



Les Documents de Travail de l'IREDU
Working Papers

Institut de Recherche sur l'Éducation
Sociologie et Économie de l'Éducation
Institute for Research in the Sociology and Economics of Education

The effects of armed conflict on schooling in Sub-Saharan Africa

Thomas Poirier

Janvier 2011
DT 2011/1



Pôle AAFE – Esplanade Erasme – B.P. 26513 - F 21065 Dijon Cedex
Tél.+33 (0)3 80 39 54 50 - Fax +33 (0)3 80 39 54 79
iredu@u-bourgogne.fr- <http://iredu.u-bourgogne.fr>



Thomas POIRIER¹

Ph.D. Student

Institute for Research in the Sociology and Economics of Education (IREDU),
UMR 5225, CNRS-University of Burgundy, Dijon, France

The effects of armed conflict on schooling in Sub-Saharan Africa

Abstract

In the past decades, most of the countries in Sub-Saharan Africa have been affected by armed conflicts. By means of a time-series cross-sectional (TSCS) database, we attempt to measure the impact of war on a sample of 43 countries in Africa from 1950 to 2010. These conflicts, and especially civil wars, are shown to have a strong negative effect on the educational performances of the countries studied. The rate of children not attending school, as well as secondary school enrollment rates, seems particularly sensitive to periods of conflict. It also appears that government expenditures in social sectors including education are a positive factor in increasing school enrollment. In contrast, military expenditure is significantly and inversely related to schooling opportunities. Thus, if but 1 % of the GDP were allocated to education expenditure, the rate of children not attending school would decrease by 1.6 % and the secondary school enrollment rate would increase by 2.2 %.

Résumé

Au cours de ces dernières décennies, la plupart des pays d'Afrique subsaharienne ont connu au moins un conflit armé. Cette étude présente des résultats préliminaires sur l'impact de ces conflits sur l'éducation entre 1950 et 2010 sur un panel de 43 pays d'Afrique. Les conflits et plus spécialement les guerres civiles ont un effet négatif très fort sur les performances éducatives des pays. Les non scolarisation et le secondaire paraissent particulièrement sensibles aux périodes de conflit. Il apparaît également que les dépenses gouvernementales dans les secteurs sociaux et notamment en éducation sont un facteur favorable à l'augmentation des taux de scolarisation. A contrario, les dépenses militaires diminuent de façon significative les chances de scolarisation. Ainsi, si seulement 1 % du PIB était alloué en direction de l'éducation, le taux de non scolarisation diminuerait de 1,6 % tandis que le taux de scolarisation secondaire augmenterait de 2,2 %.

Key words: Armed conflict, Education, Sub-Saharan Africa

JEL Codes: C32; H52; I22

¹ Corresponding author at: IREDU, Pôle AAFE, Esplanade Erasme, B.P. 26513, 21065 Dijon Cedex - France.
Tel.: +33 (0)3 80 39 37 41. Fax.: +33 (0)3 80 39 54 79.
E-mail address : thomas.poirier@u-bourgogne.fr

1. Introduction

Armed conflicts cause major damage and bring with them devastating consequences for a country, including casualties, displacement of populations, and the destruction of public infrastructure. In the long term, it appears to be very difficult to re-establish peace after a period of conflict. In a World Bank report (2003), Collier *et al.* showed that the economic and social costs of wars are high and that they persist for years after the end of the conflict. In recent years, there has developed a substantial literature in which researchers debate the long-term negative consequences of armed conflicts. For instance, Brakman, Garretsen and Schramm (2004) show that the Allied bombing had a significant but temporary impact on post-war city growth in Germany as a whole, as well as in West Germany separately (although this is not the case for city growth in East Germany). Most studies arrive at similar conclusions. Miguel and Roland (2006) present evidence drawn from the American bombing in Vietnam. They find that war had no lasting impact on poverty rates, consumptions levels, literacy, infrastructure or population density. Chen, Loayza and Reynal-Querol (2007) analyze a panel of 41 countries involved in internal wars during the period 1960-2003 and find that when the end of war marks the beginning of lasting peace, recovery and improvement in economic performance, health, education and political development are indeed significant.

In the last decades, almost three-fourths of all countries in Sub-Saharan Africa (SSA) have been affected by armed conflicts (Gleditsch *et al.*, 2002). Situations of conflict are often considered to be one of the most important factors in the deterioration of education. For example, Akresh and de Walque (2008) demonstrate the strong negative impact of Rwanda's genocide on children's schooling, with exposed children completing one-half year less education, resulting in an 18.3 % decline in school completion. In the first place, children are often the first victims of wars : Bird (2007) underlines that two million children have died in the past decade as a consequence of armed conflict within the SSA region, and six million more have been injured or permanently disabled. In addition, as O'Malley (2010) points out, education, as one of the more visible institutions in the civil society, is often targeted by the belligerent parties in countries affected by military conflict. In many cases, an attack on the educational system represents an attack on the state. Conversely, certain states or paramilitary organizations may target academics in order to neutralize real or imagined opponents. In some

contexts, there is also a phenomenon of youth recruitment into armed militias (child soldiers). The displacements caused by wars also prevent children's enrollment in school. In 2009, 27 million people worldwide were displaced, including 11.6 million people in 21 African countries (IDMC, 2010). Evidently, such events entail more drastic effects in Africa, as some countries in the region have education participation indicators which are among the lowest in the world. In 2007, in SSA, the Net Enrollment Rate (NER) was approximately 72 % (UNESCO, 2010). Some countries, like Eritrea or Niger, did not even reach the 50 % level. On average, the literacy rate in SSA was measured at 60 %, but in Chad or Sierra Leone, it did not exceed 40 % of the total population. In the same year, 72 million children worldwide were not attending school, of whom 32 million lived in SSA. Since the beginning of the 2000's, and in spite of the fact that African countries have expanded primary enrollments, rapidly developing current trends have illustrated a probable failure to reach Universal Primary Education (UPE) for 2015 (Easterly, 2009).

Given this context, the objective of this study is to present preliminary results on the effects of war on education in a broad sample of countries in the SSA region. The question is: to what extent is school enrollment impacted by armed conflicts? We assume that wars have a negative impact on schooling. However, this assumption raises certain issues: do all conflicts, whether civil, interstate or international, have the same effects? Are the consequences uniform whatever the intensity and duration of the conflict? By means of a time-series cross-sectional (TSCS) database, we attempt to measure the impact of war on a sample of 43 countries in SSA from 1950 to 2010. We gathered information on conflict from the Peace Research Institute (PRIO) and indicators of civil liberties and political rights from the Freedom House. We then combined educational data from the Barro & Lee database and economic data from the Penn World and the World Bank's World Development Indicators.

2. Data and methodology

Our analysis focuses on Sub-Saharan African countries. The African continent includes a majority of countries which, in respect to current trends concerning the goal of universal education, will not, in all likelihood, achieve the objectives of Education for All (EFA) by 2015 (UNESCO, 2010). In addition, most of the countries in SSA have been affected by

armed conflicts. Thus, 43 Sub-Saharan countries compose our sample of countries (for a list of countries with country codes, see Appendix A).

When studying these countries over time, the main obstacle we face is the lack of data and the reliability of that which is available. In this study, we rely on a number of databases known for their rigor and relevance. We have thus built from several databases a panel database for the period of time from 1950 to 2010 providing information on:

- Armed conflict;
- Education;
- Economic situation;
- Civil liberties and political rights.

A detailed description of our variables, including definitions and sources, is provided in Appendix B.

The information on conflicts is provided by the Armed Conflict Dataset of the International Peace Research Institute, Oslo (PRIO)¹. This database, version 4-2009, identifies the number of conflicts for 142 countries from 1946 to 2008. Our panel of countries, each one providing an observation, consists of 42 countries (excluding Sao-Tome-and-Principe). The data document the conflicts for each country according to four dimensions:

- Territorial armed conflict between a state and a non-state group outside its own territory;
- Interstate armed conflict between two or more states;
- Internal armed conflict between the government of a state and one or more internal opposition group(s) without intervention from others states;
- Internationalized internal armed conflict between the government of a state and one or more internal opposition group(s) with intervention from others states on one or both sides.

¹ UCDP/PRIO Armed conflict dataset, version 4-2009. Available at <http://www.prio.no/> (accessed on 07/12/2010).

The data also characterize the conflicts in respect to their level of intensity. The viewpoint here is largely dichotomist: at between 25 and 999 battle-related deaths in a given year, a conflict is considered as minor. A minimum of 1,000 battle-related deaths in a given year qualifies the conflict as major.

Over the observed sixty year period, we find that 80 % of the countries in our sample were engaged in at least one conflict (Appendix C). Only eight countries out of the 43 have never been involved in any kind of conflict, either internal or multistate: Benin, Botswana, Malawi, Namibia, Sao-Tome-and-Principe, Swaziland, Togo and Zambia. Some countries have faced several conflicts in the course of the same year. Angola and Ethiopia hold the unfortunate first place in terms of war in recent decades. Over the 60 years observed, both countries have experienced only 16 years without war and Ethiopia has faced up to five conflicts during the same sub period.

The education data comes from the recently updated data set on educational attainment in the world established by Barro and Lee². This panel data set was updated in 2010 for 146 countries, including 33 Sub-Saharan countries. The data show the distribution of the educational attainment of the total adult population and of the adult population over the ages of 15, 20 and 25 by sex at seven levels of schooling. For each level of education (primary, secondary, tertiary), data provide information on participation rates as well as completion rates. The rate of children not attending school is also documented. As part of our analysis, we particularly focus on children not enrolled in school and on primary school achievement. The data are broken down into 5-year intervals, from 1950 to 2010. In our analysis, these data have been annualized.

In one main component of our analysis, we use economic data provided by the Penn World Table³. This database, composed of 35 variables, displays a set of national accounts covering a spatial dimension of 189 countries, and the period 1950-2007 (with 2005 as base year) as time reference. For the needs of our study, we collected data concerning GDP per capita and investment share of real GDP per capita from 27 countries in SSA. Most data are available from 1960. We also selected some complementary economic data provided by the

² Barro, R.J., Lee, J.W., 2010. A new data set of educational attainment in the world, 1950-2010. National Bureau of Economics Research Working Paper 15902. Available at <http://www.barrolee.com/> (accessed on 07/12/2010).

³ Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.3, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, August 2009. <http://pwt.econ.upenn.edu/> (accessed on 07/12/2010).

World Bank's World Development Indicators⁴. These data concern the total spending on education (in % of GDP), military expenditure (in % of GDP) and the general government final consumption expenditure (in % of GDP). Because these data are more accurate than the previously mentioned set, it will be interesting to analyze them in the light of our hypotheses.

Finally, we added to our database the set of comparative and historical data established by the Freedom House in the World⁵. These data are the standard-setting comparative assessments of global political rights and civil liberties. Published annually since 1972, the survey ratings and narrative reports concern 193 countries and 15 related and disputed territories, including all the countries in our sample. The score indicated in the database is the average of the separate scores for civil liberties and political rights. In the Freedom House ranking, countries whose combined average for political rights and civil liberties fell between 1.0 and 3.0 (i.e., $1.0 \leq \text{avg_pr_cl} < 3.0$) were designated "free"; between 3.0 and 5.5 (i.e., $3.0 \leq \text{avg_pr_cl} < 5.5$) "partly free"; and between 5.5 and 7.0 (i.e., $5.5 \leq \text{avg_pr_cl} \leq 7.0$) "not free".

The empirical analysis explores the behavior patterns of education variables during periods of armed conflict. Using TSCS data⁶, we test the impact of various economic, social and political variables on education variables. In this context, we preferred a simple method of fixed-effects (FE) regression, one for each SSA country. This provides a first evaluation of the effects of armed conflict by estimation through Ordinary Least Squares (OLS). The panel literature includes extensive debate about how to model effects, and in particular, whether we should treat them as fixed or random. For TSCS data, fixed effects are a more appropriate choice, whereas random effects are used for panel data (Beck, 2001).

The fixed-effect regression can be modeled as follows:

$$Y_{i,t} = \alpha_i + \beta X_{i,t} + \mu_{i,t}$$

$$\mu_{i,t} = \alpha_i + \epsilon_{it}$$

Where Y_{it} is the dependant variable observed for individual i at time t ; α_i is the unobserved individual effect, β the parameter of interest and $\mu_{i,t}$ the error term.

⁴ Available at <http://databank.worldbank.org/ddp/home.do> (accessed on 07/12/2010).

⁵ Available at <http://www.freedomhouse.org/template.cfm?page=1> (accessed on 07/12/2010).

⁶ A database is a TSCS when: $T > 1$, $N > 1$ and $N < T$.

3. Results

Adopting this causal framework in the statistical modeling that follows⁷, we selected three educational variables: the rate of children not attending school, the primary school completion rate and the secondary education enrollment rate. As part of our preliminary results, we chose to limit the explanatory variables. In terms of the variables of conflict, preliminary tests revealed that the variable “internal armed conflict” was more significant than the other three variables of conflict (territorial armed conflict, interstate armed conflict and internationalized armed conflict). It therefore seemed interesting to aggregate the latter into a single variable (called “Other conflict” in our models) and compare it to the first variable of conflict (called “Civil conflict” in our models). To appreciate the effect of conflict on education, we also selected the variable “intensity”.

In terms of economic variables, we chose the GDP per capita, the investment share of real GDP per capita, the military and education expenditures, both also defined as a share of GDP. In order to take diffusion effects into account, these economic variables were lagged for five years in the models (indicated “L5” below).

As for the approach we selected to treat the data in a panel reference, it seemed meaningful to broadly decompose the variety of sources in search of that which is endogenous. When analyzing primary education completion rate, the average correlation within countries reaches a level of 0.64; on the other hand, correlation within years over the entire period studied reaches a level of 0.06. Respective values for the rate of children not attending school are 0.57 and 0.34 and 0.44 and 0.32 for the rate of secondary enrollment. In this way, spatial dispersions outbalance dispersion due to dynamic effects, particularly in the case of the primary completion rate.

⁷ For our empirical analysis, we used the software Stata, version 11.0.

Table 1

Fixed-effect regression (robust), Rate of children not in school (15 years and over).

Dependant variable :		
Rate of children not in school	Explanatory variables	Coefficients
	Civil conflict	4.247*** [1.499]
	Other conflicts	2.965** [1.365]
	Intensity	-1.519 [0.951]
	GDP per capita (L5)	-0.002*** [0.000]
	Investment share of real GDP (L5)	-0.138** [0.658]
	Military expenditures (L5)	0.323*** [0.941]
	Education expenditures (L5)	-0.638*** [0.186]
Constant		48.230***
Adjusted R-Squared		0.9746
Observations/countries		429 / 28

Notes: Robust standard errors in brackets; *significant at 10 %, **significant at 5 %, ***significant at 1 %.

In this model (Table 1), we find that the variables of conflict have a positive and significant effect on the rate of children not attending school. The assumption that conflicts increase the non enrollment rate is thus verified in the first model. Military expenditures, which generally increase during a conflict, also have a positive and significant effect.

In contrast, the variables “education expenditures” and “investment share” have a negative effect. They thus act to reduce the proportion of children not attending school. The GDP is also significant although its coefficient is low compared to the other two variables.

Finally, the variable “intensity”, describing the severity of a conflict, has a negative but not significant effect in terms of usual confidence levels.

In light of these initial results, it is interesting to analyze the average marginal effects by computing the elasticity effect of the explanatory variables. By means of this procedure⁸,

⁸ In terms of techniques, our results were obtained using the mfx command in the Stata statistical package.

we pose the following quantitative question: how much would our dependent variable increase if the independent variable had increased by 1 % five years ago?

Table 2

Average marginal effects (robust).

Dependant variable:	Explanatory variable	Coefficients
Rate of Children not in school	Education expenditures (L5)	-0.0169*** [0.004]
	Military Expenditures (L5)	0.008*** [0.002]
Observations	429	

Notes: Robust standard errors in brackets; *significant at 10 %, **significant at 5 %, ***significant at 1 %.

Based on these results, we can say that if education expenditures had increased by 1 % five years ago, the rate of children not attending school would have decreased by 1.6 %. Conversely, if military expenditures had increased by 1 %, the rate of children not in school would have increased by 0.8 %.

Table 3

Fixed-effect regression (robust), Primary education completion rate (15 years and over).

Dependant variable :	Explanatory variables	Coefficients
Primary completion rate	Civil conflict	-2.495 [2.158]
	Other conflicts	-0.722 [1.913]
	Intensity	1.564 [1.469]
	GDP per capita (L5)	0.002*** [0.000]
	Investment share of real GDP (L5)	0.140* [0.086]
	Military expenditures (L5)	-0.002 [0.079]
	Education expenditures (L5)	1.126*** [0.263]
Constant	14.282***	
Adjusted R-Squared	0.9164	
Observations/countries	429 / 28	

Notes: Robust standard errors in brackets; *significant at 10 %, **significant at 5 %, ***significant at 1 %.

In this model (Table 3), the variables “civil conflict”, “other conflicts” and “military expenditures” have a negative effect on the primary school completion rate. This trend may justify our assumptions although these variables are not significant.

On the other hand, other economic variables have a positive and significant effect. We can say that social spending, particularly that targeted to education (“education expenditures”), increases the primary school completion rate.

The variable “intensity” is positive but not significant. As in our first model, this variable raises questions about how it should be interpreted.

Table 4

Fixed-effect regression (robust), Secondary education enrollment rate (total, 15 years and over).

Dependant variable :	Explanatory variables	Coefficients
Secondary enrollment rate	Civil conflict	-2.271** [1.053]
	Other conflicts	-2.137** [0.923]
	Intensity	0.376 [0.799]
	GDP per capita (L5)	0.004*** [0.000]
	Investment share of real GDP (L5)	0.108** [0.045]
	Military expenditures (L5)	-0.124** [0.061]
	Education expenditures (L5)	0.505*** [0.173]
Constant		12.742***
Adjusted R-Squared		0.9765
Observations/countries		429 / 28

Notes: Robust standard errors in brackets; *significant at 10 %, **significant at 5 %, ***significant at 1 %.

Turning now to the secondary school enrollment rate (Table 4), our results are appealing. They confirm previous results. Conflicts and related expenditures (military expenditures) have a negative effect, while social spending has a positive one. In this model, and contrary to our findings concerning primary education (Table 2), coefficients are significant. Conflicts therefore have a very strong impact on secondary enrollment.

As in the first model (Table 1), we have computed the average marginal effects:

Table 5

Average marginal effects (robust).

Dependant variable:	Explanatory variable	Coefficients
Secondary enrollment rate	Education expenditures (L5)	0.0223*** [0.007]
	Military Expenditures (L5)	-0.0054** [0.002]
	Observations	429

Notes: Robust standard errors in brackets; *significant at 10 %, **significant at 5 %, ***significant at 1 %.

If we compare the marginal effects above to those computed for the rate of children not attending school (Table 2), we note that they are more pronounced in the case of the secondary enrollment rate. Indeed, if education expenditures had increased by 1 % five years ago, secondary school enrollment would have increased by 2.2 %. If military expenditures had increased by 1 %, this rate would have decreased by 0.5 %.

The R-squared (R^2) in the models merits commentary. Indeed, its analysis reveals that the explanatory variables account for a large part of the variance in the models. In the analysis of our data by Stata, we had the choice between two main commands: xtreg, fe and areg. We chose the areg procedure. This command includes the robust option for the correction of heteroskedasticity in groups⁹ using White's method. In fact, the coefficient estimates and standard errors are the same using the xtreg, fe and areg procedures, but the calculation of the R^2 is different. In the areg procedure, we estimate coefficients for each of our covariates and for each dummy variable in our groups. In the xtreg, fe procedure, the reported R^2 is obtained simply by fitting a mean deviated model where the effects of the groups (all of the dummy variables corresponding to country cases) are assumed to be fixed quantities. All the group effects are simply subtracted out of the model and no attempt is made to quantify their overall effect on the fit of the model. The SSE (sum-of-squares-error) is the same regardless of which approach we take, but the SST (sum-of-squares total) is different. In the xtreg, fixed-effect approach, the R^2 reported is not the R^2 that is calculated from the regression for areg, but the regression for the mean detrended dataset. As such, the SST in the xtreg, fe approach is less than the SST in the areg approach. The difference is real. When adopting the xtreg, fe method,

⁹ Statistical phenomena which may be magnified in the present situation by the huge differences in the sizes of the countries in our sample.

the effects of the groups are fixed and unestimated quantities which are subtracted out of the model before the fit is performed. In the areg approach, the group effects are estimated and affect the total sum of squares of the model under consideration. The examples below illustrate this point:

Table 6

Fixed-effect regression (robust), Rate of children not in school (15 years and over), comparison between areg and xtreg, fe commands (Stata).

Dependant variable : Rate of children not in school		Coefficients	
		Model 1 (xtreg,fe)	Model 2 (areg)
	Civil conflict	4.246*** [1.623]	4.247*** [1.499]
	Other conflicts	2.964 [1.972]	2.965** [1.365]
	Intensity	-1.519 [1.293]	-1.519 [0.951]
	GDP per capita (L5)	-0.002*** [0.000]	-0.002*** [0.000]
	Investment share of real GDP (L5)	-0.138*** [0.487]	-0.138** [0.658]
	Military expenditures (L5)	0.323*** [0.884]	0.323*** [0.941]
	Education expenditures (L5)	-0.638*** [0.196]	-0.638*** [0.186]
	Constant	48.230***	48.230***
	Adjusted R-Squared	-	0.9746
	R-squared	Within	0.1616
		Between	0.3515
		Overall	0.3291
	Observations/countries	429 / 28	429 / 28

Notes: Robust standard errors in brackets; *significant at 10 %, **significant at 5 %, ***significant at 1 %.

First, the comparison between the two models shows that the coefficients are identical, except for the variable “other conflicts”.

Xtreg, fe computes three R-squared values. The “R² within” gives the share of intra-individual variability of the dependent variable explained by the explanatory variables. The

“R² between” considers the contribution of the fixed effects to the model. The “R² overall” reflects the overall quality of the regression.

In the example given above, we can say that variety within the country explains 16 % of the variance in the model whereas variety between countries accounts for 35 %.

Table 7

Fixed-effect regression (robust), Secondary enrollment rate (total, 15 years and over), comparison between areg and xtreg, fe commands (Stata).

Dependant variable : Secondary enrollment rate		Coefficients	
		Model 1 (xtreg,fe)	Model 2 (areg)
	Civil conflict	-2.271 [1.304]	-2.271** [1.053]
	Other conflicts	-2.137 [1.583]	-2.137** [0.923]
	Intensity	0.376 [1.039]	0.376 [0.799]
	GDP per capita (L5)	-0.004*** [0.000]	0.004*** [0.000]
	Investment share of real GDP (L5)	-0.108*** [0.391]	0.108** [0.045]
	Military expenditures (L5)	-0.124*** [0.709]	-0.124** [0.061]
	Education expenditures (L5)	0.505*** [0.157]	0.505*** [0.173]
	Constant	12.742***	12.742***
	Adjusted R-Squared	-	0.9765
	R-squared	Within	0.2385
		Between	0.5265
		Overall	0.5613
	Observations/countries	429 / 28	429 / 28

Notes: Robust standard errors in brackets; *significant at 10 %, **significant at 5 %, ***significant at 1 %.

In Table 7, variety within the country explains 23 % (“R² within”) of the variance in the model whereas variety between the countries accounts for 35 % (“R² between”). We note a difference in the variables of conflict. Indeed, the coefficients are similar but in model 1, they are not significant.

In both cases, we can conclude that variety is mainly explained by the difference between countries rather than by intra-individual variety.

Finally, we tested the Freedom House's indicators on the educational performances. Freedom House ranks countries in terms of political rights and civil liberties. Countries are classified according to various indicators which translate the situation in the country, at a particular observation date, for objectives that are derived to a large extent from the Universal Declaration of Human Rights. Obviously, these objectives are documented by means of factual events such as the transparency of political choice, liberty in the press and so on (reference to latest FH report). Countries are assessed as free, partly free, or not free in terms of political rights and civil liberties in accordance with the value attributed each year to each country for these two indicators. Each indicator is scaled from the value of 1, the best situation, to the value of 7, the worst.

Our present hypothesis is based on the fact that these two indicators may be impacted by the population's participation in education. In fact, we must use extreme caution, as such a hypothesis is largely impossible to test without the expected spurious correlations and structural effects. One fractional issue might be to chart the evolution of both indicators in respect to three main explaining factors: the indicator of school participation, GDP per capita taken as a trend for economic development and the occurrence of a conflict during the 5 year span that preceded the observations.

In this case, we could adopt a panel approach, as the variation of indicators and variables is here largely heterogeneous within countries; we calculate panel-corrected standard error (PCSE) estimates for linear cross-sectional time series models where the parameters are estimated by either OLS or Prais–Winsten regression¹⁰. When computing the standard errors and the variance–covariance estimates, the procedure used assumes that the disturbances are, by default, heteroskedastic and contemporaneously correlated across panels. We did not use fixed effect dummies here, so the variety explained is low. Results concerning primary school achievement are to be rejected due to their lack of confidence. For other variables, the impact of past or present conflict shows a marginal value close to 0.5 for both the political rights and civil liberties scales. Despite its high significance, the marginal impact for the uneducated population at age 15 is low. A simulation of marginal impact, that is to say

¹⁰ Using the `xtpcse` procedure in Stata.

a decrease from the 20 % level to the 10 % level in this uneducated population, results in a decline of around 0.25 in both scales of political rights and civil liberties. Impact effects from change in secondary education are higher, as, for example, a move from 20 % to 30 % means a decline (more liberties) of around 0.30 in both scales of freedom potential.

Table 8

Impact of no school at age 15, economic growth and conflicts on liberties and political rights.

Explained	GDP per capita	No school at age 15	Conflicts have occurred in past 5 years	Constant	R2
Political rights	-.0000872***	.0093729***	0.47249**	5.12	0.1081
Civil Liberties	-.0088601***	.000126***	0.49647**	4.54	0.071

Notes: *significant at 10 %, **significant at 5 %, ***significant at 1 %.

Estimations included 824 observations sampled in 22 Sub-Saharan countries, from the period 1965 to 2007.

Table 9

Impact of participation in secondary schooling, economic growth and conflicts on liberties and political rights.

Explained	GDP per capita	Secondary participation	Conflicts have occurred in past 5 years	Constant	R2
Political rights	-.0000263***	-.019383***	0.39595**	5.63	0.1513
Civil Liberties	-.000026*	-.020099***	0.417387**	5.25	0.1032

Notes: *significant at 10 %, **significant at 5 %, ***significant at 1 %. Estimations included 824 observations sampled in 22

Sub-Saharan countries, from the period 1965 to 2007.

4. Discussion

These preliminary results confirm that armed conflicts have a strong negative impact on education. Indeed, results show that the rate of children not attending school as well as that of secondary school enrollment is very sensitive to conflicts (Tables 1 and 4). The model presented in Table 3 shows that the primary completion rate appears to be less affected. Nevertheless, as demonstrated in the cases of secondary school enrollment and children not in school, when the country's resources are allocated to education, they contribute significantly to improving school enrollments. Military expenditures have the opposite impact since school

enrollments decrease under its effect. The calculation of the average marginal effects (Tables 2 and 5) demonstrates that the rate of children not attending school could decrease by 1.6 % and the secondary school enrollment rate could increase by 2.2 % if an extra 1 % only of the GDP were allocated to education expenditures. These findings indicate that a rise in education investment has two effects: on the one hand, the primary school completion rate increases; on the other hand, further study in secondary school also increases significantly. Certainly, UPE is one of the goals of EFA, but several studies have highlighted the importance of secondary school. In a study of fragile states, Chauvet and Collier (2007) underline that one of the characteristics of these states is the relentless nature of their fragility and the lack of reforms. The introduction of reforms, including in particular a wealthier economy, is considered to be a necessary condition for the advancement of fragile states out of the category. Unfortunately, the econometric estimation of a state's likelihood of out of the fragile state category suggests that each year, the chances are less than 2 % that a substantial impetus will begin. This implies that fragile states remain so an average of approximately 55 years. Chauvet and Collier identified factors which contribute to the emergence of a state from its fragile status: secondary education, population size, the gross income related to natural resources and technical assistance. A 1 % increase in the number of those who have completed secondary education doubles the likelihood of the implementation of reforms, even if this condition has little impact on the progress of reform. In this way, the persistence of fragile status decreases from 55 to 37 years. Twenty-two countries in our sample are considered as fragile¹¹ and 45 % of the states involved in internal armed conflict relapse into armed conflict within five years (ibid). In fragile states, the risk of civil war may be attributed to two major factors: the proportion of young men in the population and the weakness of growth (Collier, Hoeffler and Rohner, 2006). Education may in fact have a double effect in limiting the risks of war: at school, young men are busy and a long formal education increases their chances of employability. Thus, investment in education can reduce the risk of conflict, and our study corroborates previous results highlighting the importance of education in the peace process (Miller-Grandvaux, 2009). Education may therefore offer a way out of the "war trap" and, by extension, the poverty trap that some countries face. This positive framework is only sustainable if certain "returns on investment", such as the employability of youths, are

¹¹ In 2007, the World Bank listed 34 fragile states, including 22 Sub-Saharan countries.

obtained from success in formal schooling. If this is not the case, education may be viewed in its negative aspects, reinforcing the idea of the “education trap” as pointed out by Prichett (2001).

5. Conclusion

This study discusses the negative impact of conflict on education. Our empirical analysis also indicates that social expenditures, especially expenditures in education, have a positive and very significant impact on the educational performance of our sample of countries. Military expenditures have the opposite effect. This trend indicates that when a country invests in the social sector, particularly in education, school enrollments increase significantly. This can also be interpreted as an indicator of government priorities. When a government gives priority to the social sector, it sends a signal to the population that lasting peace has returned, which in turn raises confidence in the civil peace needed to boost investment (Collier and Hoeffler, 2002). In addition, the occurrence of civil conflicts in Africa is intimately related to government expenditure policy and, thus, the failure of a government to commit to a strong redistributive towards social domains such as education (Azam, 2001). It is also generally accepted that periods of peace are more conducive to investments in the social sector. Studies show that pre-conflict periods are often marked by increased military expenditures, at the expense of education and / or health. These preliminary results are part of a larger work that attempts to highlight the impact of fragility on education. Our findings lead us to raise certain questions for further study and analysis. Indeed, the primary school completion rate does not appear to be significantly affected by conflict, unlike the rate of children not attending school or that of secondary enrollment. According to our models, the intensity of the conflict does not appear to be a relevant factor in enrollment. These questions call for further, more in depth study to complete and complement this initial research.

Appendix A: Countries and country codes

	Country	Country code
1	ANGOLA	AO
2	BENIN	BJ
3	BOTSWANA	BW
4	BURKINA FASO	BF
5	BURUNDI	BI
6	CAMEROON	CM
7	CENTRAL AFRICAN REPUBLIC	CF
8	CHAD	TD
9	CONGO	CG
10	CONGO, THE DEMOCRATIC REPUBLIC OF THE	CD
11	CÔTE D'IVOIRE	CI
12	EQUATORIAL GUINEA	GQ
13	ERITREA	ER
14	ETHIOPIA	ET
15	GABON	GA
16	GAMBIA	GM
17	GHANA	GH
18	GUINEA	GN
19	GUINEA-BISSAU	GW
20	KENYA	KE
21	LESOTHO	LS
22	LIBERIA	LR
23	MADAGASCAR	MG
24	MALAWI	MW
25	MALI	ML
26	MAURITANIA	MR
27	MOZAMBIQUE	MZ
28	NAMIBIA	NA
29	NIGER	NE
30	NIGERIA	NG
31	RWANDA	RW
32	SAO TOME AND PRINCIPE	ST
33	SENEGAL	SN
34	SIERRA LEONE	SL
35	SOMALIA	SO
36	SOUTH AFRICA	ZA
37	SUDAN	SD
38	SWAZILAND	SZ
39	TANZANIA, UNITED REPUBLIC OF	TZ
40	TOGO	TG
41	UGANDA	UG
42	ZAMBIA	ZM
43	ZIMBABWE	ZW

Source: International Organisation for Standardization

Appendix B: Definitions and sources of variables

Variables	Definition	Source
Some primary school	Some primary school education (% of population aged 15, 20 or over 25)	Barro & Lee dataset 2010
Primary school completed	Primary school completed (% of population aged 15, 20 or over 25)	Barro & Lee dataset 2010
Some secondary school	Some secondary school education (% of population aged 15, 20 or over 25)	Barro & Lee dataset 2010
Secondary school completed	Secondary school completed (% of population aged 15, 20 or over 25)	Barro & Lee dataset 2010
Some higher education	Some higher education undertaken (% of population aged 15, 20 or over 25)	Barro & Lee dataset 2010
Higher education completed	Post-secondary school degree completed (% of population aged 15, 20 or over 25)	Barro & Lee dataset 2010
Government expenditure	General government final consumption expenditure (% of GDP)	World Bank's World Development Indicators
Military expenditure	Military expenditure (% of central government expenditure)	World Bank's World Development Indicators
Investment share	Investment share of real GDP per capita (unit %)	Penn World Tables 6.3
GDP per capita	Real GDP per capita, current price	Penn World Table 6.3
Territorial conflict	Armed conflict between a state and a non-state group outside its own territory	International Peace Research Institute, Oslo (PRIO)
Interstate conflict	Armed conflict between two or more states	International Peace Research Institute, Oslo (PRIO)
Internal conflict	Armed conflict between the government of a state and one or more internal opposition group(s) without intervention from other states	International Peace Research Institute, Oslo (PRIO)
International internal conflict	Armed conflict between the government of a state and one or more internal opposition group(s) with intervention from others states (secondary parties) on one or both sides	International Peace Research Institute, Oslo (PRIO)
Civil liberties and political rights	Civil liberties and political rights = (political rights + civil liberties)/2. For Freedom House, countries whose combined average for political rights and civil liberties fell between 1.0 and 3.0 (i.e., $1.0 \leq \text{avg_pr_cl} < 3.0$) were designated "free"; between 3.0 and 5.5 (i.e., $3.0 \leq \text{avg_pr_cl} < 5.5$) "partly free"; and between 5.5 and 7.0 (i.e., $5.5 \leq \text{avg_pr_cl} \leq 7.0$) "not free"	Freedom House

Appendix C: Number of conflicts per year observed

Country	Number of conflicts per period observed						Total for period observed
	0	1	2	3	4	5	
ANGOLA	16	40	4	0	0	0	60
BURKINA FASSO	56	4	0	0	0	0	60
BURUNDI	44	17	0	0	0	0	61
BENIN	61	0	0	0	0	0	61
BOTSWANA	61	0	0	0	0	0	61
D.R. OF CONGO	44	12	5	0	0	0	61
CENTRAL AFRICAN R.	56	5	0	0	0	0	61
CONGO	55	6	0	0	0	0	61
COTE D'IVOIRE	58	3	0	0	0	0	61
CAMEROON	55	6	0	0	0	0	61
ERITREA	57	3	0	0	0	0	60
ETHIOPIA	16	11	15	7	10	1	60
GABON	60	1	0	0	0	0	61
GHANA	58	3	0	0	0	0	61
GAMBIA	60	1	0	0	0	0	61
GUINEA	58	2	0	0	0	0	60
GUINEA EQUATORIAL	39	21	0	0	0	0	60
GUINEA-BISSAU	47	13	0	0	0	0	60
KENYA	55	6	0	0	0	0	61
LIBERIA	49	12	0	0	0	0	61
LESOTHO	60	1	0	0	0	0	61
MADAGASCAR	59	2	0	0	0	0	61
MALI	57	4	0	0	0	0	61
MAURITANIA	55	6	0	0	0	0	61
MALAWI	61	0	0	0	0	0	61
MOZAMBIQUE	34	27	0	0	0	0	61
NAMIBIA	61	0	0	0	0	0	61
NIGER	54	6	1	0	0	0	61
NIGERIA	52	6	2	0	0	0	60
RWANDA	50	11	0	0	0	0	61
SUDAN	24	36	1	0	0	0	61
SIERRA LEONE	51	10	0	0	0	0	61
SENEGAL	52	9	0	0	0	0	61
SOMALIA	40	20	0	0	0	0	60
SAO-TOME & PRINCIPE	60	0	0	0	0	0	60
SWAZILAND	61	0	0	0	0	0	61
CHAD	26	32	0	1	1	0	60

TOGO	61	0	0	0	0	0	61
TANZANIA	60	1	0	0	0	0	61
UGANDA	29	31	1	0	0	0	61
SOUTH AFRICA REPUBLIC	38	16	7	0	0	0	61
ZAMBIA	61	0	0	0	0	0	61
ZIMBABWE	52	9	0	0	0	0	61
Total	2,163	393	36	8	11	1	2,612

Source: Prio database

Understanding the table: observed over a period of 60 years, Angola was not in conflict for 16 of those years; 40 times during the period of observation, the country experienced at least one conflict and four times, the country had to face two conflicts in the same year. Of the 60 observed periods, only Ethiopia experienced five conflicts in a single year. Only eight countries have not experienced conflict: Benin, Botswana, Malawi, Namibia, Sao-Tome-and-Principe, Swaziland, Togo and Zambia.

References

Akresh, R., de Walque, D., 2008. Armed conflict and schooling: evidence from the 1994 Rwandan Genocide. HiCN Working Paper 47. University of Sussex, Brighton.

Azam, J.P., 2001. The redistributive state and conflicts in Africa. *Journal of Peace Research* 38 (4), 429-444.

Bird, L., 2007. Children in crisis: Education rights for children in conflict affected and fragile states. Paper commissioned for the EFA Global Monitoring Report 2008, Education for All by 2015: will we make it? UNESCO, Paris.

Beck, N., 2001. Time-series-cross-sections data: What have we learned in the past few years? *Annual Review of Political Science* 4, 271-293.

Brakman, S., Garretsen, H., Schramm, M., 2004. The strategic bombing of German cities during World War II and its impact on city growth. *Journal of Economic Geography* 4 (2), 201-218.

Chauvet, L., Collier, P., 2007. L'aide aux États fragiles: quand et comment? In Châtaigner J-M., Magro, H. (Eds.), *États et sociétés fragiles. Entre conflits, reconstruction et développement*. Karthala, Paris, pp.435-451.

Chen, S., Loayza, N.V., Reynal-Querol, M., 2007. The Aftermath of civil war. World Bank Policy Research Working Paper 4190. World Bank, Washington, DC.

Collier, P., Hoeffler, A., 2002. Aid, policy, and growth in post-conflict societies. World Bank Policy Research Working Paper 2902. World Bank, Washington, DC.

Collier, P., Hoeffler, A., Rohner, D., 2006. Beyond greed and grievance: feasibility and civil war. Centre for the study of African economies, Working Paper Series 2006/10, University of Oxford, Oxford.

Easterly, W., 2009. How the millennium development goals are unfair in Africa. *World Development* 37 (1), 26-35.

Gleditsch, N.P., Wallensteen, P., Eriksson, M., Sollenberg, M., Strand, H., 2002. Armed conflict 1946-2001: a new dataset. *Journal of Peace research* 39 (5), 615-637.

International Displacement Monitoring Centre, 2010. Internal displacement monitoring report: Global Overview of Trends and Developments in 2009. Norwegian Refugee Council, Geneva, Switzerland.

Miguel, E., Roland, G., 2006. The long run impact of bombing Vietnam. National Bureau of Economic Research Working paper 11954. University of California, Berkeley.

Miller-Grandvaux, Y., 2009. Education and fragility: a new framework. *Journal of Education for International Development* 4 (1).

O'Malley, B., 2010. Education under attack. UNESCO, Paris.

Pritchett, L., 2001. Where has all the education gone? *World Bank Economic Review* 15 (3), 367-391.

UNESCO, 2010. Reaching the marginalized. Education for All Global Monitoring Report. UNESCO, Paris.

World Bank, 2003. Breaking the conflict trap: civil war and development policy. World Bank Policy Research Report. World Bank and Oxford University Press, Washington DC.