Engel curve, but by applying a coefficient related to the ratio of the food and non-food expenditure. Let us notice that this ratio relates to the whole of each category of expenditure, whereas the ratio referring to expenditure of the poorer part of the population would have been more suitable.

31. Some elements of table 1 appear in INSD/ORC Macro (2004), although minor differences are to be noted.

32. In this context, the impact of sexual violence and prostitution on HIV prevalence is often highlighted.

33. The sample of individuals used relates to only those who were tested – positive or not.
34. It is possible to check the dominance of a concentration curve $L'(s)$ on another $L'(s)$. If $L'(s)$ is everywhere closer to the diagonal than $L'(s)$, the HIV inequality apprehended by $L'(s)$ is unambiguously lower than that relating to $L'(s)$.

35. It is to be noticed that $C$ can also be estimated in relation to the relative index of inequality $RII$. Indeed, one shows that $RII$ is the regression coefficient related to the prevalence rate of HIV, $\mu/\mu_0$, with its relative rank, $R$. In fact, $RII$ and $C$ are connected by $\beta = C/2n^2\sigma_x^2$, where $\sigma_x^2$ is the variance of $R$. If these two approaches produce comparable results, the concentration curve is more interesting insofar as it allows graphic comparisons. The concentration index, noted $C$, is equal to twice the areas between $L(s)$ and the diagonal:

$$C = 1 - \frac{1}{n} \int_0^1 L(s) ds$$

[1]

where $C = 0$ when $L(s)$ coincides with the diagonal, and is negative (positive) if $L(s)$ lies above (below) the diagonal. In the study, the inequality of HIV prevalence is apprehended using individual data, compared to the living standard of households in terms of assets whose relative rank is noted $R$. That is to say $x(s) = 1, ..., n$ the score as regards health of the $i$th individual – an HIV prevalence rate. The $n$ individuals are ranked by living standard of the households in terms of assets, beginning by the poorest individual. So the concentration index can be calculated as follows:

$$C = \frac{1}{2n\mu} \sum_{i=1}^n x_i R_i - 1$$

[2]

where $\mu = 1/n \sum_{i=1}^n x_i$ indicates the average of the score as regards infection of the virus. See Kakwani, Wagstaff, van Doorslaer (1997), when the inequality of health is apprehended using grouped data.

36. It is pointed out that the response rate of the test was 89.3 percent of the selected sample, and the absence of a test is due to: (i) refusal: 5.4 percent; (ii) absence: 3.2 percent; (iii) other cases: 2.1 percent.

37. It is to be indicated that taking into account the quadratic effect of the assets index of households in models (2) and (3) makes the latter non-significant. So the term with the square of the assets index – increased by a constant to neutralize the negative values – is not added in the various estimates.

38. This distribution is a function of the individuals ranked and beginning by the poorest. If one takes into account the stratification of households in terms of the assets index, the distribution is very slightly different: (i) the poor and very poor: 18 percent; (ii) middle inferior and superior: 42.9 percent; (iii) rich: 39.1 percent. This disparity is explained by the fact that the assets index has been elaborated at the household level.

39. This result is coherent with information contained in the descriptive analysis of the report of EDSBF 2003, the latter indicating that HIV prevalence is highest in the age bracket of 35-39 years old – 3.4 percent – (INSD/ORC Macro, 2004).

40. In 2003, 28.8 percent of the household heads were polygamous.

41. This does not exclude that in some provinces bordering on other countries, HIV incidence is not higher than the national average. For example, in Kompienga and Tapoa, seroprevalence is, respectively, 6.4 and 2.4 percent.

42. Variety of beans.

43. Standard models of regression and the tests of spatial dependence – 1 of Moran, and Lagrange, for example – are not presented.

44. Several strategies of this variable were tried in the econometric equations, without success: number of adults per capita and household having resided in Côte d’Ivoire during the previous 12 months; number of adults per household having resided in Côte d’Ivoire during the previous 12 months, etc.

45. Tests for simultaneity were carried out starting from the test of specification of Hausman. For example, in the model (1) of table 3, the variable relating to migration was regressed with expenditure per capita, Gini index of expenditure per capita, and urbanization rate. The residues obtained were then integrated in the equation (1). A test of the null hypothesis of absence of simultaneity is rejected with one percent, i.e., the coefficient of the residues is not statistically significant $t = 0.131; p = 0.896$.

46. Migrants from Côte d’Ivoire can repatriate resources contributing to raising those of the households where they live.

47. 0.9 and 1.9 percent annually, respectively, during periods 1983-1993 and 1993-2003.

48. In this respect, a study showed that the price of many non-patented anti-retroviral drugs, made in India or Thailand, were often at least as expensive as those manufactured by laboratories of developed countries (Adelman, Norris, 2005).

49. Approximately three quarters of adult women.

50. In 2000, an investigation into HIV prevalence among sex workers of Bobo-Dioulasso showed that 55 and 31 percent of the prostitutes, respectively « seaters » and « roamers » were HIV positive (UNICEF, 2004).

51. In particular, the degradation of the terms of trade.

52. In particular, corruption at the levels of public expenditure and the process of privatization.

53. Events of October 24-26, 2000 – in Abidjan and in the whole of the country –, and incidents of December 4-5 of the same year involved many exactions.

54. The promotion of the concept of « Ivoirity », revealing of the rise of nationalism, and the methods of the various politico-military transitions showed the weakness of the political institutions.

55. In particular, corruption at the levels of public expenditure and the process of privatization.

56. Events of September 2002 led to partition between the North, supported by the « rebels », and the South, under the official authorities.

57. Nationalism in Côte d’Ivoire involves a regulation of migratory flows, a reform in favour of the « autochthonous » of the liberal system of access to the land, and a regulation of the participation of foreigners in elections.