



ECONOMIC RESEARCH PAPERS

N° 73

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Wars in Africa:
Some Econometric Results**

by

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The views and interpretations in this paper are those of the author
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N° 73
(December 2002)

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The African Development Bank
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Abidjan 01
Côte d'Ivoire

Abstract

In this paper, we investigated whether civil wars in Africa have economic and political causes. The model is based on the Collier-Hoeffler “greed” and “grievance” theory in which rebels will conduct a civil war for “loot-seeking” and “justice-seeking” reasons. Using logit models the propositions were tested empirically. In particular, six variables, GDP per capita growth rate in the preceding period, the amount of natural resources (proxied by primary commodity exports-GDP ratio), peace duration, democracy, social fractionalisation, and population size are significant and strong determinants of the onset of civil wars in Africa. The policy implication is the combination of economic diversification, poverty and population reduction, and political reforms so as to prevent conflict situations in African countries.

Résumé

Dans ce document, nous avons effectué des recherches pour déterminer si les guerres civiles en Afrique ont des causes économiques et politiques. Le modèle s'appuie sur la théorie *Collier-Hoeffler* de la « cupidité » et de « l'affliction », selon laquelle les rebelles s'engagent dans une guerre civile pour « piller » et « établir la justice ». À l'aide de modèles logit, les propositions ont été testées de manière empirique. Six variables, notamment, le taux de croissance du PIB par habitant au cours de la période précédente, la quantité de ressources naturelles (approximative ajustée du ratio exportations de produits primaires/PIB), la durée de la paix, la démocratie, le fractionnement social et le nombre d'habitants sont des facteurs importants et très déterminants de la survenue des guerres civiles en Afrique. Au plan politique, cela doit se traduire par une panoplie de mesures, notamment, la diversification de l'économie, la réduction de la pauvreté et de la population et les réformes politiques, en vue de prévenir les situations conflictuelles dans les pays africains.

Economic and Political Causes of Civil Wars in Africa: Some Econometric Results

by

John C. Anyanwu*

I. Introduction

Since the end of the Cold War, civil war has become the predominant form of violence globally (Wallensteen and Sollenberg, 2000; de Soysa, 2001; Collier and Hoeffler, 2002). For example, of the 25 major armed conflicts listed by the Stockholm International Peace Research Institute (SIPRI) in 2000, all except two were internal. Also, all of the 15 most deadly conflicts in 2001—those that caused 100 or more deaths—were internal conflicts. Indeed, all but 3 of 57 major armed conflicts registered for 1990–2001 were internal. Unfortunately, in SIPRI's 2000 Yearbook, it was stated that "...Africa is the most conflict ridden region of the World and the only region in which the number of armed conflicts is on the increase" (SIPRI, 2000). Again, in its 2002 Yearbook, SIPRI stated that "Africa continued to be the region with the greatest number of conflicts" (see also Figure 1). These domestic conflicts pose a serious threat to economic development, especially for these poor African countries. Empirical works have shown that conflicts can tear down levels of economic development that took decades to achieve. Also, for a long time after their termination the spin-offs of conflicts continue to limit economic growth (Collier 1998).

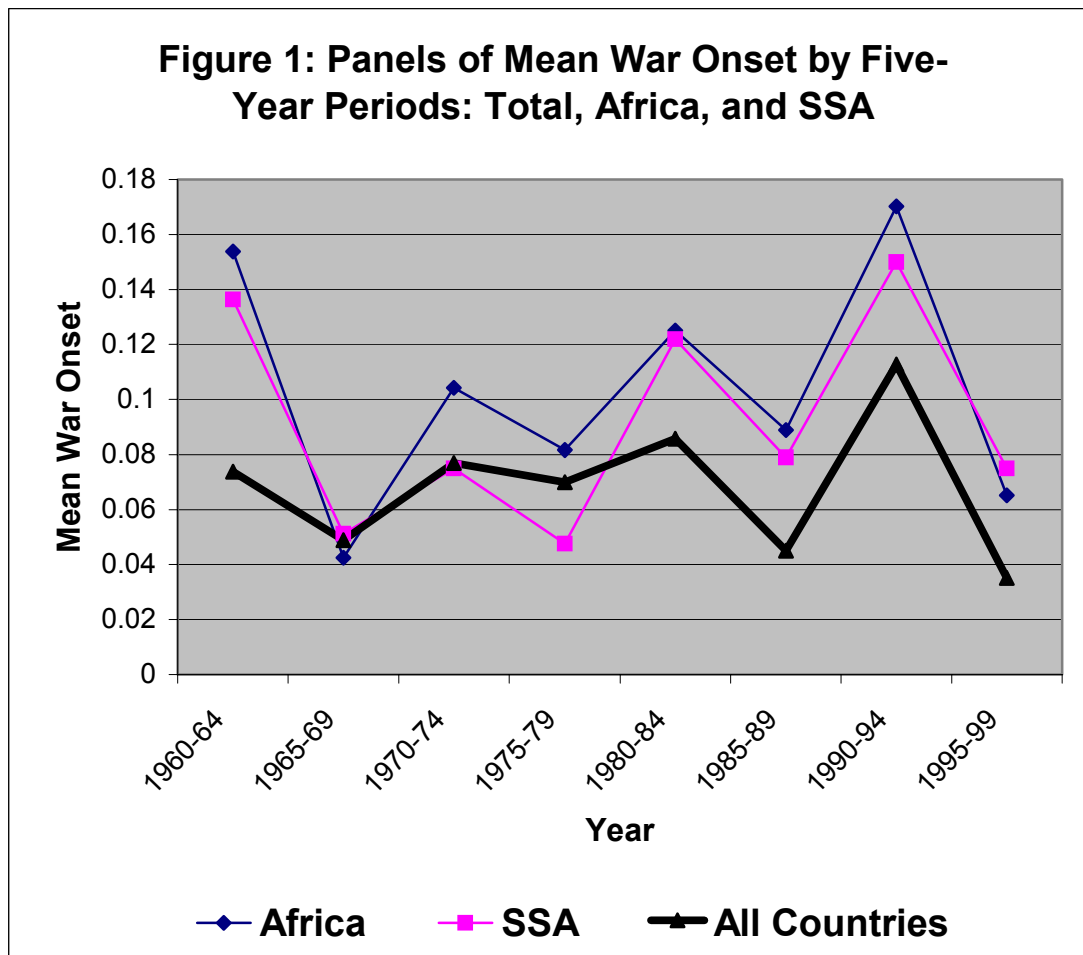
In this paper we apply the Collier-Hoeffler model of conflicts (Collier and Hoeffler, 1998; 2000; 2001; 2002) as modified by Sorli (2002) to analyze the onset or outbreak of civil war in Africa as a whole during the period, 1960-1999. Our main interest is to explore the impact of economic and political variables on civil war outbreak in Africa and hence propose domestic and international policies to effectively prevent civil wars in Africa.

The rest of the paper is organized as follows. Section 2 summarizes the theory of civil war onset and outlines our hypotheses. Section 3 describes our methodology and data. Section 4 presents our findings. Section 5 concludes with some of the policy implications of our analysis.

II. The Theory of Civil War Outbreak

Collier (1998; 1999) and Collier and Hoeffler (1999a; b) distinguished between two possible motives for civil war: "justice-seeking" and "loot-seeking". In more recent papers, Collier and Hoeffler (2000; 2001; 2002) have re-examined these motivations, referring to them as "greed" and "grievance."

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Greed is used here as a desire for private gain. It is argued that the existence of a “lootable” resource base is both a motive for rebellion and a facilitating factor. Rebels have an incentive to challenge governments because of private gain, which is a function of opportunities foregone by engaging in violence and the availability of loutable income, which is the payoff for successfully engaging in rebellion. But greed is explained by atypical opportunities, being one of the chief conditions for profit-seeking, rebel organizations to exist. Collier and Hoeffler’s main proxy for greed is the ratio of primary commodity exports to gross domestic product (GDP) and is seen as offering the opportunity for extortion, which helps to finance war. Thus, they argue that the risk of civil war initiation increases as the natural resource endowment increases and decreases as the opportunity cost of rebellion increases. However, following Le Billon’s typology of natural resources into geographical location (‘proximate’ or ‘distant’ to capital) and the geographical concentration (‘proximate’ or ‘diffuse’), Sorli (2002) considered Collier and Hoeffler’s use of primary commodity dependence as lumpy. Sorli had therefore suggested and used (for the Middle East and North Africa) a break down of primary commodity dependence into mineral and oil dependence. In particular, it is argued that the unique technology, infrastructure and the dominant role of oil in the international commodity market, in addition to its influence on economic and political development, justifies this dichotomy. Our estimation with this dichotomy showed that the dichotomy was not important for Africa hence they were dropped.

Also, rebellions may occur when forgone income is unusually low and this can be proxied by mean income per capita, male secondary schooling, and the growth rate of the economy in the preceding period (representing new income opportunities). Collier and Hoeffler (2001) point to another dimension of opportunity – weak government military capability. Thus, while forests and mountains provide rebels with a safe haven, geographical dispersion of the population may inhibit government capability (see also Herbst, 2000). Another source of rebel military opportunity is social cohesion – ethnic and religious diversity within a country tends to reduce their ability to function. Thus, an ethnically diverse society may reduce the opportunity for rebellion by limiting the recruitment pool. This is usually measured by the index of ethno-linguistic fractionalization.

Rebellions may also be caused by grievance and may aim at achieving justice. The demand versus supply of justice determines the conditions for the onset of “justice-seeking” rebellions. The proxies for the level of grievance include social (ethno-linguistic and religious) fractionalization, the degree of political repression/democracy, ethnic dominance, and economic dysfunction (slow growth; high inflation; high income or asset inequality). While social fractionalization and the presence of minimum form of democracy could reduce the opportunity cost of rebellion, political repression and economic dysfunction would decrease it. While Huntington (1991) asserts that political violence is connected with democratization, it is posited that in regime transition processes, major change is going on, and the ones who benefitted from the earlier situation always hold change back. Thus, while transition brings about the hope for better times, this might not be delivered hence violence is likely to occur (see Gurr, 1970).

III. Methodology and Data

For comparability, we follow the basic Collier-Hoeffler studies with some variation discussed in detail below. The objective is to assess the relative strengths of explanations holding constant variables that proxy the competing explanations discussed above. We use a dependent variable measuring civil war onset (“warsa”) set equal to 1 if a war was initiated during any 5-year period and 0 if no war occurred. Civil war is defined as an internal war in which: “(a) military action was involved, (b) the national government at the time was actively involved, (c) effective resistance (as measured by the ratio of fatalities of the weaker to the stronger forces) occurred on both sides, and (d) at least 1,000 battle deaths resulted” (Singer and Small, 1004). The data (1960-1999) on 161 countries are organized in five-year panels and are drawn from Sorli (2002) as a modification of Collier and Hoeffler (2002). We made some small data improvements in this paper and to estimate the probability of civil war onset, we used a pooled logit model. The variables are described in appendix 1.

Hegre et al (2001) had emphasized the importance of political stability as well as the level of democracy in the outbreak of civil war. In this study, therefore, we include variables on democracy and transition. We used a variable measuring the lowest score of a composite measure of democracy from Gates et al (2001), mainly capturing an objective measurement of political participation from executive recruitment and executive constraint (Vanhanen, 1990). Transition is a dummy variable taking the value one if a change in indicators result in a movement from one category to another in the executive dimension; a change of at least two units in the constraints dimension; or a 100 percent increase or 50 percent decrease in the participation dimension. The creation or dissolution of States is also defined as a polity change. Unlike Collier and Hoeffler our model patterns to the

whole of the African continent (North Africa and Sub-Saharan Africa) rather than theirs, which was limited to Sub-saharan Africa.

The basic model is $\Pr(\text{WARSA}_{1960-1999}) = f(E, D, P, R, S, A)$, where E denotes economic variables (GDP per capita and GDP growth rate), D denotes demographic variables (population size and geographic dispersion), P denotes political variables (peace duration, minimum democracy and its squared term, and transition), R denotes resources (primary commodity exports to GDP ratio and its squared term), S denotes socio-cultural variables (proxied by social fractionalization and ethnic dominance), and A denotes Sub-Saharan Africa. The North African dummy dropped due to insufficient data points. We note that resources could also be classified as economic variables as in Elbadawi and Sambanis (2002).

Based on the above specification, we test three key hypotheses:

H1: Economic development (GDP per capita, GDP growth rate, primary commodity exports-GDP ratio and its squared term) is significantly and negatively associated with civil war onset in Africa. These empirical measures reflect both the opportunity costs of violence (Collier and Hoeffler 2000) and the relative strength of the state (Fearon and Laitin, 2001).

H2: Democracy should reduce the onset of civil war in Africa. This hypothesis is contrary to Collier and Hoeffler's (2000, 2001, 2002) results. We also consider political transition as a proximate cause of civil war.

H3: Ethnic fractionalization should be significantly associated with civil war onset in Africa. Both high and low levels of fractionalization should reduce the onset of civil war by making it harder to coordinate the initiation of new wars. We also consider ethnic dominance as another proximate cause of civil war in Africa.

IV. Empirical Results and Tests of our Hypotheses

4.1 Descriptive Statistics

Table 1 shows the descriptive statistics for Africa for the period, 1960-1999, showing also war episodes (civil war outbreak) and peace episodes (no civil war). Out of the 78 war outbreaks during the period, 40 (or 51.28 percent) occurred in Africa. As the table shows, the African conflict episodes started at approximately the mean income of the continent but slightly less than the mean income of the peace episodes. With respect to the second economic variable - the growth rate of the economy in the preceding period - we discover that war episodes were preceded by lower growth rates. This result is consistent with evidence that the lower is the rate of growth, the higher is the probability of unconstitutional political change (Alesina et al, 1996). The descriptive statistics also give support to the opportunity cost hypothesis: conflict episodes were on average more dependent upon primary commodity exports (and its squared term) than the peace episodes. This indicates that increases in war outbreak were partly due to rebel responses to financial opportunities in Africa contrary to the findings of Collier and Hoeffler (2000, 2001, 2002).

As predicted by theory, the descriptive data support the thesis that peace duration reduces grievance and war episodes. Also, data supports the thesis that democracy reduces the probability of war

outbreak: minimum democracy (and its squared term) was substantially larger (almost double) in peace episodes. In the same way, transition was larger in peace episodes. However, the descriptive data suggests that social fractionalization is important: war episodes have higher mean values. This rejects the thesis that social cohesion enhances opportunity. On the other hand, ethnic dominance is more common in peace episodes than in war episodes.

With respect to demographic variables, the descriptive data shows that war episodes in Africa had markedly larger populations than the peace episodes. Table 1 indicates that the concentration of the population is as common in peace episodes as in war episodes. Sub-saharan Africa is prone to civil war (0.39) than to peace episodes (0.28) (Table 1).

4.2 Regression Results and Tests of Hypotheses

Our estimation results are presented in table 2, with column 1 as our baseline result. We first turn to the economic variables. The risk of onset of civil war is positively but non-significantly associated with per capita income. This partly fails to lend support to the Collier-Hoeffler economic theory of civil war. However, the other proxy for earnings foregone – economic growth rate in the preceding period – is robustly and negatively associated with war onset in Africa. An additional percentage point on the growth rate reduces the risk of war by about two percentage points.

As in Sorli (2002) and Collier-Hoeffler (2000, 2001, 2002) we find that the presence of natural resources (proxied by primary exports-GDP ratio) seems to provide easily “lootable” assets for “loot-seeking” rebels or convenient sources of support of “justice-seeking” movements as exposed by Collier (1999). Thus, while we accept the hypothesis that economic development is significantly associated with the onset of civil war in Africa, we note that higher economic growth significantly reduces civil war while dependence on, or the availability of, natural resources increases the risk of war onset in the Continent. We note also that it is not the level of per capita income *per se* that leads to war outbreak in Africa.

Democracy is clearly significant and negatively associated with civil war onset in Africa. This supports the findings of Elbadawi and Sambanis (2002), Ellingsen et al (2001), and Sorli (2002) but contradicts the findings of Collier and Hoeffler (2002). In our results, democracy shows to be an important explanatory variable, and yields strength to a more

traditional “grievance-based” and liberal peace-rooted explanation of civil war. Thus, we accept the hypothesis that democracy reduces the onset of civil war in Africa. Also, in accordance with political theory, peace duration is significantly and negatively associated with civil war in Africa. In addition, social fractionalization significantly reduces the risk of civil war outbreak. This means that cohesion is important for rebel effectiveness hence social fractionalization makes a society substantially safer. This accords with the reality in Africa, which is characterized by high degree of religious and ethnic fractionalization. Thus, we accept the hypothesis that ethnic fractionalization is significantly and negatively associated with civil war onset in Africa. The non-significance of the positive association between ethnic dominance and civil war in Africa arises because fewer African societies are characterized by ethnic dominance.

Table 1: Descriptive Statistics for Africa

Variable	N	Mean	Std. Dev.	Min.	Max.	No civil war (N=334)	Civil war (N=40)
War starts	382	.1047	.3066	0	1	0	1
Natural log of GDP per capita (const. US\$)	399	6.9292	.6989	5.4027	8.8877	6.945	6.919
GDP per capita growth t-1	347	.6289	3.7491	-10.664	13.189	.869	-1.526
Primary commodity exports/GDP	403	.1699	.1345	.006	.568	.171	.188
Primary commodity exports/GDP squared	403	.0469	.0720	.000036	.3226	.048	.0512
Peace duration	382	301.356	169.2954	1	592	314.585	188.25
Minimum democracy	324	.4188	.5133	0	1.6560	.440	.240
Minimum democracy squared	324	.4381	.7843	0	2.7424	.463	.280
Transition	416	.3534	.4786	0	1	.351	.325
Social fractionalization	416	2946.267	2166.493	20	6975	2901.003	2960.875
Ethnic dominance (45-90%)	416	.4231	.4946	0	1	.412	.350
Natural log of population	412	15.3023	1.5169	10.6383	18.5275	15.114	16.089
Geographical dispersion	408	.5866	.1921	0	.923	.5836	.5838
Sub-saharan African dummy	416	.8462	.3612	0	1	.278	.385
Africa dummy	416	1	0	1	1	1	1

The coefficient of the size of the population is highly significant, positively associated with civil war, and unity. This suggests that risk is proportional to size. We also find that the Sub-saharan African dummy coefficient is significant only at 15 percent significance level and positively associated with civil war. While this may suggest that Sub-Saharan Africa is subject to some minor unobserved additional or reduced risk factors, it is nevertheless consistent with the finding of “no Africa effect” by Collier and Hoeffler (2002) and Sorli (2002), though the coefficient from the former was negative when the entire sample was used. This suggests that the global estimation might be masking sub-region African pictures found by Collier-Hoeffler and Sorli.

V. Conclusion and Policy Implications

We have investigated whether civil wars in Africa have economic and political causes. The model used is based on the Collier-Hoeffler “greed” and “grievance” theory in which rebels will conduct a civil war for “loot-seeking” and “justice-seeking” reasons. Using logit models the propositions were tested empirically. In particular, six variables, GDP per capita growth rate in the preceding period, the amount of natural resources (proxied by primary commodity exports-GDP ratio), peace duration, democracy, social fractionalization, and population size are significant and strong determinants of the onset of civil wars in Africa.

These results are guideposts for policy to reduce civil war onset in Africa. First, African countries and their development partners need to take measures to accelerate economic growth given that rapid economic growth will gradually make rebel recruitment harder. However, given that such high growth rates cannot be realized without external assistance, it is imperative that Africa’s development partners and the international community as a whole need to increase aid to the

Table 2: Regression Results of the Onset of Civil war in Africa+

Explanatory Variable	Model 1 - (Baseline)	Model 2	Model 3
Natural log of GDP per capita (const. US\$)		.301 (.694)	.242 (.701)
GDP per capita growth t-1	-.159 (.073)**	-.159 (.074)**	-.154 (.074)**
Primary commodity exports/GDP	6.088 (2.345)**	5.487 (2.724)*	12.006 (8.867)
Primary commodity exports/GDP squared			-12.220 (15.895)
Peace duration	-.004 (.002)**	-.004 (.002)**	-.003 (.002)**
Minimum democracy	-5.863 (2.150)***	-5.923 (2.155)***	-5.764 (2.166)***
Minimum democracy squared	3.904 (1.463)***	3.910 (1.462)***	3.796 (1.635)***
Transition	.825 (.588)	.811 (.589)	.849 (.598)
Social fractionalization	-.0004 (.0002)**	-.0004 (.0002)**	-.0005 (.0002)**
Ethnic dominance (45-90%)	.716 (.605)	.697 (.610)	.673 (.619)
Natural log of population	1.053 (.365)***	1.059 (.366)***	1.058 (.371)***
Geographical dispersion	.344 (1.611)	.526 (1.658)	.194 (1.732)
Sub-saharan African dummy	1.894 (1.183)	2.308 (1.525)	2.220 (1.521)**
Constant	-19.899 (6.507)***	-22.360 (8.726)***	-22.282 (8.737)***
N	253	253	253
Pseudo R-squared	0.25	0.25	0.25
Log Likelihood	-52.77	-52.67	-52.36

Notes: + Standard errors in parentheses; ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively.

Continent. This is more so when it has been shown that aid is effective in accelerating economic growth. Second, the international community should take measures (including appropriate sanctions) to make it more difficult for rebel organizations to sell the commodities (such as conflict diamonds), which they loot. Third, African countries need to diversify their economies away from dependence upon primary commodity exports. Appropriate economic reforms and policies would therefore be imperative in this direction (see Collier, 2000). Fourth, to make loot-seeking rebels unpopular, African governments should transparently use revenues from primary commodity exports to finance effective basic social services, including education and health.

However, economic development must be complemented by political development and liberalization to attain an amplified effect. The pace of political reforms toward better governance and improved political rights should be accelerated in Africa given that our results have shown that democracy is a useful tool to reduce the onset of civil war in the Continent. African countries may also need to check population increase through a combination of economic and social as well as medical tools given the finding that the risk of civil war is proportional to the size of the population.

APPENDIX 1

Description of variables

“The data source for all variables used in this paper is Sørli (2002), being a modification of Collier and Hoeffler (2002). It provides a panel data set for 161 countries and eight time periods, 1960-64, 1965-70, ..., 1995-99. Thus, it provides 1288 potential observations.

War starts

The war start variable takes a value of one if a civil war started during the period and zero if the country is at peace. If a war started in period t and continues in $t+1$ we record the value of the war started value as missing. A civil war is defined as an internal conflict in which at least 1000 battle related deaths (civilian and military) occurred per year. We use mainly the data collected by Singer and Small (1984, 1994) and according to their definitions Nicholas Sambanis updated their data set for 1992-99.

GDP per capita

We measure income as real PPP adjusted GDP per capita. The primary data set is the Penn World Tables 5.6 (Summers and Heston 1991). Since the data is only available from 1960-92 we used the growth rates of real PPP adjusted GDP per capita data from the World Bank's World Development Indicators 1998 in order to obtain income data for 1995. Income data is measured at the beginning of each sub-period, 1965, 1970, ..., 1995.

(GDP growth) $t-1$

Using the above income per capita measure we calculated the average annual growth rate as a proxy of economic opportunities. This variable is measured in the previous five-year period.

Primary commodity exports/GDP

The ratio of primary commodity exports to GDP proxies the abundance of natural resources. The data on primary commodity exports as well as GDP was obtained from the World Bank. Export and GDP data are measured in current US dollars. The data is measured at the beginning of each sub-period, 1965, 1970, ..., 1995.

Population

Population measures the total population; the data source is the World Bank's World Development Indicators 1998. Again, we measure population at the beginning of each sub-period.

Social fractionalization

We proxy social fractionalization in a combined measure of ethnic and religious fractionalization. Ethnic fractionalization is measured by the ethno-linguistic fractionalization index. It measures the probability that two randomly drawn individuals from a given country do not speak the same language. Data is only available for 1960. In the economics literature this measure was first used by Mauro (1995). Using data from Barrett (1982) on religious affiliations we constructed an analogous religious fractionalization index. Following Barro (1997) we aggregated the various religious affiliations into nine categories: Catholic, Protestant, Muslim, Jew, Hindu, Buddhist, Eastern Religions (other than Buddhist), Indigenous Religions and no religious affiliation. Data is available for 1970 and 1980 and the values are very similar. For 1960, 1965 and 1970 we used the 1970 data and for 1980, 1985, 1990 and 1995 we use the 1980 data. For 1975 we use the average of the 1970 and 1980 data.

The fractionalization indices range from zero to 100. A value of zero indicates that the society is completely homogenous whereas a value of 100 would characterize a completely heterogeneous society.

We calculated our social fractionalization index as the product of the ethnolinguistic fractionalization and the religious fractionalization index plus the ethnolinguistic or the religious fractionalization index, whichever is the greater. By adding either index we avoid classifying a country as homogenous (a

value of zero) if the country is ethnically homogenous but religiously divers, or vice versa. Evidence (Collier and Hoeffler, 2000) shows that this aggregation rule is superior to variants.

Ethnic dominance (45-90%)

Using the ethno-linguistic data from the original data source (Atlas Narodov Mira, 1964) we calculated an indicator of ethnic dominance. This variable takes the value of one if one single ethno-linguistic group makes up 45 to 90 percent of the total population and zero otherwise.

Geographic Dispersion

We constructed a dispersion index of the population on a country-by-country basis. Based on population data for 400km² cells we generated a Gini coefficient of population dispersion for each country. A value of 0 indicates that the population is evenly distributed across the country and a value of 1 indicates that the total population is concentrated in one area. Data is available for 1990 and 1995. For years prior to 1990 we used the 1990 data.

Peace Duration

This variable measures the length of the peace period since the end of the previous civil war. For countries, which never experienced a civil war, we measure the peace period since the end of World War II until 1962 (172 months) and add 60 peace months in each consecutive five-year period.

Sub-Saharan Africa Dummy

Takes the value of one for the following countries: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Brazzaville, Djibouti, Democratic Republic of Congo, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe (see Collier & Hoeffler, 2002: 27-30; and Sørli, 2002: 27-29).

Variables added by Sørli (2002) that are relevant to our analysis:

Minimum democracy and transition

Variables are taken from the data set from Gates et al., 2001".

African Countries in Our Data Set:

Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Brazzaville, Djibouti, Democratic Republic of Congo, Egypt, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe.

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