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Effects of armed conflict on economic growth in sub-Saharan Africa

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Summary

The empirical literature on the relationship between armed conflict and economic growth has been sparsely explored. Thus, the aim of this paper is to fill this gap in the literature by analysing the effects of armed conflict on economic growth by focusing on a sample of 16 Sub-Saharan African countries over the period 1984-2016. To do so, we use four indicators of conflict, namely: internal conflict, external conflict, ethnic tensions and religious tensions. In addition to these variables, we construct a synthetic conflict indicator using the PCA (Principal Component Analysis) method. The results obtained from the double least squares technique, which takes into account endogeneity problems, show that armed conflicts negatively affect economic growth in Sub-Saharan Africa. Also, these results remain robust to the addition of control variables and the use of alternative conflict indicators. However, we have also shown that a high level of economic growth can drive conflict to some extent in sub-Saharan African countries. From the same perspective, this has important policy implications.

Keywords: Conflict, economic growth, double least squares and principal component analysis.

JEL Code: *D72, D74.*

1. INTRODUCTION

Wars and armed conflicts[1] ravage a significant part of the planet. There is some debate as to how to account for them, but from 1990 to 2005, the Stockholm International Peace Research Institute (SIPRI), despite its rather restrictive definition, counted 57 armed conflicts,

[1] The definition used by the Stockholm International Peace Research Institute (SIPRI) to define a major armed conflict is: a contestation over a government or territory that involves the use of armed force between combatants, at least one of whom is the government of a state, and that has resulted in the death of at least 1,000 people in one year
http://www.sipri.org.

ing about 33 countries, i.e. almost one third of the world's countries. Their number has certainly decreased since the 1990s. However, the end of conflicts does not mark a return to "normal" and periods of "post-conflict reconstruction", which are often fragile, are still marked by violence that threatens to lead to new conflicts. Experienced at all levels of organised societies (families, associations, companies, etc.), conflict appears to be a shock that occurs when antagonistic elements and forces come into contact and seek to oust each other. To support this assertion, specialists in conflict issues describe conflict as the confrontation of at least two protagonists.

In the same perspective, armed conflicts have a negative effect on economic growth as they lead to loss of working hours due to reduced availability of labour due to loss of life, injury and disability effects. In addition, conflicts lead to land abandonment and reduced production due to population displacement. Reduced labour availability and limited land use lead not only to lower agricultural production [1] but also, and more importantly, to lower economic growth. A simple comparison of growth rates of countries in conflict situations shows that real GDP growth is, on average, about 2.5 percentage points lower in conflict situations. While growth tends to be slower during conflict in all countries, non-oil commodity exporting countries have suffered the most from conflict, partly because many of them have experienced high intensity conflicts (Central African Republic, Liberia, Democratic Republic of Congo and Sierra Leone). An increase in conflict intensity is on average associated with a decline in real GDP per capita growth of 3.2 percentage points per year. This result is similar to that obtained by [2], which also shows that high intensity conflicts in the Middle East and North Africa have a greater impact on economic growth than others.

Thus, the effect of conflict on growth, on the other hand, appears to depend on certain macroeconomic characteristics, in particular the quality of institutions and fiscal fundamentals, at the time of conflict. Specifically, an increase in conflict intensity is associated with a decline in growth of about 1.5 percentage points in a country with relatively strong institutions and 3 percentage points in countries with weaker institutions. Similarly, growth decreases by 2.4 percentage points when a conflict affects a country with a negligible budget deficit and by 3.4 percentage points if the deficit is 5% of GDP. Moreover, the effects of conflict on growth are dynamic and persist for at least five years after the conflict begins. Moreover, conflict discourages domestic and foreign investors as it fosters an overall climate of instability that is not conducive to investment. However, despite the evidence showing the effects of conflict on economic growth, very few studies have focused on the link between the two. Thus, the aim of this paper is to fill this gap in the literature by analysing the effects of conflict on economic growth in sub-Saharan Africa. There are several reasons for focusing on this part of the African continent (see Figure 5, Appendix 4). On the one hand, this area is subject to repeated episodes of conflict due to its abundance of natural resources [3]. On the other hand, unlike other regions in the world, most countries in this region suffer from low economic growth [4] and high poverty (IMF, 2011) and are still struggling to catch up with developed countries.

This study contributes to the conflict literature in several ways. First, most of the work on conflict has focused on a single component of conflict. For example, the work in [5] examines the impact of internal and external conflicts on a country's overall trade. This work focuses on internal conflicts while [5] looks at the effect of external conflicts on economic growth. In contrast, [6] analyses the effect of ethnic and religious conflicts on economic growth. Reducing conflict to one dimension is unfortunate because according to the International Country Risk Guide (ICRG), conflict incorporates all these dimensions. Therefore, this paper takes into consideration all these dimensions of conflict in addition to constructing a synthetic indicator based on the principal component analysis method. Second,

...p[illegible]nship between conflict and economic growth suffer from imperfections because they do not correct for endogeneity problems. Indeed, there is evidence in the literature that economic development is a source of conflict (conflicts in the allocation of resources generated by growth) [7]. There is therefore an endogeneity problem driven by reverse causality. Ignoring these endogeneity problems leads to biased estimators. In this study we rely on double ordinary least squares to deal with endogeneity problems. Thus, the results reveal that armed conflicts negatively affect economic growth in Sub-Saharan Africa both directly through disruptions in the production process and indirectly through weaknesses in the accumulation of factors of production. Also, these results remain robust to the addition of control variables and the use of alternative conflict indicators.

The paper is organised as follows: Section 1 provides the introduction while Section 2 provides a review of the literature on the links between armed conflict and economic growth. In Section 3, we specify the true determinants of conflict using the PCA method. Section 4 presents the methodology and describes the data. Section 5 discusses the results of the econometric estimations. The conclusion highlights the main results and policy recommendations.

2. LITERATURE REVIEW

The relationship between armed conflict and economic growth has received considerable attention in both the theoretical and empirical literature. Although most studies conclude that there is a negative relationship between armed conflict and economic growth, there is a body of literature that indicates that the effect of conflict on economic growth depends on the determinants of the conflict that are highlighted. Indeed, the studies of [8] and [9] highlight the distinction between, on the one hand, the "*grievance model*", where conflict results from inequality, political oppression and divisions, whether ethnic or religious, and, on the other hand, the "*greed model"*, which emphasises the role played by natural resources in the emergence and maintenance of conflict. Thus, the export of resources increases the risk of war in four ways: financing rebels and weapons, increasing corruption in the administration, increasing incentives for secession and increasing the vulnerability of the population to exogenous shocks [10].

The interaction between political instability and economic growth has been studied by various authors. A recent review of this literature was conducted by [11]. A first pitfall in this work is the measurement of political instability. One method often used is to quantify political instability by a composite index. This indicator is constructed, most often by the principal components method, from direct observation of the occurrence of various types of unrest (coups d'état, conspiracies, demonstrations, etc.). This method is based on an often hazardous quantification of discontinuous events. The impossibility of constructing a reliable quantitative measure of political instability leads us to favour, as in [12] and [13], a different approach in terms of the probability of political unrest. In this approach, the factors that influence the probability of political unrest are estimated by a probit model and this probability is used as an explanatory variable in the growth equation. This provides a better understanding of political risk.

Some econometric work, such as that of [14][2] , has introduced ethnic splits and conflicts as a determining variable for Africa's low growth. However, they are based on questionable methods, making the number of ethnic groups a possible crisis factor. Thus, Burundi or Rwanda, which are bi-ethnic, are treated as homogeneous and stable. The work of

[2] W. Easterly, R. Levine, "Africa's Growth Tragedy: Policies and Ethnic Divisions", *Quarterly Journal of Economics*, no. 114, 1997, pp. 1203-1250.

[3] ... the contrary, that conflicts were all the more likely when the number of ethnic groups was limited and prohibited alliance games. Moreover, the interaction between political instability and economic growth has been analysed by many authors[4] . For example, [16] has shown with cross-sectional data on 31 African countries that political instability has a very negative effect on economic growth.

This result of [16] was extended by [17], which reaffirms the double negative influence of instability on economic growth, both directly through total factor productivity and indirectly through physical and human capital accumulation. Using a probit model, [18] show that political risk significantly and negatively affects the growth rate of the economies in the sample.

[19][5] estimates, based on econometric tests, that four major determinants increase the probability of the occurrence and duration of African conflicts: low income, which can be equated with a lower opportunity cost of rebellion; natural resources, which do not play a monotonic role and increase the risk of conflict up to a certain threshold (by increasing the potential gains of rebels), and then reduce it (perhaps because they increase the capacity of states to ensure order); population size, which increases the risk by making secession possible; and finally, ethno-linguistic fractionation, which also does not play its role monotonically. More recently, [19][6] has differentiated five main explanatory factors of conflicts: high dependence on primary products, which offers opportunities for rebels to finance themselves through predation; financing by diasporas; low state resources prohibiting defence financing; low employment opportunities for uneducated youth, reducing the opportunity cost of warlike activity; and the dispersion of populations in uncontrolled territories.

3. DETERMINATION OF THE EXPLANATORY FACTORS OF CONFLICTS BY THE ACP METHOD

3.1 Design of the conflict indicator

To analyse the relationship between armed conflict and economic growth, we build on the work of [19][7] and [20] to construct a conflict indicator (Cf_{it}). To do so, we use four conflict indicators, namely internal and external conflicts as well as ethnic and religious tensions. This indicator is presented as follows:

$$Cf_{it} = \sum_{i=1}^{n} Cint_{it} + Cext_{it} + Teth_{it} + Trel_{it} \; / \; 4$$

With Cf_{it} the conflict indicator, $Cint_{it}$ internal conflict, $Cext_{it}$ external conflict, $Teth_{it}$ ethnic tensions and $Trel_{it}$ religious tensions. Also, t represents the time dimension and i the country dimension. Indeed, the newly constructed indicator is a weighted average of

[3] P. Collier, A. Hoeffer, *op. cit.*
[4] Alberto Alesina, R. Perotti, "The Political Economy of Growth: A Critical Survey of the Recent Literature", *World Bank Economic Review*, no. 8, 1994, pp. 351-371.
[5] . P. Collier, A. Hoeffer, "On Economic Causes of Civil Wars", *Oxford Economic Papers*, vol. 50, 2000, p. 563-573.
[6] P. Collier, A. Hoeffer, *ibid.*
[7] . P. Collier, A. Hoeffer, "On Economic Causes of Civil Wars", *Oxford Economic Papers*, vol. 50, 2000, p. 563-573.

of variables listed above. Also, we use the basic data but the weights are given by PCA (Principal Component Analysis). Thus, it is important to specify that this indicator allows us to better capture the conflict both internally and externally and to analyse its effects on economic growth. It should also be noted that the construction of this indicator provides a clearer picture of the real factors that explain conflict in sub-Saharan Africa. Moreover, according to the Conflict and Political Violence Index constructed by Maplecroft[8] , in 2014, 5 sub-Saharan African countries are classified as being at extreme risk of political violence and 10 countries are at high risk.

3.2 PCA Results and Interpretation

The histogram of the eigenvalues (Table 9, Appendix 2) shows that the first factorial axis accounts for exactly 55.60% of the total dispersion of the clouds. This principal component is therefore retained to construct the synthetic index of socio-political instability according to the relative contributions to the explanation of the total inertia.

Graphical representation of the scatterplot

There is a scattering of the scatter plot around the mean (Figure 1 and 2 Annex 3). This is due to the fact that in some countries, the high level of instability has had an immediate impact on the well-being of the population. The period selected for this study was particularly difficult for all the countries of sub-Saharan Africa. The period was marked by internal conflicts, ethnic and religious tensions, military involvement in politics and corruption. All of these factors created a climate of instability, which had an impact on the economic growth of the countries in this part of Africa.

Furthermore, a more detailed examination of the graphs and interpretation aids provided by the PCA also makes it possible to interpret the axes themselves in terms of the contribution of the initial variables to the inertia explained by the axis that carries them. For reasons of space, we choose here to represent the cloud of variable points in a factorial plane of axes (1,2). The observation of Figure 3 (Annex 3) shows that the variable points: internal conflicts, ethnic and religious tensions, corruption and the involvement of the military in politics contribute more to the positioning of the first factorial axis than external conflicts. On the other hand, these first five variables weakly illustrate the second factorial axis than external conflicts. This means that the factors that better explain conflict in this work are: internal conflict, ethnic and religious tensions, corruption and military involvement in politics.

The study of the weights attributed to the first axis and the temporal evolution of the synthetic index of socio-political instability represented in Figure 4 in Annex 3 shed additional light on the interpretation of this index. The first observation that can be made is that not only are two of the five components of the first principal component indicators of high instability, but the coefficients assigned to them are the highest. Moreover, as the graph mentioned above shows, instability remains very high over the period 1990 to 2016. This is a particularly troubled period, characterised by repeated coups d'état, ethnic and religious tensions, civil wars and mass killings of populations in the countries included in this study. On the other hand, Figure 5 (Annex 3) shows the evolution of conflicts in the world. We can see that sub-Saharan Africa is the area most affected by conflicts. From the 1990s onwards, the dynamics of conflict evolution became more pronounced simply because of the great

[8] Maplecroft is a global risk and strategy consultancy based in Bath, UK. Its work includes analysis of the key political, economic, social and environmental risks affecting global businesses and investors.

political instability that prevailed during this period. It was marked by coups, assassinations, ethnic and religious tensions, mutinies and war over natural resources. It should also be noted that this conflict trend is higher in sub-Saharan Africa as this part of Africa is rich in natural resources. This is why the '*greed model*' developed by [19] emphasises the role of natural resources in the emergence and maintenance of conflict.

4. METHODOLOGY AND DATA

4.1 Description and specification of the model

In this study, we draw on the work of [21] that deals with the effects of terrorism on child mortality in Africa. We adopt this specification in the case of our study which analyses the relationship between conflict and economic growth in Sub-Saharan Africa. Thus, we focus on a static panel model estimated using the double least squares technique.

The specification equation is as follows:

$$PIB_{it} = \beta_0 + \beta_1 Cf_{it} + \beta_2 X'_{it} + \gamma_{it} \quad \textbf{(1)}$$

Where PIB_{it} represents the country's gross domestic product, Cf_{it} the conflict indicator (consisting of variables such as: internal conflict, external conflict, ethnic tensions and religious tensions), X'_{it} the matrix of other control variables which can be summarised as: corruption (Cor_{it}), natural resource rents ($\mathrm{Re}n_{it}$), military expenditure (Dem_{it}), inequality (Ing_{it}), gross fixed capital formation (Inv) and human capital (Cah_{it}) and γ_{it} the error term. Furthermore, t represents the time dimension and i the country dimension.

More specifically, equation (1) can be written as :

$$PIB_{it} = \beta_0 + \beta_1 Cf_{it} + \beta_2 Cor_{it} + \beta_3 \mathrm{Re}n_{it} + \beta_4 Ing_{it} + \beta_5 Dem_{it} + \beta_6 Cah_{it} + \beta_7 Inv_{it} + \gamma_{it} \quad \textbf{(2)}$$

Moreover, when we look at the specification of equation (2), we can see that one of the problems that can arise from the estimation of this equation by ordinary least squares is the endogeneity driven by reverse causality. Indeed, the theoretical and empirical literature shows that growth can be a source of conflict [22]. More specifically, a level of economic growth can lead to a rate of unemployment in the country considered. Also, the unemployment rate explains the political instability in these economies by reducing the opportunity cost of conflict [23]. Thus, ignoring this endogeneity problem may lead to biased results. Therefore, like [24], we use double ordinary least squares to solve this problem. Furthermore, like these authors, we also use the number of protests recorded by the African Social Conflict Database.

This variable has the advantage of being highly correlated with conflict and meets the exclusion condition of [25] in that it is not related to economic development. The instrumental variable, protest, is a count variable measuring the number of protest events as recorded by the Social Conflict in Africa (SCAD) database developed by [26]. Indeed, this database contains information on protests, riots, strikes and other social disturbances. For our instrument, protest, we exclude all types of organised violence (e.g. organised violent riots) and only consider events that were intended to be non-violent (e.g. peaceful protests,

riots and strikes). In the same perspective, authors such as [21] have used the same instrument in their work to show the impact of terrorism on child mortality. Moreover, this instrument has the merit of being time-varying and uncorrelated with other macroeconomic variables. Thus, protests can vary from one period to another.
More specifically, equation 2 can be written as :

$$Cf_{it} = \gamma_0 \gamma_1 Pib_{it}\ \gamma_2 Cor_{it} + \gamma_3 Ren_{it}\ \gamma_4 Ing_{it} + \gamma_5 Dem_{it} + \gamma_6 Cah_{it} + \gamma_7 Inv_{it} + \gamma_8 Protest_{it} + \varepsilon_t \quad \textbf{(3)}$$

$Protest_{it}$ **:** measures the number of conflict protests in Africa at time t

The global model

$$PIB_{it} = \beta_0 + \beta_1 Cf_{it} + \beta_2 Cor_{it} + \beta_3 \text{Re}n_{it} + \beta_4 Ing_{it} + \beta_5 Dem_{it} + \beta_6 Cah_{it} + \beta_7 Inv_{it} + \gamma_{it} \quad \textbf{(2)}$$

$$Cf_{i,t} = \gamma_0 \gamma_1 Pib_{it}\ \gamma_2 Cor_{it}\ \gamma_3 Ren_{it}\ \gamma_4 Ing_{it} + \gamma_5 Dem_{it} + \gamma_6 Cah_{it} + \gamma_7 Inv_{it} + \gamma_8 Protest_{it} + \varepsilon_t \quad \textbf{(3)}$$

4.2 Estimation technique

To estimate the model, we use the double least squares method developed by [27] in 1957 and [28] in 1961. The double least squares (DLS) estimation procedure is the most widely used in practice. It applies to all models that are either fair or over-identifiable. This DLS method is based, as the name suggests, on the two-stage application of OLS. The properties of the CMD estimator are asymptotically identical to those of a classical estimator, i.e. for small samples the parameter estimates may be biased. Note that the DMC estimator can be interpreted as an estimator of the instrumental variables method[9] , the exogenous variables of the other equations being the instruments.

4.3 Data

The data required for this study came from the World Bank's *World Development Indicators* (WDI, 2016) database, as well as from the Inequality (WIID GLOBAL, 2021) and Oil (UNCTAD, 2016) databases, and from the Bank of Central African States (BCAS) and the International Monetary Fund (IMF) databases. In addition, in order to deepen our analyses on conflicts, we also used the Transparency International database, the Social Conflict in Africa (SCAD) database developed by [29], the Major Episodes of Political Violence database (MEPV, 2018) and the ICRG 2017 database on armed conflicts in Sub-Saharan Africa. These data, which cover the period 1984-2016, make it possible to analyse not only the effects of armed conflict on economic growth in sub-Saharan Africa in the long and short term, but also and above all to show the mechanism by which economic development could generate armed conflict.

[9] Greene W.H., pages 681 - 684, 2000.

1) Explained variable

As in previous work, the dependent variable (Pib_{it}**)** is GDP per capita [16] and [5]. It comes from the World development Indicators database (WDI, 2016) and captures the evolution of economic growth in SSA countries in the case of this study.

4.3.2 Independent variables

The independent variables are also in line with the literature [5] and [29]. These are :

The internal conflict ($Cint_{it}$), captures political violence and its potential impact on the government. It takes into account civil war, coup d'état, terrorism, political violence and civil disorder.

External conflicts ($Cext_{it}$) refer to risks to the government from foreign actions that can range from non-violent external pressures (e.g. trade restrictions, territorial disputes and diplomatic pressures) to cross-border conflict and war.

Ethnic tensions ($Teth_{it}$) measures the degree of tension attributable to racial, national or linguistic divisions.

Religious tensions ($Trel_{it}$) measures tensions related to the domination of society by a single religious group that tends to replace civil law with religious law, suppressing religious freedom or expression of religious identity. And the synthetic conflict indicator (Cf_{it}) constructed from the PCA as well as [19] and [11].

4.3.3 Control variables

The control variables are also in line with the literature on the determinants of growth. These are :

Natural resources (Ren_{it}), specifically the oil resource, makes it possible to capture the effect of the oil rent not only on economic growth but also and above all on conflicts. According to the *greed model* developed by [19], natural resources play a fundamental role in the emergence and maintenance of conflict.

The level of corruption ($Corr_{it}$) is an important determinant of conflict. It is used to analyse the effect of corruption on economic growth. For example, [19] shows that a high level of corruption reduces economic growth through expenditure. However, corruption influences the growth of an economy by reducing the quality of the production of goods. Low quality goods are generally in lower demand and can reduce the flow of goods in the market [30].

Inequality (Ing_{it}) is considered in this study as a determinant of conflict. Thus, the more unequal societies are, the higher the probability of political instability and conflict events. This analysis is consistent with the work of [11]; [31] and [32]. Furthermore, an unequal society grows less quickly and reduces poverty less quickly, since it is likely to miss out on profitable investment projects. These results are comparable to those of [33].

Military expenditure (Dem_{it}) as a determinant of conflict makes it possible to measure the share of revenues allocated to the defence of a state in order to guarantee the security of the population and political stability. Thus, the effect of military expenditure on economic growth has been analysed by several authors, notably [34] and [35].

The level of investment (Inv_{it}) is measured by gross fixed capital formation. This variable includes productive investment and infrastructure investment [36]. It is a major component of public expenditure and is one of the fundamental mechanisms by which the state stimulates economic growth. At the level of the empirical literature, research work has approved the existence of a relationship between investment and economic growth since the works [37] and [38]. Indeed, investments affect growth through their action on supply and demand.

In most cases, [39] suggests that human capital (Cah_{it}) is not optimally used in economies where rent-seeking and corrupt activities thrive. This result is valuable because it empirically supports the hypothesis introduced by [40] that certain conditions must be met for human capital to have an effective effect on economic growth. Considering the approach of human capital as proposed by [41], it can be considered as an indicator of the level of education in a country, it can be expected to have a positive effect on economic growth.

5. RESULTS AND ROBUSTNESS

This section presents two main points. On the one hand, the first point presents the basic results. On the other hand, we analyse the robustness of the results.

5.1 poignant results and discussion

In order to deal with the potential bias of conflict endogeneity, we use the instrumental variables method to estimate the parameters. Several variables can be used as instruments, but in the case of this study we choose the protest variable. Also, it has the advantage of being strongly correlated with conflicts and respects the exclusion condition of [42] insofar as it is not linked to economic growth.
The results of the double least squares estimation are presented in Table 3 below.

The results of the estimation of the global model by the DMC method

Table 1: Effect of conflict on economic growth

Variables	Dependent variable : GDP per capita				
	(1)	(2)	(3)	(4)	(5)
Internal conflicts	- 0.450**				
	(0.226)				
External conflicts		- 0.424*			
		(0.253)			
Ethnic tensions			- 1.035**		
			(0.476)		
Religious tensions				- 1.450**	
				(0.683)	
Conflict indicator					- 0.666**
					(0.338)
Corruption	- 0.872**	- 1.024***	- 0.908**	- 0.908**	- 0.929**
	(0.404)	(0.386)	(0.392)	(0.405)	(0.395)
Oil resources	0.00712*	0.00821**	0.00707*	0.00821**	0.00753**
	(0.00372)	(0.00361)	(0.00366)	(0.00357)	(0.00364)

I[illegible]ties	-0.0744*	-0.0478*	-0.120*	-0.178**	-0.0838*
	(0.0547)	(0.0548)	(0.0614)	(0.0801)	(0.0560)
Military expenditure	-0.451***	-0.494***	-0.472***	-0.520***	-0.478***
	(0.129)	(0.129)	(0.128)	(0.133)	(0.129)
Investment	-0.00265	-0.00856	-0.00125	0.00562	-0.00385
	(0.0329)	(0.0335)	(0.0329)	(0.0342)	(0.0330)
Human capital	0.0113	0.0139	0.0121	0.0147	0.0127
	(0.0231)	(0.0233)	(0.0231)	(0.0238)	(0.0231)
Constant	2.000	-0.344	4.938	5.292	1.895
	(3.094)	(3.664)	(3.193)	(3.353)	(3.119)
(Cragg-Donald Wald F statistic	**285.664**	**242.594**	**203.436**	**70.837**	**617.752**
Stock-Yogo weak ID test critical values	**19.93** **11.59**	**19.93** **11.59**	**19.93** **11.59**	**19.93** **11.59**	**19.93** **11.59**
Comments	512	512	512	512	512
R-squared	0.080	0.059	0.077	0.012	0.071

Source: Author's estimate using stata 15.0 Standard errors in parentheses
Notes: Standard deviations in brackets. *** p<0.01, ** p<0.05, * p<0.1

When we analyse the results of the estimations, it is clear that the instrumental variables technique allows us to correct the endogeneity bias that could result from either simultaneity bias, reverse causality or omitted variables. Before commenting on the double least squares results, our analysis will focus on the interpretation of the yogo stocks as noted by authors such as [43] and [44]. Indeed, the results from the double least squares regression are valid if and only if the **Cragg-Donald Wald F statistic** is higher than not only the value of the yogo stock but also the value of the **weak ID test critical values.** Thus, the results show that for each model, the Cragg-Donald Wald F statistic is greater than both the yogo stock and the weak ID test critical values at the 10 and 25% threshold. To illustrate, let us consider model 1. We see that **285.664** is greater than both **19.93** and **11.59.** This means that the results of the double least squares (2SLS) estimation are reliable.

Moreover, since we use a single variable as an instrument, the problem of model identification does not arise. Furthermore, we obtain a significant correlation between the conflicts and the instrument and an absence of correlation between the latter and the residuals, thus confirming the validity of the instrument, since it does not violate the orthogonality condition. Overall, the results obtained using the instrumental variables method remain consistent with the analysis of the fixed effects model, confirming the negative effect of conflicts on economic growth insofar as conflicts directly lead to disruptions in the production process through weaknesses in the accumulation of production factors. These results are in line with those of [16] which also show the effect of instability on economic growth. Also, it should be noted that the coefficients of all components of the conflict indicator including itself are negative and significant evidence of a negative relationship between conflict and economic growth. In other words, conflict negatively affects economic growth in SSA. Between 1970 and 2002, Africa in general and sub-Saharan Africa in particular was the scene of 35 wars, the vast majority of which were internal conflicts. All these wars have had negative consequences on the economic growth of the countries in this area, which is why SSA is the poorest part of Africa today.

The estimation results also show that the coefficient on the corruption variable is negative and statistically significant at the 5 and 1% level for the Sub-Saharan African

This could be explained by the fact that In other words, corruption has a negative effect on economic growth. Such a result means that the improvement in the level of corruption in SSA countries appears to play an important role in the deterioration of economic growth. Thus, corruption not only increases the cost of production, but also reduces the quality of resource productivity. This can directly or indirectly slow down overall economic growth, as these resources could have been used and benefited the whole community if they had been allocated efficiently [30]. Furthermore, corruption influences the growth of an economy by reducing the quality of the production of goods. Low-quality goods are generally in lower demand and can reduce the flow of goods in the market. These results are consistent with those of [19], which show that high levels of corruption dampen economic growth through spending.

The oil resource variable positively and significantly affects economic growth at the 5% and 10% threshold in SSA. Indeed, an improvement in oil revenues in SSA countries leads to an increase in economic growth. Sub-Saharan Africa is a very resource-rich area and oil in particular seems to play a major role in economic growth in this area. All else being equal, a one percent increase in oil rent accelerates economic growth by 0.712% (model 1) and 0.821% (model 2). This result is similar to those obtained in their respective studies by the following authors: [45]; [46] and [47]. However, the impact of the oil rent, which is limited to only 0.008%, still reflects a problem of governance, i.e. its rational management.

As far as the inequality variable is concerned, its significance and negative sign attest that the more unequal societies are, the higher the probability of political instability events and the lower the growth rate will be. In other words, inequality is negatively correlated with economic growth. Thus, such a result could be explained by the fact that inequality will lead to social instability which will cause disruptions in the production process and a loss of income for the economies in question. This situation in the medium or long term will lead to disruptions in the economic cycle and a significant loss of growth points. Furthermore, in a situation of high inequality, investment projects, both privately and collectively profitable, are not undertaken due to the lack of collateral among their initiators and therefore of access to credit. On the contrary, entrepreneurs with collateral or even funds to invest will carry out their projects, even if they are possibly mediocre. Overall, an unequal society therefore grows less quickly and reduces poverty less quickly, since it risks missing out on profitable investment projects. These results are comparable to those of [48].

The coefficient on the military expenditure variable is negative and statistically significant at the 1% level. In other words, there is a negative correlation between increased military spending and economic growth. This result means that the increase in resources allocated to military spending in an economy will generate a shock in the other sectors of the economy so as to reduce their resources and their contribution to economic growth. Thus, when military spending is high, it diverts some of the economic resources away from investment, thus retarding economic growth. The more the majority of an economy's resources are allocated to military spending, the more this will have a negative impact on the investment and structuring projects that ensure economic growth. These analyses are in line with those of [49].

Table 2: Effect of Economic Growth on Conflict

	Double Least Squares method		
	Dependent variable : Conflict indicator (Cf1)		
Variables	Coefficients	t	P>|t|
GDP	-0.000625** (0.00725)	0.09	0.051

	-0.540*** (0.0582)	9.29	0.000
Rpet	-0.00515*** (0.000544)	9.48	0.000
Ing	0.0294*** (0.00879)	3.35	0.001
Dep	0.00323 (0.0215)	0.15	0.881
Inv	-0.000171 (0.00541)	-0.03	0.975
Cah	0.00327 (0.00385)	0.85	0.395
Constant	2.019*** (0.502)	4.02	0.000
(Cragg-Donald Wald F statistic	**272.002**	**182.109**	**62.934**
Stock-Yogo	**19.93**	**19.93**	**19.93**
weak ID test critical	**11.59**	**11.59**	**11.59**
Observation	528		
R-squared	0.288		

Source: Author's estimate under stata 15.0 Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Before commenting on these results, it is important to check that the instruments obtained from the double least squares method are valid. Therefore, we consider the rk Wald F-stat test of [43] which tests the null hypothesis of weak instruments. For each regression in Table 2, the test statistic of [43] for weak identification is above the demanding critical value of Stock and [44] at the 10% and 25% threshold. In all cases, we individually reject the null hypothesis of individual weak identification. Therefore, the results of the 2SLS estimation are reliable.

The estimation results show that economic growth negatively and significantly affects conflict at the 5% threshold in the Sub-Saharan African countries considered. In other words, there is a negative correlation between economic growth and conflict. Thus, an increase in growth of 1 unit leads to an increase in conflict of 0.000625** units in the same period. This result means that a high level of economic growth in a given region of a SSA country can lead to exogenous shocks as people in other regions may rebel against the ruling power. Also, this rebellion will lead to a long period of political instability with serious socio-economic consequences. In other words, it is a conflict of minorities rebelling against the majority that oppresses them. This was the case, for example, in South Africa with arpatheid (Nelson Mandela was the great hero of this period) and in Nigeria with the Biafran war during the time of General Gowan. To date, this is also the case with the Anglophone crisis in Cameroon and the Islamic boko Haram sect in Nigeria. These results are in line with our expectations.

The level of corruption negatively and significantly affects conflict at the 1% threshold in Sub-Saharan Africa. Thus, this result supports our expectations and corroborates the empirical work of [50] and [51]. Thus, the said result could be explained by the fact that a high level of corruption in any SSA country will create social frustrations and tensions. Since in this system, a vicious circle appropriates the majority of the country's resources in all sectors of activity at the expense of others. This is obviously an overly capitalist system where society is dominated by selfish and egocentric mentalities, i.e. the pursuit of individual rather

[illegible] welfare. This result could also be explained by the spoliation of the law, the cumbersome administrative procedures and the bribes, which render ineffective the measures to fight against bad governance.

The variable oil resources negatively and significantly affects conflict at the 1% level in the SSA countries considered. In other words, there is a negative correlation between oil resources and conflict. Such a result means that the diversity and abundance of natural resources in SSA appears to play an important role in promoting conflict. This result is consistent with those of [16]. It is consistent with the Dutch disease theory which states that "countries with the greatest natural resource endowments are those that lag furthest behind in development". This is because those countries that are sufficiently endowed with natural resources are places where there is constant conflict. This is what is commonly known as the war for natural resources [52] and [53].

With regard to inequality, its positive sign and significance at the 1% level attest to the fact that the more unequal societies are, the greater the probability of having events of political instability and conflict. This analysis is consistent with the work of [16]; [54] and [55].

5.2 Robustness analysis

Several robustness analyses are conducted to show the stability of our results. First, we use an alternative indicator of institutions, namely democracy. Many empirical works have shown that democracy is a fundamental determinant of economic growth. Indeed, democracy affects growth to the extent that it promotes political stability. In other words, it leads to transparency in the political system, peace, tranquillity and an optimal allocation of resources. Moreover, in a democratic system, the state is sovereign and therefore the actions of rebel forces do not affect economic growth. Moreover, countries with strong democratic regimes tend to suffer less from political instability and consequently improve their level of production which leads to strong economic growth [56]. Second, we use an alternative indicator of conflict. This is the conflict indicator from the Major Episodes of Political Violence database (MEPV, 2018).

In this database, we used the variables civil war (civwar), international war (intwar) and ethnic war (ethwar). Also, we rely on the work of [19] to construct the alternative conflict indicator[10] . Finally, as with previous work, we include other explanatory variables considered relevant in the analysis of the determinants of economic growth. These are: trade openness, inflation, industrialisation and democracy.

The theoretical mechanism by which each of the variables affects economic growth is described next:

In the case of trade openness **(Ouv_{it})In the case of trade openness,** it is defined as the sum of exports and imports relative to GDP. This variable generally captures trade policy and could positively influence the inflow of foreign direct investment (FDI) and therefore improve economic growth.

[10] Although we would have liked to use databases such as prio and CSP, we are unable to do so because of the multiple problems they present. In the case of prio, using this database would lead to a reduction in our sample size as it contains few observations on certain countries. For example, Cameroon contains only 7 years of data instead of 33 years as in this study. This is also the case for Liberia, which contains only 6 years of data. In the case of the CSP database, there is little variation in the variables. The variables vary very little. In general, we have variables between 0 and 1. The use of these variables could undoubtedly bias the results of our analysis.

In the case of inflation (Inf_{it}) [57], as an indicator of macroeconomic stability, it reflects the quality of economic policies implemented. Indeed, a high inflation rate is likely to have a negative effect on foreign direct investment (FDI) inflows, which could have a negative impact on economic growth. In other words, a high level of inflation is characterised by a decrease in the purchasing power of consumers, which in turn leads to a decrease in investment and therefore a deterioration in growth. In addition, better control of inflation can improve the credibility of the government, and thus reduce the likelihood of political instability. For example, the recent riots in Tunisia, Egypt and other African countries are partly attributable to high inflation rates that damaged purchasing power and undermined public confidence in their respective governments. In the literature, the work of [58] has shown that there is a strong causality between inflation and political instability.

In the case of industrialisation(Ind_{it})In the case of industrialisation, the more resources an economy allocates to investment projects, the more positive the effect on economic growth. In other words, SSA countries would benefit from industrialising and diversifying their economic base to cope with resilience and obtain the growth points needed for development in this part of Africa.

In the case of democracy($Demo_{it}$), it gives the different actors in society free and fair elections, the possibility to put pressure on the state and even to sanction it. Furthermore, the literature considers democracy as a meta institution, i.e. an institution from which the quality of other institutions in a country is strengthened [59] and [60]. Moreover, countries with strong democratic regimes tend to suffer less from political instability and consequently improve their level of production which leads to strong economic growth [56].

The results of the CMD estimation are presented in the following table:

Table 3: **Effects of conflict on economic growth, case of the alternative institutions (democracy) indicator**

	Dependent variable : GDP per capita				
Variables	(1)	(2)	(3)	(4)	(5)
Internal conflict	- 0.576**				
	(0.239)				
External conflict		- 0.593**			
		(0.278)			
Ethnic tensions			- 1.139**		
			(0.464)		
Religious tensions				- 1.760**	
				(0.726)	
Conflict indicator					- 0.847**
					(0.357)
democracy	0.00503**	0.00987**	0.0449*	0.0145*	0.00563*
	(0.0753)	(0.0753)	(0.0672)	(0.0797)	(0.0737)
Oil resources	0.00459*	0.00508**	0.00397*	0.00611**	0.00477**
	(0.00357)	(0.00360)	(0.00364)	(0.00364)	(0.00358)
Inequalities	-0.0429*	-0.00109*	-0.0836*	-0.165**	-0.0510*
	(0.0534)	(0.0502)	(0.0616)	(0.0876)	(0.0552)
Military	-0.488***	-0.542***	-0.533***	-0.604***	-0.528***

exp[illegible]					
	(0.140)	(0.139)	(0.137)	(0.145)	(0.138)
investment	0.00659	-0.000108	0.00807	0.0177	0.00565
	(0.0328)	(0.0338)	(0.0328)	(0.0343)	(0.0330)
Human capital	0.0102	0.0135	0.0121	0.0144	0.0121
	(0.0232)	(0.0236)	(0.0232)	(0.0242)	(0.0233)
Constant	1.644*	-1.816*	5.134*	5.803*	1.525*
	(3.078)	(3.748)	(3.214)	(3.442)	(3.105)
(Cragg-Donald Wald F statistic	**254.689**	**205.032**	**211.144**	**66.602**	**556.208**
Stock-Yogo	**19.93**	**19.93**	**19.93**	**19.93**	**19.93**
weak ID test	**11.59**	**11.59**	**11.59**	**11.59**	**11.59**
critical values					
Comments	512	512	512	512	512
R-squared	0.069	0.036	0.067	-0.018	0.057

Source: Author's estimate under stata 15.0 Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Before commenting on these results, it is important to check that the instruments obtained from the double least squares method are valid. Therefore, we consider the rk Wald F-stat test of [43] which tests the null hypothesis of weak instruments. For each regression in Table 3, the test statistic of [43] for weak identification is above the demanding critical value of Stock and [44] at the 10% and 25% threshold. In all cases, we individually reject the null hypothesis of individual weak identification. Therefore, the results of the 2SLS estimation are reliable. Overall, the results in Table 3 confirm those obtained in Table 1. Armed conflict significantly and negatively affects economic growth. In contrast, the alternative indicator of institutions captured by democracy positively and significantly affects economic growth.

The results of the estimations reaffirm that armed conflict (captured by its components) negatively and significantly affects economic growth at the 5% threshold in the Sub-Saharan African countries considered. Indeed, there is a strong correlation between conflict and economic growth. In other words, conflicts affect economic growth both directly through disruptions in the production process and indirectly through weaknesses in the accumulation of production factors. They are comparable to those of [16] who also admit the double channel of influence of instability on economic growth. In total, the negative effect is explained by the fact that conflicts lead to a loss of working hours due to the reduced availability of labour because of loss of life, injuries and disability effects. In addition, conflict leads to land abandonment and reduced production due to population displacement. Reduced labour availability and limited land use lead not only to lower agricultural production [61] but also, and more importantly, to lower economic growth.

The addition of the democracy variable as an alternative indicator of institutions does not provide any additional information in the specification of the basic model. Therefore, this new control variable substitutes corruption[11] in the basic model and is interpreted as follows:

The democracy variable positively and significantly affects economic growth in Sub-Saharan Africa at the 5 and 10% threshold. In other words, there is a positive correlation between democracy and economic growth. Indeed, democracy affects growth to the extent that it promotes political stability. In other words, it leads to transparency in the political system, peace, tranquillity and an optimal distribution of resources. Moreover, in a democratic system, the state is sovereign and therefore actions by rebel forces to destabilise

[11] To avoid the multicollinearity problem in the baseline specification, we replace corruption with democracy

only to not affect economic growth. Moreover, countries with strong democratic regimes tend to suffer less from political instability and consequently improve their level of production which leads to strong economic growth [56].

In the case of the variables oil resources, inequality and military expenditure, the results obtained are in line with those obtained previously in Table 3. Thus, for the comments we refer to the analyses mentioned above.

Table 4: Effects of conflict on economic growth, case of the alternative conflict indicator (Civil War, International War and Ethnic War)

	Dependent variable : GDP per capita			
Variables	(1)	(2)	(3)	(4)
Civil war	-0.421**			
	(0.401)			
International Warfare		-0.782**		
		(0.758)		
Ethnic warfare			-0.914*	
			(0.636)	
Conflict indicator				-0.222*
				(0.187)
Corruption	-1.177***	-1.326***	-1.362***	-1.260***
	(0.371)	(0.372)	(0.376)	(0.364)
Oil resources	0.00986***	0.0101***	0.00848**	0.00958***
	(0.00329)	(0.00328)	(0.00353)	(0.00332)
Inequalities	-0.0756**	-0.0813**	-0.0961**	-0.0825**
	(0.0541)	(0.0552)	(0.0575)	(0.0549)
military expenditure	-0.440***	-0.553***	-0.550***	-0.494***
	(0.163)	(0.138)	(0.138)	(0.141)
investment	-0.00608	-0.00280	-0.00641	-0.00542
	(0.0331)	(0.0330)	(0.0334)	(0.0330)
Human capital	0.0131	0.0149	0.0166	0.0143
	(0.0231)	(0.0231)	(0.0233)	(0.0230)
Constant	4.792	4.813	5.978*	5.126
	(3.156)	(3.175)	(3.388)	(3.208)
(Cragg-Donald Wald F statistic	**133.238**	**54.919**	**72.783**	**166.595**
Stock-Yogo weak ID test critical values	**19.93** **11.59**	**19.93** **11.59**	**19.93** **11.59**	**19.93** **11.59**
Comments	512	512	512	512
R-squared	0.076	0.069	0.056	0.076

Source: Author's estimate under stata 15.0 Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Before commenting on these results, it is important to check that the instruments obtained from the double least squares method are valid. Therefore, we consider the rk Wald F-stat test of [43] which tests the null hypothesis of weak instruments. For each regression in Table 4, the test statistic of [43] for weak identification is above the demanding critical value

Stock and Yogo [14] at the 10% and 25% threshold. In all cases, we individually reject the null hypothesis of individual weak identification. Therefore, the results of the 2SLS estimation are reliable. Overall, the results in Table 4 confirm those obtained in Table 1. Armed conflict (captured by new indicators) significantly and negatively affects economic growth. In contrast, the alternative indicator of institutions captured by corruption affects economic growth negatively and significantly.

The estimation results are consistent with those obtained previously. Thus, for comments, we refer to our previous analyses.

Table 5: Effects of conflict on economic growth, case of control variables (industrialisation, trade openness and inflation)

	Dependent variable : GDP per capita				
Variables	(1)	(2)	(3)	(4)	(5)
Cint	- 0.400**				
	(0.228)				
Cext		- 0.428**			
		(0.260)			
Teth			- 0.877*		
			(0.484)		
Trel				- 1.255*	
				(0.651)	
Cf1					- 0.601*
					(0.340)
Corr	-0.744*	-0.853**	-0.788*	-0.714*	-0.781*
	(0.412)	(0.398)	(0.402)	(0.422)	(0.406)
Rpet	0.00726*	0.00816**	0.00703*	0.00794**	0.00756**
	(0.00382)	(0.00367)	(0.00385)	(0.00369)	(0.00375)
Ing	-0.0756*	-0.0483*	-0.117*	-0.167**	-0.0843*
	(0.0553)	(0.0556)	(0.0630)	(0.0786)	(0.0565)
dept	-0.516***	-0.556***	-0.542***	-0.601***	-0.544***
	(0.139)	(0.138)	(0.137)	(0.142)	(0.137)
inv	-0.00621	-0.0125	-0.00486	9.42e-05	-0.00746
	(0.0327)	(0.0334)	(0.0328)	(0.0337)	(0.0329)
notebook	0.00927	0.0112	0.0104	0.0115	0.0103
	(0.0230)	(0.0232)	(0.0230)	(0.0236)	(0.0231)
ind	0.0360**	0.0370**	0.0346**	0.0472**	0.0374**
	(0.0219)	(0.0221)	(0.0221)	(0.0224)	(0.0219)
ouv	-1.15e-10	-1.68e-10	-6.20e-11	-1.02e-10	-1.23e-10
	(1.60e-10)	(1.65e-10)	(1.63e-10)	(1.65e-10)	(1.61e-10)
inf	-0.000238	-0.000277	-0.000235	-0.000321	-0.000261
	(0.000279)	(0.000282)	(0.000279)	(0.000288)	(0.000280)
Constant	2.213	-0.412	5.036	5.168	2.112
	(3.172)	(3.812)	(3.319)	(3.397)	(3.193)
(Cragg-Donald Wald F statistic	**280.615**	**225.054**	**197.093**	**77.981**	**604.784**
Stock-Yogo	**19.93**	**19.93**	**19.93**	**19.93**	**19.93**
weak ID test	**11.59**	**11.59**	**11.59**	**11.59**	**11.59**

crit					
Comments	512	512	512	512	512
R-squared	0.088	0.068	0.086	0.038	0.080

Source: Author's estimate using stata 15.0 Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Before commenting on these results, it is important to check that the instruments obtained from the double least squares method are valid. Therefore, we consider the rk Wald F-stat test of [43] which tests the null hypothesis of weak instruments. For each regression in Table 5, the test statistic of [43] for weak identification is above the demanding critical value of Stock and [44] at the 10% and 25% threshold. In all cases, we individually reject the null hypothesis of individual weak identification. Therefore, the results of the 2SLS estimation are reliable. Overall, the results in Table 5 confirm those obtained in Table 1. Armed conflict (captured by its components) significantly and negatively affects economic development captured by economic growth. In contrast, the alternative indicator of institutions captured by corruption affects economic growth negatively and significantly.

The estimation results show that the addition of the control variables does not affect the significance of the variables in the basic model specification. In other words, these results are consistent with those obtained previously. Therefore, we refer to the comments developed above. However, in the present case, we will limit our analyses to the significance of the newly introduced control variables.

The coefficient of the industrialisation variable is positive and statistically significant at the 5% level for the Sub-Saharan African countries considered. In other words, there is a strong correlation between the level of industrialisation and economic growth. Such a result means that the more resources an economy allocates to investment projects, the more it has a positive effect on economic growth. In other words, SSA countries would benefit from industrialising and diversifying their economic base to cope with resilience and to obtain the growth points needed for development in this part of Africa.

Furthermore, the negative effect of conflict on institutions captured by its alternative indicator (democracy) may justify the sometimes contradictory results provided by studies that examine the relationship between armed conflict and economic growth; hence the interest in taking institutional variables into account in the analysis between armed conflict and economic growth.

In sum, it can be argued that the estimation of the static panel model using the double least squares method allows for a better assessment of the connections between armed conflict and economic growth in sub-Saharan Africa. Thus, the structural model selected supports the conclusion that static panel models are very useful in investigating the different channels through which conflict affects economic growth.

6. CONCLUSION AND RECOMMENDATION

The objective of this paper is to analyse the effect of armed conflict on economic growth in a sample of 16 Sub-Saharan African countries over the period 1984-2016. To do so, we use four conflict indicators, namely: internal conflict, external conflict, ethnic tensions and religious tensions. In addition to these variables, we construct a synthetic conflict indicator using the PCA (Principal Component Analysis) method. We also use this method to determine the real explanatory factors of conflicts in sub-Saharan Africa. These are, of course,

location of oil resources ($Rpet_{it}$), internal conflicts ($Cint_{it}$), ethnic tensions ($Teth_{it}$) and religious tensions ($Trel_{it}$), corruption ($Corr_{it}$) and military spending (Dem_{it}). These results corroborate Philippe Hugon's (2001) analysis that mineral and oil resources are more likely to be sources of conflict than agricultural resources. Oil resources are a source of wealth for a country. Thus, they add value to GDP and thus contribute to the improvement of a country's economic growth. On the other hand, military spending tends to fuel conflicts in Sub-Saharan Africa in particular and in Africa in general. Furthermore, corruption is a scourge that undermines a society, a state or a community of countries. This gangrene in a purely capitalist system leads to frustrations, tensions, uprisings, social imbalance and even conflicts between nationals of the same country. However, the results obtained using the double least squares technique corroborate the hypothesis that conflicts negatively affect economic growth in sub-Saharan Africa both directly through disruptions in the production process and indirectly through weaknesses in the accumulation of factors of production. Moreover, we have also shown that a high level of economic growth can lead to some degree of conflict in sub-Saharan Africa. These results remain robust to the addition of control variables and the use of alternative indicators of conflict. Also, these results provide policy lessons. On the one hand, Sub-Saharan African countries would benefit from accelerating the diversification process of their economies in order to strengthen their resilience to possible shocks that may occur. On the other hand, we call on the responsibility of local governments to create the necessary conditions to ensure a climate of stability, peace and security for their populations and an attractive business climate not only for domestic investments but also and especially for foreign direct investors.

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ANNEXES

Annex 1: List of countries and description of variables and data sources.

Table 6: List of countries

South Africa	Cameroon	Liberia	Sierre Leone
Angola	Congo Brazzaville	Nigeria	Sudan
Botswana	Ghana	RDC	Zambia
Burkina Faso	Kenya	Senegal	Zimbabwe

Source: authors

Table 7: Description of variables

Variables	Definitions	Sources
Internal conflicts	It is an assessment of political violence and its potential impact on government. It takes into account civil war, coup d'état, terrorism, political violence and civil disorder.	ICRG 2017
External conflicts	They relate to risks to the government from foreign actions that can range from non-violent external pressures (e.g. trade restrictions, territorial disputes and diplomatic pressures) to cross-border conflict and war.	ICRG 2017
Ethnic tensions	They measure the degree of tension caused by racial, national or linguistic divisions.	ICRG 2017
Religious tensions	They measure the tensions associated with the domination of society by a single religious group that tends to replace civil law with religious law, which suppresses religious freedom or the expression of religious identity.	ICRG 2017
Conflict indicator	Aggregate indicator of political instability	Author
Corruption	Measures the degree of corruption in a country	WDI 2016
Oil resources	This is a way of capturing the effect of oil rents not only on economic growth but also, and above all, on conflict. According to the *greed model* developed by Collier and Hoeffler (2002), natural resources play a fundamental role in the emergence and maintenance of conflict.	CENUCED

Inequalities	are considered in this study as a determinant of conflict. Thus, the more unequal societies are, the greater the likelihood of political instability and conflict events.	WIID 2021
Military expenditure	It is a conflict determinant that measures the share of revenues allocated to the defence of a state in order to guarantee the security of the population and political stability.	WDI 2016
Investment	The level of investment is measured by gross fixed capital formation. This variable includes productive investment and infrastructure investment (Asiedu and Lien, 2011).	WDI 2016
Democracy (Polity2)	This index is a measure of the degree of democracy in a country. The index values range from -10 to 10, with higher values associated with stronger democratic institutions	Polity IV
Human capital	Considering the human capital approach as proposed by Gary Becker (1960), it can be considered as an indicator of the level of education in a country, it can be expected to have a positive effect on economic growth.	WDI 2016
Commercial opening	This is the sum of imports and exports as a percentage of GDP	WDI 2016
Military policy	The extent to which the military is involved in politics. For example, it may be the result of an external or internal threat, it may be symptomatic of underlying difficulties, or it may be a large-scale military takeover. In the long run, a military system of government reduces democratic accountability.	ICRG 2017
GDP per capita	It measures the level of economic growth in a country	WDI 2016
Political instability	Political instability is a composite concept. It is the manifestation of several factors that do not fully overlap and need to be considered simultaneously	
Industrialization	It is captured by the value added of the manufacturing sector. Like Assongu (2017), we use this variable to analyse its effect on economic growth.	WDI 2016
Inflation	Measured by the annual growth rate of the implicit GDP deflator	WDI 2016

Source: Authors

Table 8: *Statistics on descriptive variables*

Variables	Obs	Mean	Std.Dev	Min	Max
Internal conflict	528	7.402667	2.510789	0	12
External conflict	528	8.802399	2.246657	0	12
Ethnic tensions	528	2.922506	1.298949	0	5
Religious tensions	528	4.061869	1.36618	0	6

[illegible]	528	5.79736	1.518989	0	8.5
Gross domestic product	528	3.365792	8.021558	-51.03086	106.2798
Oil resources	528	147.0944	108.7535	46.34167	372.1083
Inequalities	528	59.43292	7.204781	38.142	77.085
Corruption	528	2.237768	1.102118	0	6
Military expenditure	528	1.722007	2.673684	0	29.72769
Investment	528	16.57175	13.37365	-49.35732	118.9347
Human capital	528	17.81324	18.60097	-69.5098	238.4788
Commercial opening	528	8.40e+08	2.23e+09	-8.34e+08	1.72e+10
Industrialization	528	28.77422	16.72776	-23.94671	95.78291
Democracy	528	0.2083333	5.788998	-9	9
Protests	528	0.1312169	0.1021636	0	0.6309988

Source: Authors' estimates under stata 15.0

Annex 2: Results of the PCA method

Table 9 Presentation of PCA results

Component	Eigenvalues	Difference	Proportion	% Cumulative
PCA1	3,33603	2,40181	0,5560	0,5560
PCA2	- 0,934218	- 0,270406	0,1557	0,7117
PCA3	- 0,663812	- 0,210846	0,1106	0,8223
PCA4	- 0,452966	- 0,0331795	0,0755	0,8978
PCA5	- 0,419786	- 0,226596	0,0700	0,9678
PCA6	- 0,193191	/	0,0322	1,0000

Source: Authors' estimate using stata 2013
Principal component (Eigenvectors)

Table 10: Presentation of PCA results

variables	Vector1	Vector 2	Vector 3	Vector 4	Vector 5	Vector 6
corruption	0,4818	- 0,3131	0,0472	- 0,0138	- 0,1259	- 0,8072
Relative tensions	0,3839	- 0,5711	0,2284	0,3503	0,4484	0,3880
Military Po	0,4536	- 0,1117	- 0,2321	0,0384	- 0,7433	0,4171
Eth tensions	0,3612	0,3380	- 0,7575	0,1830	0,3839	- 0,0228
Conflict of interest	0,4242	0,2226	0,2469	- 0,7819	0,2739	0,1519
Conflict ext	0,3231	0,6321	0,5069	0,4803	- 0,0903	- 0,0168

Source: Authors' estimate using stata 2013

Table 11: Presentation of results

Variable	Obs	Mean	Std. Dev.	Min	Max
Conflict	528	7,402667	2,510789	0	12
Conflitext	528	8,802399	2,246657	0	12
Tensionseth	528	2,922506	1,298949	0	5
Tensionsrel	528	4,061869	1,36618	0	6
Militaryin	528	2,487689	1,730372	0	6
Corruption	528	2,237768	1,102118	0	6

Annex 3: Fixed and ols effects results

Table 12: Ols results

Variables	Dependent variable : GDP per capita				
	(1)	(2)	(3)	(4)	(5)
Cint	- 0.272**				
	(0.182)				
Cext		-0.213*			
		(0.177)			
Teth			- 0.470**		
			(0.336)		
Trel				-0.707**	
				(0.302)	
Cf1					-0.0490*
					(0.302)
Corr	0.743*	0.911**	0.774**	0.951**	0.859**
	(0.392)	(0.390)	(0.389)	(0.387)	(0.394)
Rpet	0.00853**	0.0114***	0.00880**	0.0115***	0.0106***
	(0.00365)	(0.00354)	(0.00362)	(0.00345)	(0.00366)
Ing	-0.0290	-0.0438	-0.0517	0.0175	-0.0296
	(0.0550)	(0.0562)	(0.0571)	(0.0585)	(0.0552)
Dep	-0.489***	-0.501***	-0.502***	-0.492***	-0.509***
	(0.129)	(0.129)	(0.129)	(0.128)	(0.129)
Inv	0.0156	0.0191	0.0165	0.0108	0.0163
	(0.0328)	(0.0329)	(0.0328)	(0.0327)	(0.0328)
Cah	0.0145	0.0157	0.0152	0.0148	0.0157
	(0.0233)	(0.0233)	(0.0233)	(0.0232)	(0.0233)
Constant	0.763	3.928	2.465	1.224	1.997
	(3.221)	(3.583)	(3.168)	(3.139)	(3.263)
Comments	528	528	528	528	528
R-squared	0.071	0.069	0.070	0.077	0.067

Source: Authors

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Fixed effects results

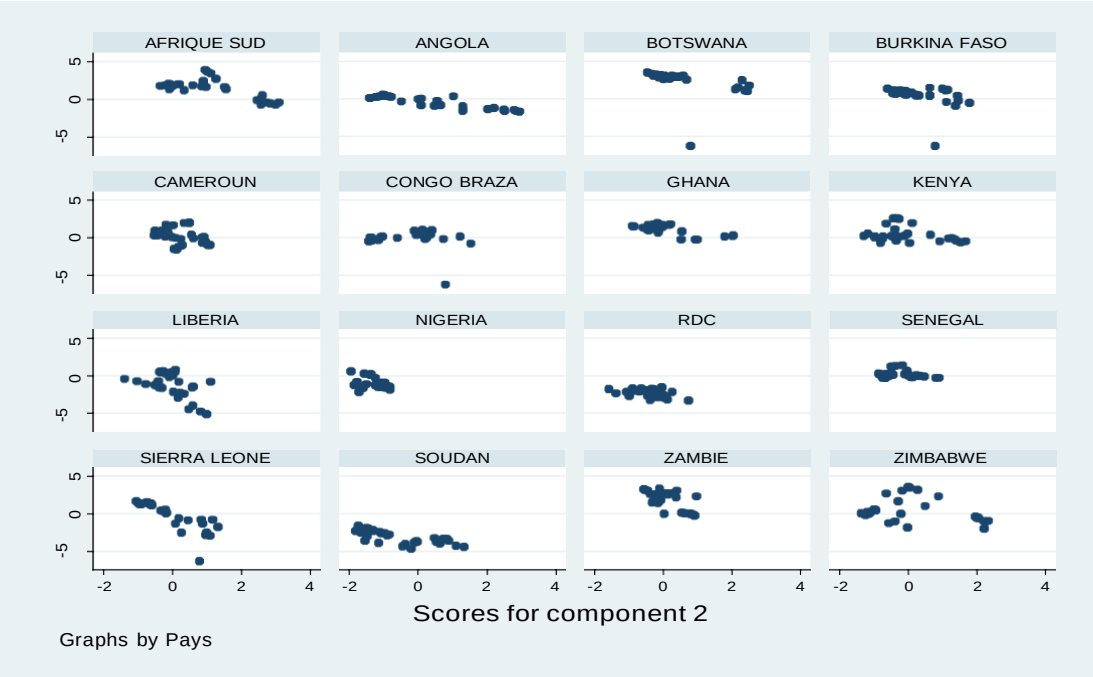
Variables	Dependent variable : GDP per capita				
	(1)	(2)	(3)	(4)	(5)
Cint	- 0.244**				
	(0.201)				
Cext		-0.260*			
		(0.195)			
Teth			- 0.504**		
			(0.455)		
Trel				-1.597***	
				(0.500)	
Cf1					-0.147*
					(0.356)

Co	0.892*	1.005**	0.949**	1.325***	1.007**
	(0.474)	(0.469)	(0.469)	(0.477)	(0.474)
Rpet	0.00800**	0.0107***	0.00839**	0.0102***	0.00995**
	(0.00388)	(0.00381)	(0.00382)	(0.00367)	(0.00388)
Ing	0.0134	0.00599	0.00528	0.0169	0.0143
	(0.106)	(0.107)	(0.107)	(0.106)	(0.107)
dep	-0.525***	-0.506***	-0.533***	-0.491***	-0.524***
	(0.143)	(0.144)	(0.143)	(0.142)	(0.143)
ouv	2.10e-10	2.22e-10	2.01e-10	2.91e-10	2.34e-10
	(2.74e-10)	(2.74e-10)	(2.75e-10)	(2.72e-10)	(2.74e-10)
Inv	0.0119	0.0137	0.0116	0.00313	0.0124
	(0.0359)	(0.0359)	(0.0359)	(0.0357)	(0.0359)
notebook	0.0110	0.0124	0.0121	0.0124	0.0121
	(0.0237)	(0.0237)	(0.0237)	(0.0235)	(0.0238)
Constant	-2.112	0.541	-1.616	3.630	-0.836
	(6.550)	(6.670)	(6.526)	(6.650)	(6.646)
Comments	528	528	528	528	528
Number of Iden	16	16	16	16	16
R-squared	0.061	0.062	0.061	0.077	0.059

Source: AuthorsStandard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

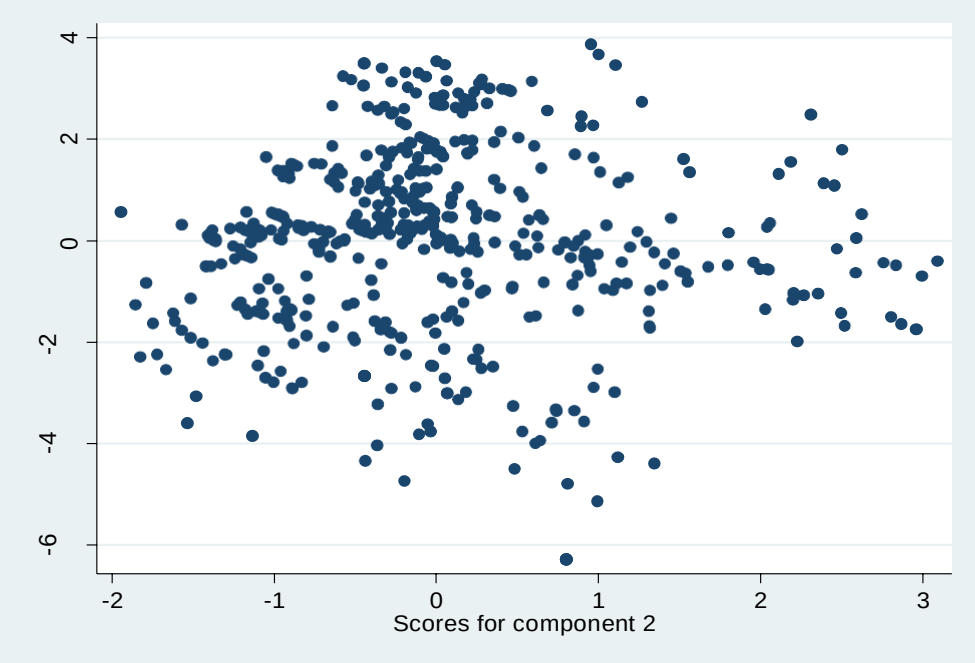
Annex 4: Presentation of graphs

Figure 1: Graphical representation of the scatter plot for each country



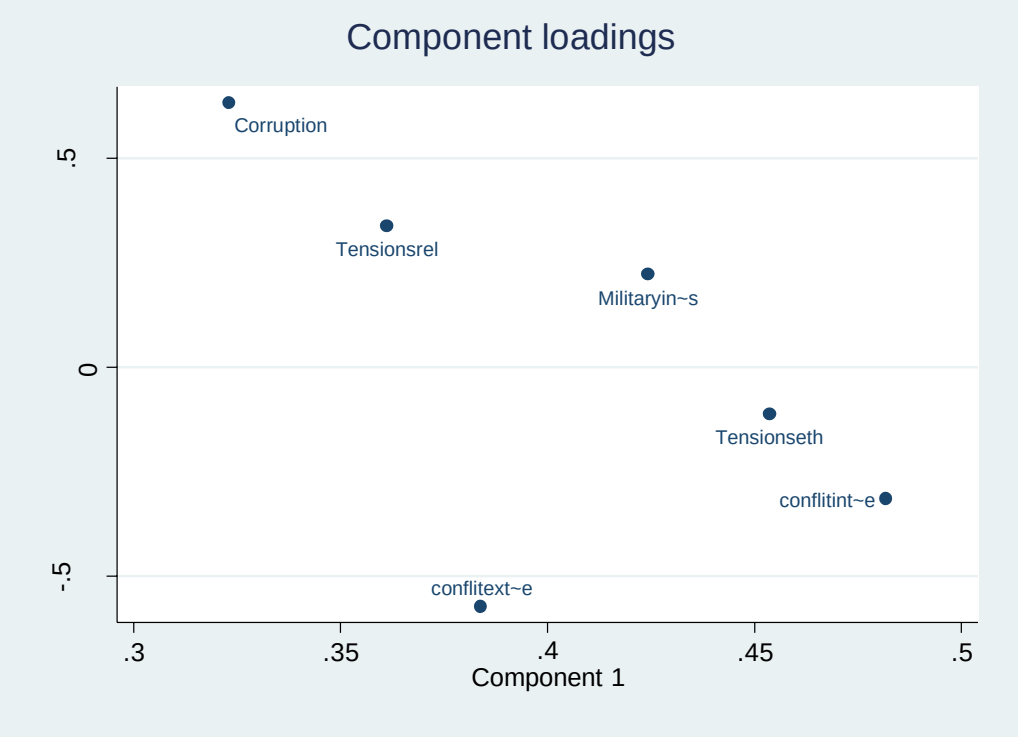
Source: Authors' construction, stata 13

Figure 2: **Graphical representation of the scatter plot for all countries**



Source: Authors' construction, stata 13

Figure 3: Graphical representation of the scatter plot



Source: authors' construction, stata 13

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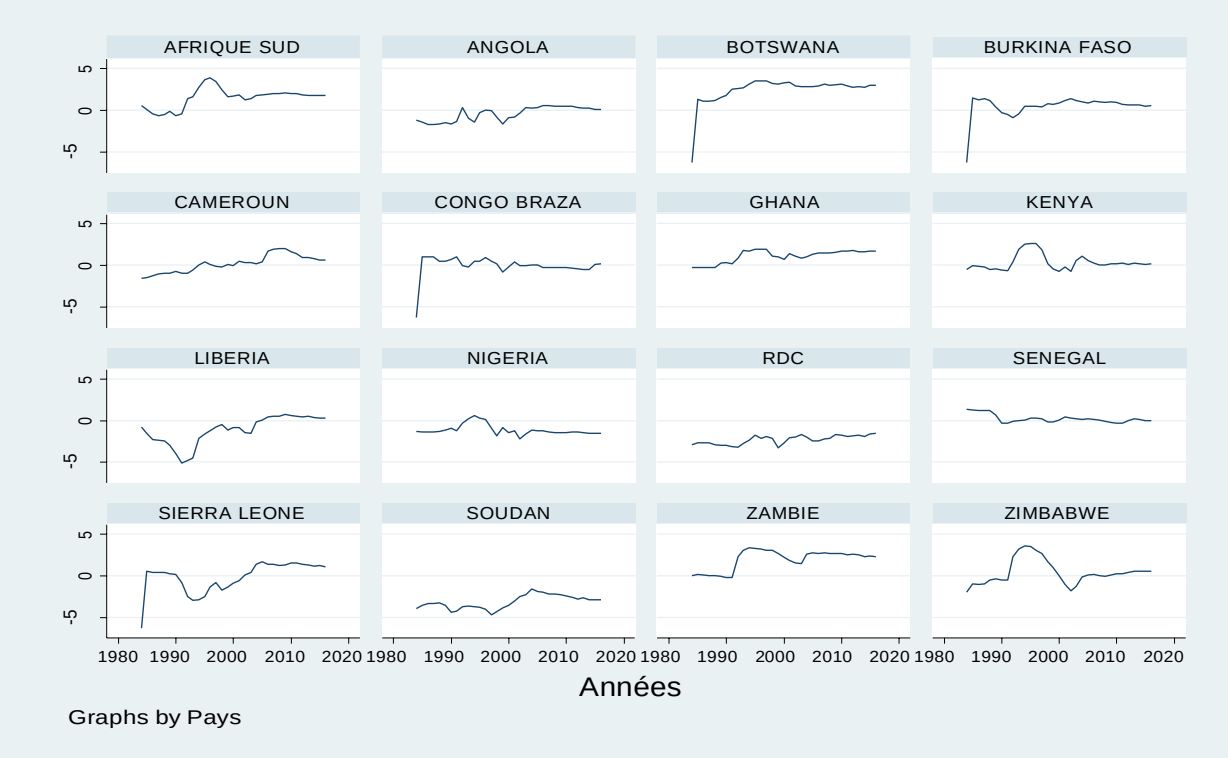
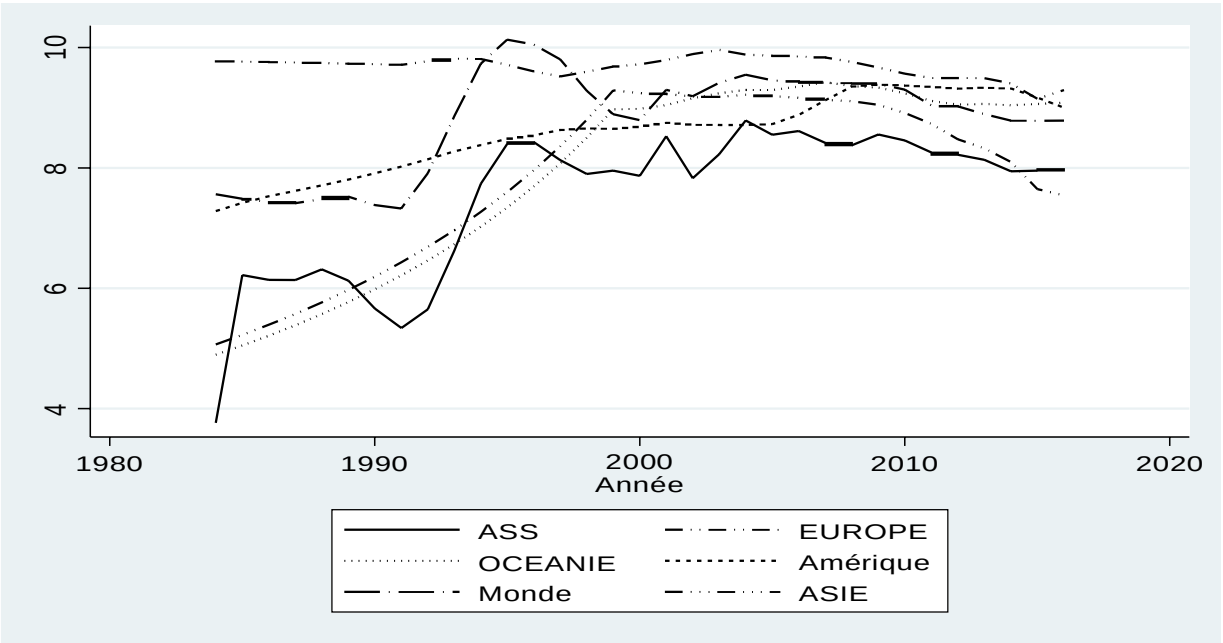
Figure 4: Temporal evolution of the conflict indicator for each SSA country



Source: Authors' construction, Stata 13

Figure 5: Evolution of the conflict indicator in the world



Source: Author's construction, 2021