

**2011 ANNUAL MEETING OF THE  
POPULATION ASSOCIATION OF AMERICA**

*Washington, DC March 31 – April 2*

***Accounting for Reversals in Child Mortality in Africa: The Role of Economic Trends, Policy and Demographic Transitions***

*by*

***Gervais BENINGUISSE<sup>1</sup>, Parfait ELOUNDOU-ENYEGUE<sup>2</sup>, Pierre NSOA MBONDO<sup>1</sup>,  
Patrice TANANG TCHOUALA<sup>1</sup>***

**Abstract**

During the 1990s, many African countries experienced a resurgence in child mortality, at the same time they were undergoing a period of demographic transition, economic decline and/or structural adjustment. This confluence of events raised key theoretical and practical questions about demographic dividends and about the prospects for these African countries to achieve their Millennium Goals in health. Our paper examines the drivers of recent trends in under-5 mortality, focusing on the contributions of demographic and economic forces, as well as national policy. The analyses combine national socioeconomic statistics with data from DHS surveys in 22 Sub-Saharan African countries representing contrasted economic and demographic regimes. The methodological approach combines decomposition analysis with regression. The results show that, for the majority of the countries studied (19 out of 22) the trends in under five mortality are predominantly driven by changes in health infrastructure. In a minority of countries (3 countries out of 22), these trends reflect compositional effects, specifically change in the proportion of children living in poor households, as a result of uneven fertility transitions.

---

<sup>1</sup> IFORD (Yaounde-CAMEROON).  
<sup>2</sup> CORNELL UNIVERSITY (USA)

## INTRODUCTION

Between the early fifties and the late eighties, Africa gained an average 13 years of life expectancy and infant mortality dropped by half (Hertrich, 2006). These gains stemmed from the application of proven medical innovations from industrial nations, such as mass vaccination. In this respect, all world countries, even the poorest have begun the first phase of demographic transition, i.e. a decline in infant mortality (Ouedraogo, 2007). However, the early nineties witnessed a reversal in child mortality trends, as many countries saw their progress stall or reverse. With the exception of North Africa where progress is continued, the continent is witnessing a slow-down, stagnation or even reversal in trends (Hertrich, 2006). More broadly, several countries have recently seen important stalls in their demographic transitions, whether fertility (Bongaarts 2005) or child mortality (UNICEF 2008).

Because these stalls contradict expectations from classic demographic theory, they raise new questions about their causes and future trajectory. While studies have begun to investigate the stalls in fertility transitions (Bongaarts 2005), similar investigations of mortality reversals is lacking, despite a wealth of cross-sectional studies of mortality determinants (Barbieri 1991; Akoto 1993; Dackam-Ngatchou 1993; Dackam Ngatchou, Gubry, and Ngwe 1993; Rakotondrabe 1996; Brouckerhoff and Hewett 2000). This research gap is unfortunate, given the putative role of mortality in triggering fertility transitions (Legrand 2005), the scientific interest in unique features of Africa's demographic transitions (Kirk and Pillet 1998; Schoumaker and Tabutin 2004), and the policy interest in reducing global child mortality under the aegis of Millennium Development (UN 2001). For sub-Saharan Africa to approach the UN target of "*reducing the under-five mortality rate by two thirds between 1990 and 2015,*" efficient policies are needed. These, in turn, require understanding the reasons for recent setbacks in child survival in some African countries.

Many sub-Saharan African countries actually witnessed an increase in infant mortality between 1990 and 2000. In theory, this surprising trend can be explained by a range of plausible influences –namely economic downturns and structural adjustment, selective fertility transitions, political unrest, or the HIV/orphans crisis—but the relative contributions of these factors is poorly understood. This paper examines two research questions:

- (1) To what extent do these recent trends in infant mortality reflect economic versus demographic change?
- (2) If socio-economic conditions are the main driver, do they work through a composition effect (change in the proportion of children in poverty) or a behavioral one (change in the health penalty associated with socioeconomic status).

The paper is structured as follows: After describing the context of this study, we review selected theoretical perspectives on mortality and inequality before presenting the methods and data. The main findings are presented before concluding with political implications.

## STUDY CONTEXT

In the last two decades, Africa has witnessed a variety of social transformations. Schooling has risen substantially --albeit selectively—but this was followed by rising unemployment. Countries have increasingly embraced multi-party politics but this transition has itself often bred internal conflict and violence. More relevant to this paper, Africa has seen a decline in average fertility rates from 6.3 children per woman in 1990 to about 5 today. In theory, these various changes could all affect child health, especially those under five.

Looking at the long historical trend, Africa saw a sharp drop in infant mortality between 1962 and 1972. Progress slowed down between 1972 and 1992, and it is especially in the nineties that Africa's lag vis-à-vis other regions became more clear, as it registered a 10% drop between 1992 and 2002 as against 25% in all other regions (Tabutin and Schoumaker, 2004)<sup>2</sup>. This downturn is most evident in countries like Burkina-Faso, Cameroon, Cote d'Ivoire, Kenya, Nigeria, Tanzania, Zimbabwe and Rwanda, where these trends have been often connected to the rising poverty in the context of weak states and decaying health infrastructure.

There is of course great regional variation in these trends. Progress has been stronger or more consistent in southern and Eastern Africa, slower in West Africa, and quasi absent in recent years in Central Africa. With a 52‰ rate of infant mortality, Southern Africa is still ahead, but its progress has been slowed by the spread of HIV/AIDS and the extent of mother-to-child transmission. At the other extreme, Central Africa has the highest mortality (116‰) and shows little progress. Eastern and West Africa still progress, though quite slowly (Tabutin and Schoumaker, 2004).

Despite the remarkable economic growth recorded these last years in sub-Saharan Africa (about 5-7% per year during the years 2000, against 3-4% in the nineties). Sub-Saharan Africa remains highly affected by the economic crisis and structural adjustment programs<sup>3</sup> of the nineties which increased poverty and urban unemployment (CEA, 2009). Recent estimates indicate that the rate of poverty in sub-Saharan Africa remains at 50% almost that of the nineties (Ravallion and Chen, 2009<sup>4</sup>)

This economic crisis and its austerity programs can affect the health of children through two channels. At the macro-economic level, they affect health budgets whose share in national budgets

---

<sup>2</sup>The Demography of Sub-Saharan Africa from the 1950s to the 2000s (2004); *Population*, 59 (3-4), pp. 521-622

<sup>3</sup> For example in Cameroon in 1994 these programs were obvious through salary cuts in the public service (major employer in the country) attaining 65% and a 50% currency devaluation.

<sup>4</sup> Ravallion, M and Chen, S. (2008), " The developing world is poorer than we thought, but no less successful in the fight against poverty.

dropped sharply after 1994. In most of these countries, this share fell below the 10% threshold recommended by the World Health Organization (WHO). At the individual level, they have impoverished households, thus weakening their capacity to access healthcare in a context where most lack health insurance. Inasmuch as this economic downturn inordinately affects the poor, the inequalities in infant mortality could increase.

The cross-national diversity and non-linearities in the observed economic and demographic trends creates a good opportunity to study the sources of changes in infant mortality. Infant mortality dropped in some countries (Senegal, Ghana, Madagascar, Malawi, Mali, etc) while stalling or reversing in others (Cameroon, Burkina-Faso, Cote d'Ivoire, Kenya, Liberia, Nigeria, Rwanda, Tanzania and Chad). Within each of these two groups, marked differences in economic fluctuations were also noted. Demographic and sociopolitical factors were also important, including selective declines in fertility, socio-political instability or increased prevalence of orphanhood. Departing from the universally high fertility levels of the 1980s, there is now wide variation across countries in birth rates<sup>5</sup> (Tabutin and Schoumaker, 2004). In particular, there have been rapid declines in fertility in Southern Africa (South Africa, Zimbabwe, Botswana) and in Ghana and Kenya, but a much slower decline (a drop of about 1 child per woman) in most countries, and finally, stagnations or even slight increases in a few countries of Central and West Africa, with Niger now holding the world fertility record, with 8 children per woman.

Adding to changes in birth rates, there have been remarkable changes in family structure, resulting from delays in family formation and the dissolution of unions, as well as increased adult mortality. Together, these three forces have changed household environment in which children are raised. DHS data show a sustained increase in the proportion of children below five who are orphaned by one or both parents (5.5% in 1991, 6.7% in 1998 and 7.6% in 2004 for Cameroon, 4.1% in 2003 for Burkina- Faso and 12.6% in 2005 for Senegal. Inasmuch as changes in family structure occur unevenly across socioeconomic groups, they might affect inequality in mortality.

## THEORETICAL BACKGROUND

Models of child mortality typically incorporate multi-level influences, including policies, community context, family resources, parental characteristics, and individual factors (Masuy-Stroobant, 2002). At the national level, public health policies directly shape the availability /access to health care and public sanitation, but socioeconomic policies also work indirectly through literacy, health behavior, and standards of living. At the community level, the availability of basic social services and infrastructure (markets, running or drinkable water, electricity, health and family planning services, etc.) has direct or indirect influences on child mortality as well. At the household level, family resources (money and the presence of caregivers) are influential. At the individual level, parental characteristics such as education, income, or occupation have been shown to be influential. Important maternal characteristics, including age at birth, nutritional status, number and spacing of births, psychological profile and health-seeking behavior. Finally, relevant characteristics for

---

<sup>5</sup> Besides some countries in which sterility was then high, namely, Gabon and the Central African Republic, or regions such as the north of D.R. Congo or Cameroon (Evina, 1994; Larsen, 1994).

children include their birth weight, duration of gestation, the presence of congenital anomalies and gender.

Theories of SES-related inequality in child mortality differ on whether they emphasize selection or causal arguments (Willems and De Maeseneer 2007). The former posit a systematic filtering during the process of social mobility: People are selected by health as they move up or down the socioeconomic ladder. Selection can be direct, with healthier individuals experiencing upward mobility while those in poor health fall. It can also be indirect, if selection arises because both mobility and mortality are influenced by a common set of precursors. Causal arguments, on the other hand, imply that individual SES does affect health, via influences that can be structural (living conditions, neighborhoods..) or cultural/behavioral (knowledge, attitudes, values, lifestyle, ..).

Several theories and frameworks clarify these influences. Meegama (1980) for instance emphasizes biological determination, focusing on the main infectious diseases and their socioeconomic causes. However, the causal mechanisms put forth remain highly age-and-cause-specific, and the analysis is narrowly centered on micro-level outcomes. Garenne and Vimard (1984) extend discussion beyond individual socioeconomic conditions and they address political and ecological context. They make no distinction between various causes of death and instead, distinguish five groups of variables operating at different levels. Mosley and Chen (1984) also distinguish independent from intermediate variables, but they group their independent variables into individual, household, and community-level variables, in a framework that integrates social and bio-medical perspectives. Palloni (1985) further advances thinking in this area by stressing policy-relevant factors, so that research findings can be more effectively linked to policy. He outlines three levels of intervention: macro-policy emphasizing social intervention (education campaigns and public subsidization); individual, household and community-level policy emphasizing individual behavior and lifestyle (maternal education, resources and living arrangements, ecological environment, health services and access); and policies that affect exposure, including exposure to infectious diseases, individual susceptibility, and resistance to disease.

Together, these perspectives highlight the variety of influences on mortality. The empirical challenge, especially in policy research, is to assess the relative importance of these influences. When exploring the influences of economic conditions, it is useful to distinguish the effects of changing poverty rates from those of the changing vulnerability of the poor (Clappier, Leray, Piquet & Trehony, 2006). The first captures change in the distribution of people across SES groups, while the second captures changes in group-specific mortality. Because these two components call for different policies –economic redistribution versus general improvement of health services and infrastructure—their relative importance merits attention. The methods in this paper are designed to separate these complementary influences.

## **DATA AND METHODS**

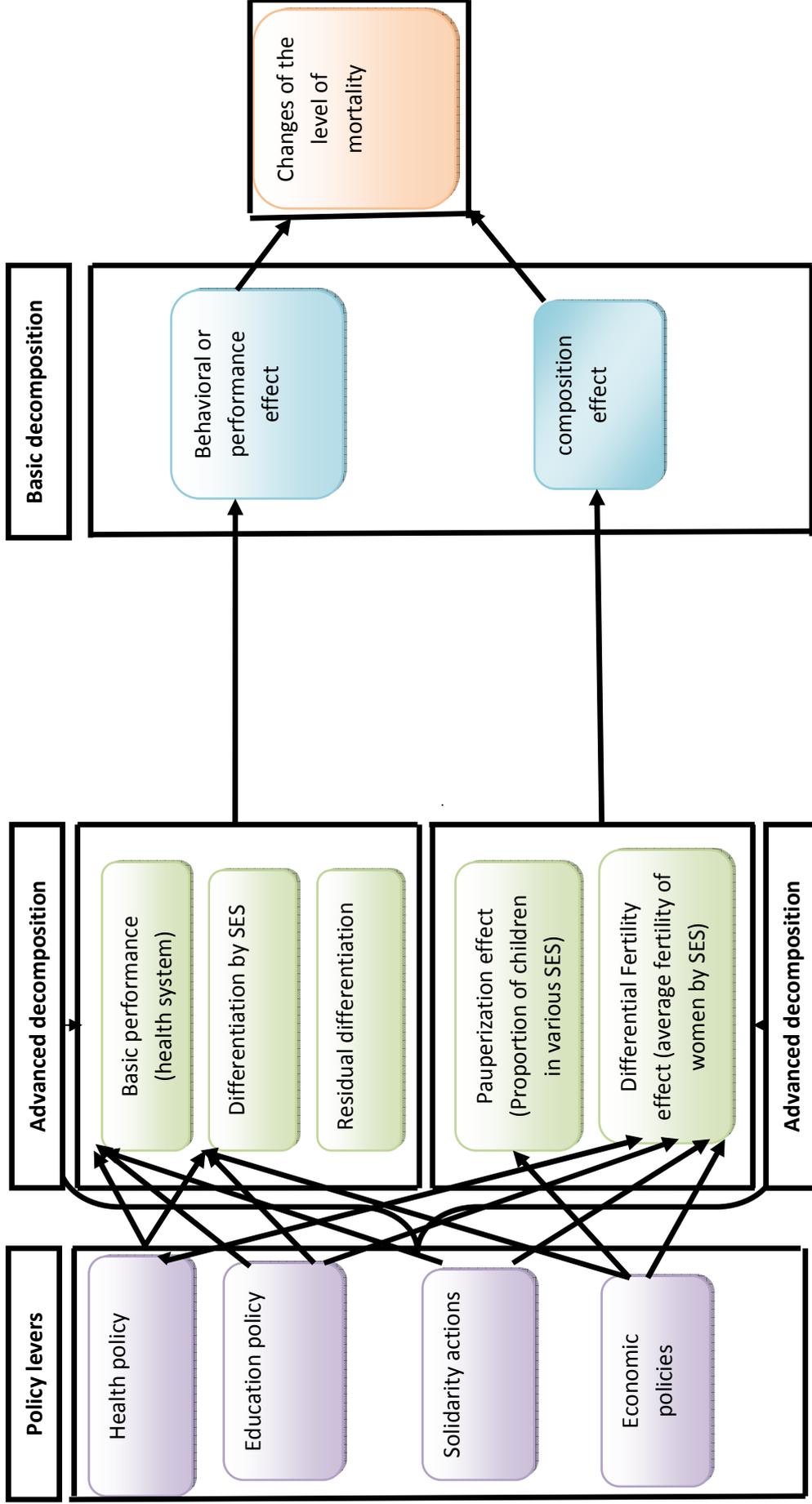
### **Decomposition methods**

Our analysis combines decomposition and regression methods. The use of decomposition makes it possible to divide the historical trend of under-five mortality into a) composition effects (change in the distribution of children across different socio-economic categories) and b) behavioral effects (changes in SES group-specific mortality). This basic decomposition can be refined by further splitting the composition effect into the effects of (a1) change in the proportion of poor families and (a2) change in the relative fertility of poor families. Likewise, the behavioral effect can be split into three component that reflect (b1) changes in the baseline mortality (the intercept  $\alpha$  in regression terminology), (b2) changes in the SES gradient of mortality (the slope  $\beta$  in regression terminology) and b3) changes in the residual (the error term  $e$  in regression terminology).

One can make a systematic link between these five terms and their corresponding policies. For instance, changes in the public health policy are most likely to affect (b1), i.e., the baseline mortality risks. The quality of public health care, public sanitation, water supply, or mass vaccination programs are key elements in this regard. On the other hand, changes in social solidarity systems, public assistance and economic transfers would most likely affect the mortality gradient associated with SES (the b2). As another example, population policies would affect changes in the relative size of families. Insomuch as population programs make contraception available to the poor, they are likely to reduce differences in fertility outcomes across various SES groups (the a2) terms. These various connections are summarized below.

# CONCEPTUAL FRAMEWORK

*Relationship between the decomposition outcomes (basic decomposition and advanced decomposition) and policy levers.*



This basic decomposition can be formally expressed as detailed in Eloundou-Enyegue and Giroux (2010). Given information on the proportion of children in various SES groups at a given time ( $w_{jt}$ ) and on the average mortality level among children in each group at that time ( $y_{jt}$ ), the national

mortality among children is  $Y_t = \sum w_{jt} * y_{jt}$ , and its change over time is

$$[1] \quad \Delta Y = \left[ \sum \bar{y}_j * \Delta w_j \right] + \left[ \sum [\bar{w}_j * \Delta y_j] \right]$$

Composition effect (A) + Behavioral or performance effect (B)

Where barred variables are averages over two time points (e.g. :  $\bar{y}_j = ([y_{j(t+1)} + y_{j(t)}] / 2)$ ).

Decomposition [1] expresses the total variation due to composition change and that due to “performance / behavior” among the different socio-economic classes.

It then becomes possible to extend this formulation by expressing the performance of a given group ( $j$ ) as a function of one or several other predictors. In a single-variable, linear model for instance,

$$y_j = \alpha + \beta x_j + \mu_j \quad [2]$$

where the intercept  $\alpha$  represents the baseline mortality,  $\beta$  is the increase in mortality associated with the unit increase in the variable X (here SES),  $\mu_j$  the error terms, which could also be interpreted as the relative overperformance /underperformance of the group, or the residual effect of other factors not considered in the analysis.

In this case, a change in the value of  $y_j$  between two periods is obtained as such:

$$[3] \quad \Delta y_j = \Delta \alpha + \bar{\beta} \Delta x_j + \bar{x}_j \Delta \beta + \Delta \mu_j$$

When category definitions of  $x$  do not change between years 1 and 2, the second term of this equation is 0, and  $\bar{x}$  is equal to  $x$ . The equation is thus reduced to:

$$[4] \quad \Delta y_j = \Delta \alpha + x_j \Delta \beta + \Delta \mu_j$$

By inserting [4] into [1], we obtain:

$$[5] \quad \Delta Y = \left[ \sum \bar{y}_j * \Delta w_j \right] + \left[ \sum \bar{w}_j * \Delta [\alpha] + \underbrace{\left[ \sum w_j * x \Delta \beta \right] + \left[ \sum w_j * \Delta \mu_j \right]}_{B2 \quad B3} \right]$$

A                      B1                      B2                      B3

Composition effect + Behavioral effect

This decomposition, which is more refined, splits the behavioral effect into the three sub-components already discussed before, including the effects of change in baseline mortality (B1), the SES gradient (B2) and the residual effect of other variables (B3).

The composition effect can be likewise disaggregated. Thus the proportion of children in poor households ( $w_j$ ) is based on the number of poor households ( $n_j$ ) and on fertility of poor households ( $f_j$ ) which is the fertility of the poor with respect to national average.

$$[6] \quad w_j = n_j * f_j$$

The change in the proportion of children from each of the socio-economic groups would depend on the change in (1) the proportion of households belonging to the different social categories and (2) the relative fertility of each household as follows:

$$[7] \quad \Delta w_j = \bar{f} \Delta n_j + \bar{n} \Delta f_j$$

We thus could insert [7] into [1] to obtain

$$[8] \quad \Delta Y = \underbrace{\left[ \sum \bar{y}_j * \bar{f} \Delta n_j \right]}_{A1} + \underbrace{\left[ \sum \bar{y}_j * \bar{n} \Delta f_j \right]}_{A2} + \left[ \sum \bar{w}_j * \Delta y_j \right] B$$

Composition effect
Behavioral effect

In this equation, A1 represents the change in the proportion of poor households within the population, while A2 represents the change in relative fertility of different socio-economic categories. One could then insert [8] into [5], yielding a much longer formulation not presented here because of its length.

Before we move to the analysis, it is worth discussing the strengths and limitations of this approach. Its basic strengths are its simplicity, flexibility, ease of interpretation, and compatibility with other methods (Eloundou and Giroux, 2010). It is simple both in its explication and application; it can flexibly incorporate other elaboration, and it is easy to interpret and discuss with policy audiences. Its major weakness, however, is that it only offers a partial solution, offering just a beginning of explanation. Knowing that 80% of the national change in child mortality is related to a compositional change is useful but insufficient. Because the regressions used in the second stage of the decomposition are very crude, they only describe associations rather than causes. As such the resulting decomposition analyses only describe the sources (not the causes) of change. In other words, this provides a way to *account for*, rather than *explain* the change in child mortality.

Complementary analyses were run to relate the etiology of change to contextual characteristics of countries. Specifically, we use the results of the decomposition analysis as dependent variable in a secondary analysis to see how these results are indeed correlated to change in the policy and contextual variables identified in the conceptual framework. In other words, we

examine the way the relative importance composition versus behavioral influences varies from one country to the next based on contextual characteristics. Given the small number of cases of analyzed (38 country-periods), this analysis must be considered mostly exploratory. The contextual variables examined here are related to 1) the healthcare system: (modern contraceptive prevalence and % of the rural population with access to improved water source), 2) education policy (proportion of women between 15-49 years with at least elementary school level), 3) economic policies (Gross National Income per capita and the share of income by the 20% poorest of the population). Similar analyses based on a larger number of cases will be explored later.

### **Data sources and variables**

Data for the decomposition are drawn from Demographic and Health Surveys (DHS) fielded in sub Saharan Africa between 1990 and 2009. The 22 countries included in the study are those who fielded at least two surveys to study the changes. The major analytical variables include the socio-economic status of the household and under five mortality rates. The socio-economic status was built within a multi-dimensional approach, through the application of the principal component analysis from the variables related to dwelling characteristics (materials of the roof, floor, walls, source of water supply, type of leisure, presence of electricity) and to the ownership of durable consumer goods (vehicle, bicycle, motorcycle, refrigerator, telephone, televisions etc). The first component, explaining the greater part of the variance, has thus been retained to classify households in quintiles, from the poorest to the richest. Other information incorporated in the analysis to refine understanding of compositional effects includes the proportion of women in each SES group and their total fertility rate.

## **MAIN FINDINGS**

### ***Trends in under five mortality***

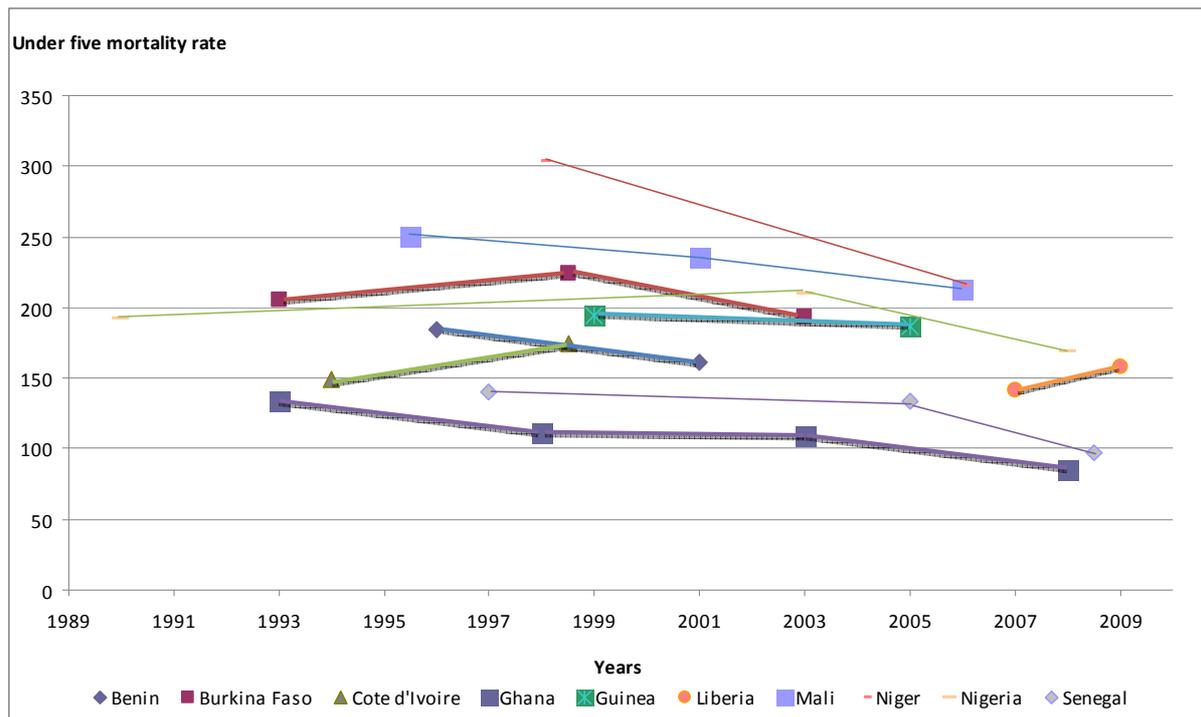
The trends in infant and child mortality vary substantially between regions at different levels: while the progress has continued in some countries, it slowed down or even reversed in others. Reversals were most common in the 1990s but mortality declined in the last decade for most of the countries. The detailed results by sub-region are given below.

### ***West Africa***

The analysis of ten (10) countries reveals two patterns of evolution (Figure 1): Either a substantial or minor drop (in 6 countries: Benin, Ghana, Mali, Niger, Senegal and Guinea) or reversals eventually followed by a resumption of the decline (observed in 4 countries (Liberia, Côte d'Ivoire, Nigeria and Burkina Faso).

Niger and Mali have the highest mortality record in the sub-region with respective levels of 304‰ and 251‰ in the nineties then 216‰ and 213‰ in the years 2000. However, Niger recorded the most spectacular drop between the nineties and 2000 (-88,4 points in eight years). At the other extreme, Ghana and Senegal have the lowest mortality of the sub-region levels below 100‰.

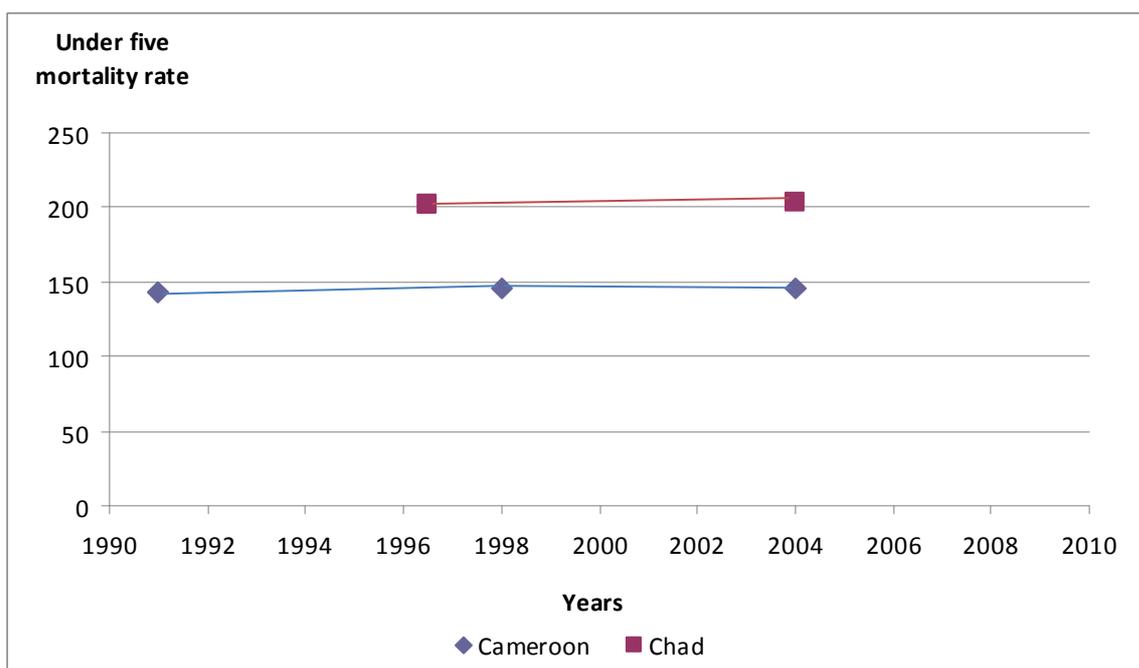
**Figure 1 : Trends in under five mortality rates between 1990 and 2009 in West Africa**



**Central Africa,**

Central Africa (at least the two countries represented here) has recorded the highest mortality rate on the continent. The analysis of infant and child mortality trends between 1990 and 2000 in the two countries represented shows a slight increase in Chad (from 202‰ in 1996-97 to 204‰ in 2004) and a non-monotonic trend in Cameroon (slight increase in the nineties followed by stability in the 2000 decade) (figure 2).

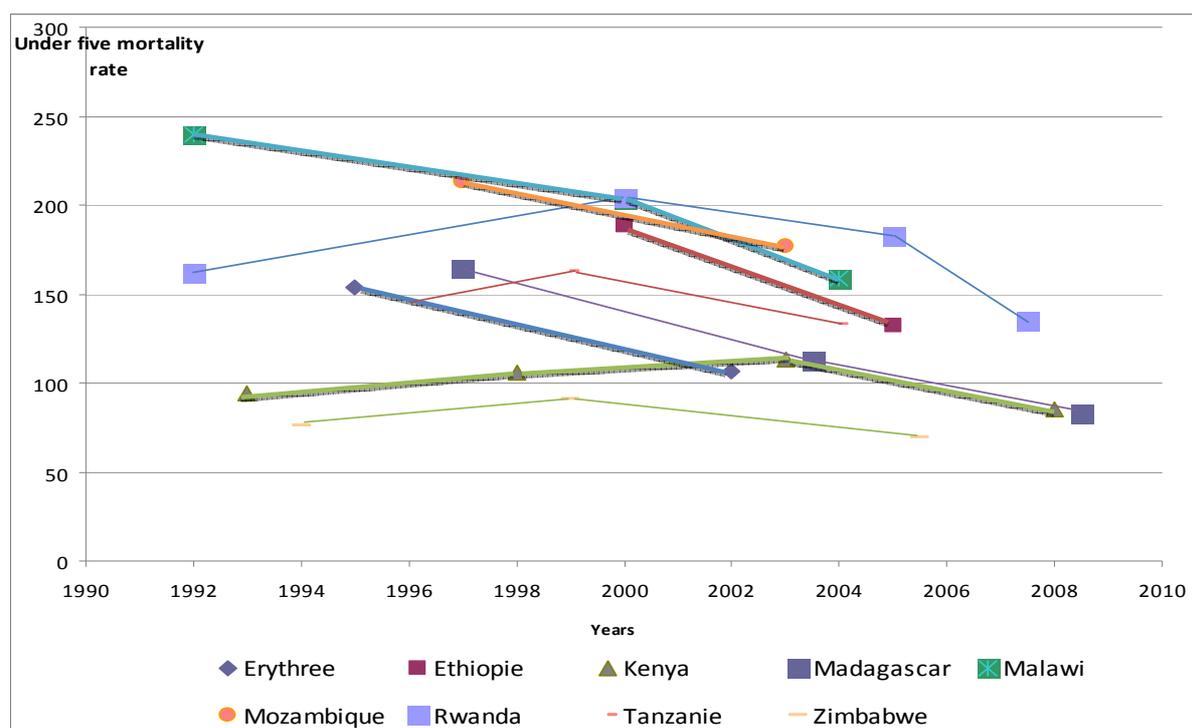
**Figure 2 : Trends in under five mortality rates between 1990 and 2009 in Central Africa**



### Eastern Africa

The trends in Eastern Africa fall into two major patterns (figure 3): either a steady decline, witnessed in five countries (Eritrea, Malawi, Ethiopia, Madagascar and Mozambique) or a reversal followed by a fall in mortality, a pattern observed in four countries (Kenya, Tanzania, Zimbabwe and Rwanda).

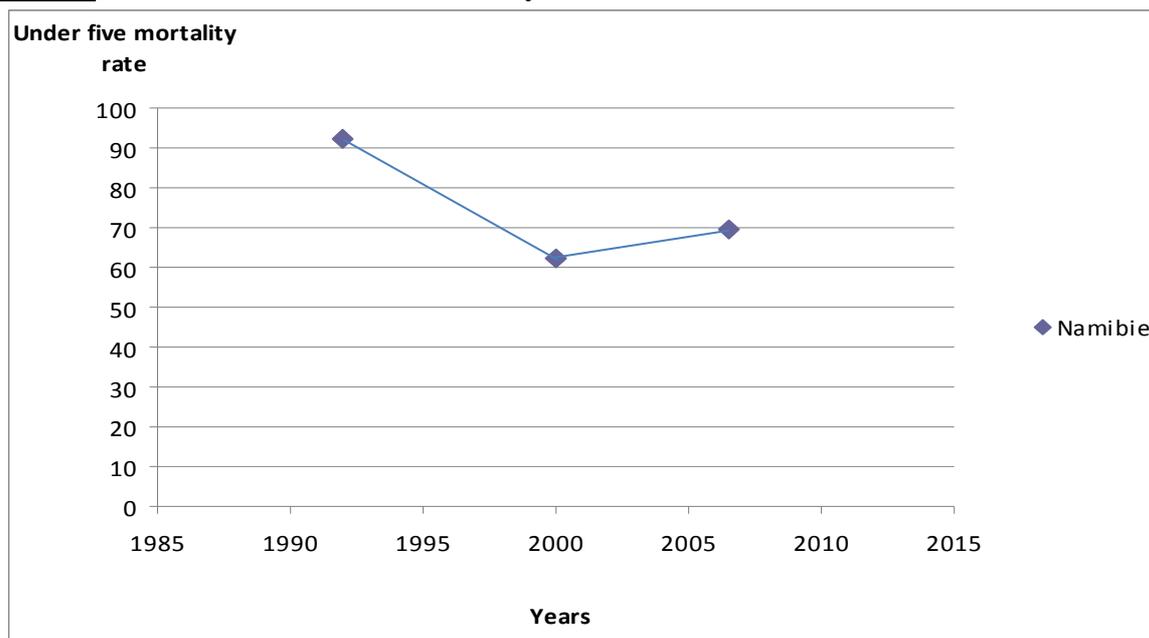
**Figure 3 : Trends in under five mortality rates between 1990 and 2009 in Eastern Africa**



### Southern Africa

Generally, Southern Africa's decline in mortality has been stalled by the spread of AIDS (and the advent of mother-to-child transmission of HIV). This sub region is represented here by Namibia where we witness a reversal through a drop (drop followed by an increase). After a substantial drop in the infant and child mortality rate (from 92‰ in 1992 to 62‰ in 2000), rates have risen back up to 69‰ in 2006 (figure 4).

**Figure 4 : Trends in under five mortality rate between 1990 and 2009 in Namibia**



## Decomposition results

### a) Basic decomposition

Basic decomposition results (Table 1 and 2) underscore the preponderance of behavioral influences, with the exceptions of Cameroon (1991 to 1998), Ghana (1998 to 2003) and Chad (1996-97 to 2004) where composition was instead dominant. In most study countries (19 countries out of 22), changes in group-specific mortality is the major source of change in infant and child mortality observed. In other words, it reflects a real change in mortality within various socioeconomic groups. Within the remaining three countries, it is rather the change in the distribution of children among socio-economic categories which drove the change. Thus, in Cameroon an increase in under five mortality between 1991 and 1998 results essentially from an increase in the proportion of children living in poor households. In Chad however, the increase witnessed between 1996-97 and 2004 come instead from an increase in the proportion of children living in middle and upper SES groups. In Ghana, it is rather a decrease in the proportion of children living in poor households that generated the decrease in infant and child mortality between 1998 and 2003. Following this basic decomposition, we now present the findings from a more refined decomposition that splits the behavioral influences into its three components (the baseline mortality, the SES gradient, and the residual) as well as the compositional influence into its two components (changing distribution of families in various SES categories versus changes in the relative fertility of these families).

### b) Advanced decomposition

One can see from this advanced decomposition (Tables 1 and 2) that the observed change (drop or increase in under-five mortality), when driven by a behavioral change, typically comes as result of trends in baseline mortality, whether it increases or declines. Important exceptions are found in Kenya (1998-2003 period) and Tanzania (1996-1999 and 1999-2004/05 periods) where it is the change in SES gradient that mattered most. Therefore, it is the general performance of the health

system [and its ability to provide mass gains for the overall population] which is the major source of change in infant and child mortality. Only for Kenya and Tanzania does the differential change in the likelihood of mortality predominate. The rising mortality in Kenya (1998-2003) and in Tanzania (1996-1999) is largely due to increased risks of dying among the poor, middle or high-SES groups. The declining rate of mortality in Tanzania between 1999 and 2004/05 is mostly linked to a decrease in the risk of dying among socio-economically disadvantaged categories.

In Cameroon, Chad and Ghana and periods where change in level of infant and child mortality is preponderantly due to compositional influences, the nature of this compositional influence itself varies. In Ghana, a reduction in the proportion of poor households was highly influential in driving the drop in mortality between 1998 and 2003. In Chad, it is rather the fertility change (increase in the relative fertility of poor families) which dominated the rise in mortality observed between 1996/97 and 2004. Cameroon's trend between 1991-1998 is still different, as its compositional influence reflects both rising poverty among families (116,5%) and selective change in fertility behavior (127,2%).

### **Effect of context on the sources of change.**

Multivariate regression was used to examine the relationship between the % of mortality change driven by change in baseline mortality, and selected contextual variables. The results are shown in Table 3. Overall, only variations of Gross National Income (GNI) per capita, share of income of the poorest 20% of the population and the prevalence of modern contraception among women aged 15-49 are significantly related (at the 5% level of confidence) to basic mortality. A one unit-increase in GNI per capita decreases the basic mortality by 5,6%. Similarly, an increase of 1% in contraceptive prevalence among women of childbearing age (15-49 years) results in a decrease in basic mortality by almost 3 points. Finally, an increase of one unit in the percentage of the income shared by the 20% of the poorest population results in spectacular drop in the basic mortality by 22 points. Such findings are consistent with the role of economic and health policies in improving health conditions in general and the decline in children mortality in particular.

## **CONCLUSION AND IMPLICATIONS**

This paper sought to account for the trends of under-five mortality in 22 sub Saharan African countries and 38 periods of time. In the vast majority of country-periods studied in this analysis, (35 out of 38), we find a dominance of behavioral change as the driving factor. Furthermore, this behavioral change is itself most reflecting of change in the baseline mortality, i.e., it reflect shared progress among all children. In other words, it is a reflection of transformation of public health and the entire health system, rather than individual responses per se. Where child mortality is rising, it is largely as a result of poor performance in the general health system, for instance, the deterioration in sanitary conditions. Similarly, where child mortality is declining, it is likewise thanks to the performance of the overall system in upgrading sanitation. However, in two countries (Kenya and Tanzania) where behavioral influences were the dominant source of change, it is rather a differential change in the risk of dying among various socio-economic categories which largely explained the trends in infant and child mortality. Where child mortality has increased, it is largely because of an

increased risk of dying among the poor. Where mortality has declined, it is likewise largely driven by a decrease in the likelihood of death among the poor.

In a minority of countries (3 countries out of 22), the composition effect predominates. Within these three countries, the composition effects is most often reflecting a change in the relative fertility of groups (2 countries out of 3) rather than a changing distribution of families among different SES groups.

These results have important policy implications: The preponderance of basic mortality as a driver suggests the critical importance of policies aimed at scaling up the performance of the health system in improving the health conditions. The system itself can be improved with either better funding or improvements in efficiency, for instance by using a performance-based approach that has been successfully implemented in Rwanda. System improvements may also be achieved by mass investments in hygiene and public health as well as in the education of the girls and women.

The preponderance of the differential mortality effect warrants actions to improve access of vulnerable population to family planning. The preponderance of the composition effect suggests a strengthening of measures to improve access of vulnerable social groups to health and family planning as well as those fighting against poverty.

**Table 1: DECOMPOSITION PARAMETERS – WESTERN AND MIDDLE AFRICA**

COUNTRIES	Period a-b	Change (sq <sub>b</sub> -sq <sub>a</sub> )	Basic decomposition		Fitting parameters			Advanced decomposition					
			% Composition	% Behavioral	ALPHA	BETA	R <sup>2</sup>	COMPOSITION		BEHAVIORAL OR PERFORMANCE			
					Year				%Pauperization	%Fertility	%Basic	%Vulnerability	%Errors
BENIN	1996-2001	-23.2	3.2%	96.8%	1996	244.9	-22.0	75%	14.6%	-11.4%	54.4%	41.6%	0.8%
					2001	232.3	-25.4	88%					
BURKINA FASO	1993-1998/99	18.9	4.1%	95.9%	1993	235.3	-10.9	34%	12.7%	-8.6%	226.4%	-131.0%	0.6%
					1998-1999	278.0	-19.5	59%					
CAMEROON	1998/99-2003	-30.7	0.2%	99.8%	2003	233.8	-14.5	71%	13.4%	-13.3%	143.8%	-45.8%	1.9%
					1991	229.8	-28.9	99%	116.5%	127.2%	-401.6%	254.4%	3.5%
					1998	220.8	-26.9	99%	10248.0%	-10469.0%	13854.4%	-141111.1%	577.7%
					2004	215.3	-24.9	98%					
IVORY COAST	1994-1998/99	25.2	14.4%	85.6%	1994	213.4	-22.5	99%	-8.4%	22.8%	190.4%	-107.1%	2.3%
					1998-1999	261.3	-32.1	91%					
GHANA	1993-1998	-21.6	-14.0%	114.0%	1993	198.7	-23.1	85%	-9.8%	-4.1%	158.0%	-40.8%	-3.2%
					1998-99	164.5	-19.9	79%	196.0%	-102.7%	1700.5%	-1687.6%	-6.2%
					2003	130.4	-7.5	72%	-2.8%	0.6%	77.4%	24.8%	0.0%
					2008	111.5	-9.7	61%	-20.9%	10.3%	122.0%	-8.3%	-3.1%
GUINEEA	1999-2005	-7.9	-10.6%	110.6%	2005	259.5	-26.0	86%	-6.7%	6.5%	151.1%	-47.0%	-4.0%
					2007	151.9	-4.2	16%	10.4%	-5.3%	248.2%	-149.2%	-4.1%
LIBERIA	2007-2009	16.5	-0.2%	100.2%	2009	176.8	-7.0	65%	2.4%	-4.8%	84.7%	17.7%	0.0%
					1995-1996	338.7	-30.0	90%	2.4%	4.1%	142.2%	-49.8%	1.0%
MALI	1995/96-2001	-16.0	5.1%	94.9%	2001	299.0	-21.9	51%	-29.2%	18.5%	358.8%	-253.3%	5.2%
					2006	279.9	-23.3	57%	2.4%	-11.5%	195.2%	-87.7%	1.7%
NIGER	1998-2006	-88.4	6.5%	93.5%	1998	367.5	-23.6	29%	6.7%	-15.4%	66.6%	38.7%	3.3%
					2006	241.8	-8.6	14%	-0.8%	1.8%	162.4%	-64.3%	0.8%
NIGERIA	1990-2003	18.2	-10.7%	110.7%	1990	280.2	-31.0	97%	-86.4%	139.3%	-838.9%	928.5%	-42.6%
					2003	345.5	-47.0	82%					
SENEGAL	1997-2005	-7.2	-8.7%	108.7%	2005	220.8	-31.0	98%					
					2008-2009	163.1	-22.9	97%					
CHAD	1996/97-2004	1.9	52.9%	47.1%	1996-1997	206.1	-2.2	2%					
					2004	190.1	3.8	9%					

**Table 2: DECOMPOSITION PARAMETERS – EASTERN AND SOUTHERN AFRICA**

COUNTRIES	Period a-b	Change (sq <sub>b</sub> -sq <sub>a</sub> )	Basic decomposition		Year	Fitting parameters			Advanced decomposition				
			% Composition	% Behavioral		ALPHA	BETA	R <sup>2</sup>	COMPOSITION			BEHAVIORAL OR PERFORMANCE	
									%Pauperization	%Fertility	%Basic	%Differentiation	%Error
ERYTHREA	1995-2002	-46.7	-1.5%	101.5%	1995	176.5	-8.3	19%	-1.2%	-0.3%	85.1%	15.8%	0.6%
					2002	136.8	-10.9	31%					
MALAWI	1992-2000	-36.9	-0.5%	100.5%	1992	283.6	-15.3	44%	4.6%	-5.1%	112.8%	-12.8%	0.4%
					2000	242.0	-13.7	57%					
ETHIOPIA	2000-2004	-44.2	-0.6%	100.6%	2004	206.3	-16.8	88%	5.0%	-5.6%	80.0%	20.1%	-0.3%
					2000	190.7	-1.3	0.3%					
KENYA	2000-2005	-56.5	-1.0%	101.0%	2005	154.0	-8.1	34%	3.0%	-4.0%	65.0%	34.6%	1.5%
					1993-1998	148.8	-19.4	91%					
KENYA	1998-2003	7.4	-3.4%	103.4%	1998	159.8	-19.7	95%	7.7%	4.1%	94.6%	-7.2%	0.8%
					2003	153.8	-14.8	71%					
KENYA	2003-2008/9	-28.4	-0.5%	100.5%	2008-2009	114.8	-10.9	63%	-51.0%	0.1%	137.2%	-38.1%	1.4%
					1997	230.5	-24.4	92%					
MADAGASCAR	1997-2003/4	-52.4	0.9%	99.1%	2003-2004	178.5	-24.3	91%	6.2%	-5.3%	99.3%	-0.6%	0.4%
					2003/4-2008/9	122.2	-14.5	99%					
NAMIBIA	1992-2000	-29.9	-1.1%	101.1%	1992	110.2	-6.3	52%	-0.3%	-0.8%	74.3%	28.6%	-1.7%
					2000	88.0	-9.3	52%					
MOZAMBIQUE	2000-2006/7	7.2	-4.5%	104.5%	2006-2007	104.8	-12.6	76%	2.5%	-7.1%	235.5%	-133.1%	2.1%
					1997-2003	295.4	-29.3	91.1%					
TANZANIA	1996-1999	17.4	4.6%	95.4%	2003	238.8	-22.1	72.9%	9.9%	-18.3%	156.6%	-55.9%	7.7%
					1996	177.3	-11.2	35%					
ZIMBABWE	1999-2004/5	-29.3	0.0%	100.0%	1999	176.6	-5.4	17%	-4.5%	9.1%	-4.0%	94.4%	5.0%
					2004-2005	168.1	-12.7	64%					
ZIMBABWE	1994-1999	14.5	-1.6%	101.6%	1994	91.2	-5.3	33%	2.3%	-2.3%	29.1%	69.4%	1.5%
					1999	112.6	-7.7	58%					
RWANDA	1999-2005/6	-21.2	-0.9%	100.9%	2005-2006	79.5	-3.5	55%	2.9%	-3.7%	156.0%	-56.3%	1.2%
					1992	172.0	-2.9	2.2%					
RWANDA	1992-2000	42.1	-1.4%	101.4%	2000	265.2	-19.4	84%	-9.0%	7.7%	221.5%	-118.2%	-1.9%
					2005	231.0	-16.9	54%					
RWANDA	2000-2005	-21.6	-19.9%	119.9%	2005	231.0	-16.9	54%	-15.4%	-4.5%	158.5%	-34.7%	-3.9%
					2005-2007/8	181.4	-16.2	75.0%					
RWANDA	2005-2007/8	-48.1	1.6%	98.4%	2007-2008	181.4	-16.2	75.0%	2.7%	-1.1%	103.2%	-4.7%	-0.1%
					2007-2008	181.4	-16.2	75.0%					

**Table 3 : Regression parameters measuring the effect of some contextual variables on the basic mortality in 38 time periods of 22 Sub-Saharan African countries**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	489.205	70.882		6.902	0.000
	Gross National Income (GNI) per capita	-0.056	0.026	-0.332	-2.175	0.039
	Share of income by the 20% poorest of the population	-22.415	8.455	-0.435	-2.651	0.014
	proportion of women between 15-49 years with at least elementary school level	-0.893	0.501	-0.321	-1.782	0.087
	% of the rural population with access to improved water source	-0.724	0.596	-0.161	-1.215	0.236
	Prevalence (%) of modern contraception among women aged 15-49	-2.907	1.020	-0.501	-2.849	0.009
Dependant variable : Basic Mortality						

## BIBLIOGRAPHY

- AKOTO E. 1993. Déterminants socioculturels de la mortalité des enfants en Afrique noire. Hypothèse de recherche d'explication, Académia, Louvain-la-Neuve, 299p.
- BARBIERI. M. 1991. Déterminants de la mortalité des enfants dans le tiers monde, les dossiers du CEPED, n°18, paris, 40p.
- BONGAARTS, J. 2005. "The causes of stalling fertility transitions." Policy Research Division Working Paper, 204. New York: Population Council.
- BROCKERHOFF M. and P.HEWETT. 2000. « Inégalités de mortalité de l'enfant chez les groupes ethniques de l'Afrique Subsaharienne : « Bulletin of the World Health Organisation » 78(1) : 30-41.
- Commission Economique des Nations Unies pour l'Afrique (CEA). 2009. Les Economies de l'Afrique Centrale 2008. Les liens entre croissance, pauvreté et inégalités, Maisonneuve & Larose, p.13-19.
- DACKAM NGATCHOU R. (1993), Education de la mère et Mortalité des Enfants en Afrique. Cahiers de L'IFORD n°2, Yaoundé, mars 1990, 160 p.
- DACKAM NGATCHOU R., P. GUBRY and E. NGWE. 1993. « Inégalités géographiques de la mortalité des enfants au Cameroun. » Social Science and Medicine 36 (10) : 1285-1290.
- DEMOGRAPHIC AND HEALTH SURVEYS (DHS) (2009). StatCompiler, ORC, Macro. Measure DHS+ Project. Available on line at <http://www.measuredhs.com/> (last accessed March 2009)
- ELOUNDOU – ENYEGUE P.M et GIROUX, S.C. (2010), Comprendre le changement social. Apports des méthodes de décomposition, Panel UIES sur le renforcement de la formation démographique en Afrique Francophone, Imprimerie Médiat, Yaoundé, Cameroun, 74p.
- GARENNE M. 1993. « Les politiques de santé publique et leur incidence démographique » CEPED, Paris. pp.237-264.
- HERTRICH V., (2006), « L'Afrique en mauvaise passe », Constructif, n°14, juin 2006, [http://www.constructif.fr/Article\\_30\\_45\\_325/L\\_Afrique\\_dans\\_une\\_mauvaise\\_passe.html](http://www.constructif.fr/Article_30_45_325/L_Afrique_dans_une_mauvaise_passe.html), Consulté le 19 octobre 2010.
- KIRK, D. and B. PILLET. 1998. "Fertility levels, trends, and differentials in sub-Saharan Africa in the 1980s and 1990s." Studies in Family Planning, 29(1): 1-22.
- MASUY-STROBANT G. 1988. Santé de l'enfant et inégalités sociales. L'enquête naissance en Hainaut, Louvain-la-neuve, Ciaco, 288p.
- MEEGAMA S.A. 1980. Socio-economic determinants of infant and child mortality in Sri Lanka: An analysis of post war experience. WFS, Scientific Report, n°8.
- MOSLEY W.H and CHEN L.C. 1984. "An analytical framework for study of child survival on developing countries." Population and Development Review (10): 25-45.
- OWOUNDI JP. 2008. Evolution temporelle de la mortalité des enfants au Cameroun. Masters thesis in Demography, IFORD, Cameroon. 131 pages.
- OUEDRAOGO D. (2007), « Les Dynamiques démographiques », Atlas de l'Intégration Régionale en Afrique de l'Ouest, Série population, CEDEAO-CSAO/OCDE – novembre 2007.
- RAKOTONDRABE. F. P. 1996. Les facteurs de la mortalité des enfants à Madagascar. Cahiers de L'IFORD no 10 ; 85 p.
- RAVALLION, M and CHEN, S. (2008), " The developing world is poorer than we thought, but no less successful in the fight against poverty, Policy Research Working Paper n°4703, World Bank, Washington DC, USA, 54p.
- SHAPIRO, D. and B. OLEKO TAMBASHE. 2001. "Fertility Transition in Urban and Rural sub-Saharan Africa: Preliminary Evidence of a Three-Stage Process." The Journal of African Policy Studies 7(2-3): 111-136.
- TABUTIN, D. and B. SCHOUAKER. 2004. "The demography of sub-Saharan Africa from the 1950s to the 2000s: A survey of changes and a statistical assessment." Population 59(3): 457-554.
- UNITED NATIONS (UN) 2001. UNDP Millennium Development Goals. <http://www.undp.org/mdg/> consulted on March 2009.

UNITED NATIONS CHILDREN'S FUND (UNICEF). 2008. The State of African Children 2008. New York, United Nations.

WORLD BANK (2009), World Development Indicators, <http://devdata.worldbank.org/dataonline/> consulted on March 28.