On the Incidence of Civil War in Africa

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An econometric model of civil war is applied to the analysis of conflict in sub-Saharan Africa. Results show that Africa has had a similar incidence of civil conflict to other developing regions, and, with minor exceptions, its conflicts are consistent with the global pattern of behavior. However, the structure of risk differs considerably from other regions. Africa's economic characteristics have made it more vulnerable to conflict, but this has been offset by social characteristics that make its societies atypically safe. The contrasting trends of conflict are analyzed: rising in Africa and declining in other regions. Results show that these trends are predicted by the model. Africa's rising trend of conflict is due to its atypically poor economic performance.

The Stockholm International Peace Research Institute (SIPRI) stated recently 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 1999, 20).[1] In this study, we apply the Collier-Hoeffler model of civil conflict (Collier and Hoeffler 1998, 2000) to analyze the incidence of civil war in sub-Saharan Africa[2] both relative to other regions and over time. We concentrate on three main questions. First, is Africa systematically different from other regions? We show that over the period from 1965 to 1999, the incidence of conflict in Africa is well explained by a global model: there is no mysterious "Africa effect." However, although on average over the period, the incidence of conflict has been similar in Africa to that in other developing regions, the underlying structure of that risk has been substantially different. Second, we examine whether there is a global time trend; that is, has the world become more or less conflict ridden? We find that non-African developing countries have gradually become less prone to civil conflict over the past 35 years, and this is accounted for not by an exogenous time trend but by trends in explanatory variables. Third, we examine SIPRI's claim that Africa has recently experienced more conflict. We show that, quite contrary to other regions,

1. This pessimistic assessment of the situation in sub-Saharan Africa is also echoed in the yearbooks from the Stockholm International Peace Research Institution (SIPRI 2000, 2001). For a recent press release, please refer to http://www.sipri.se.

2. We include all countries south of the Sahara in our analysis, but we exclude South Africa. Throughout this article, we use *Africa* to denote sub-Saharan Africa.

AUTHORS' NOTE: The findings, interpretations, and conclusions expressed in this article are entirely those of the authors. They do not necessarily represent the views of the World Bank, its executive directors, or the countries they represent.

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Africa has indeed experienced a rising trend of conflict. However, this is fully accounted for by divergent trends in African and non-African economic conditions. Africa has experienced a rising trend of conflict because its economies have performed so poorly both absolutely and relative to other regions.

In the second section, we set out the Collier-Hoeffler model and demonstrate that it is applicable to Africa. We show how the model can be used to decompose the structure of risk and contrast the structure of risk in Africa to that in other developing regions. In the third section, we turn to trends. Applying the model to each of the 5-year periods between 1965 and 1999, we compare the implied trends for African and non-African developing countries. The fourth section concludes.

WHY IS AFRICA ATYPICALLY PRONE TO CIVIL WAR?

AN OVERVIEW OF THE COLLIER-HOEFFLER MODEL

The Collier-Hoeffler econometric model of civil war (Collier and Hoeffler forthcoming [hereafter CH]) predicts the probability that a civil war will be initiated in a country during a 5-year period. The model is based on an analytic model that is in the rational choice tradition (Collier 2000b). Although the analytic model is not the only way in which the econometric results can be interpreted, it provides a helpful way of understanding them.

The analytic model focuses on whether a rebel organization will be established. The benefits of rebellion might accrue through a variety of sources. The rebellion might be motivated purely by greed—the income that can be achieved either during the rebellion from quasi-criminal looting and the benefits that ensue if the rebellion is victorious from control of the state revenues. Alternatively, it might be motivated purely by grievance—the opposition to perceived or actual injustice. The costs of rebellion are the labor force and equipment needed for a rebel army that can survive against the military threat posed by government forces. Because these costs must be met, even if the rebellion is motivated entirely by grievance, it must generate revenue. Hence, the circumstances that determine financial viability are potentially important regardless of the motivation for rebellion. The probability of rebellion increases as benefits rise relative to costs. It is useful to consider four extreme variants of the model, in which finance, grievance, military viability, and history are the decisive determinants of the risk of rebellion.

Potentially, finance is the only binding constraint on rebellion. Civil wars occur only when rebel groups are able to build large organizations, and such organizations require substantial financial resources both to meet their payrolls and to purchase armaments. Societies may differ considerably in the extent to which such large-scale finance is available so that this is decisive. Conversely, the supply of groups willing to engage in violence may be sufficiently large in most societies that variations—for example, due to differences in objective grievances—have no effect on the risk of conflict.

An alternative is that finance is usually available when needed, whereas the supply of groups wishing to satisfy grievances through violent means is the binding constraint

on rebellion. In this case, we would expect that objective indicators of grievance, such as economic inequality and ethnic or religious divisions, would fuel grievance, but the lack of democracy might channel these grievances into violence. Hence, these indicators would predict rebellion.

A further alternative is that rebellion is determined by its military viability. Rebels may need to meet a "survival constraint" determined by the size of rebel forces relative to government forces and geographic factors, such as whether the population is dispersed. Below a certain threshold, rebellion is not militarily viable. Rebellions are then more likely in societies in which government forces are weak and geographic conditions make it difficult for these forces to defend national territory.

A final alternative is that conflict risk is determined by history. Once a conflict has occurred, it creates a legacy of hatred, and this hatred fuels further conflict. In this analysis, some societies are doomed to a cycle of repeated conflict.

The CH econometric model is established through a process that initially includes proxies for all four explanations: finance, grievance, military advantage, and history. Insignificant variables are then dropped in a process of stepwise elimination. The resulting baseline model contains elements from all four explanations. CH present two alternative specifications of their baseline model. In one, the initial level of per capita income is an explanatory variable; in the other, it is replaced by a measure of the initial level of education. The two variables are too highly correlated for both to be included in the same regression, but each is significant when included separately. Here we concentrate on the model controlling for initial income rather than education. This specification allows us to use 62 additional observations, and it is also more suited for our policy experiments presented in the third section. There are no substantial differences in the coefficients on other variables from the two versions, although the income version does not provide quite as good a fit,[3] and two variables that are significant in the education version of the model become marginally insignificant in the income version. We retain these variables in the present analysis.

CH use a global panel data set for 161 countries for eight 5-year periods: 1960-1964, 1965-1969, . . ., 1995-1999. On these data, they estimate a logit regression of the probability that a large-scale civil conflict will be initiated in each 5-year period. Such conflict is defined on the conventional Singer and Small (1994) definition of 1,000 combat-related deaths. In our regression analysis, we are able to use 750 observations from 125 different countries. Of these observations, 46 were characterized by an outbreak of civil war.

The CH baseline model is presented in the first column of Table 1. Three economic characteristics are found to be significant: the initial level of income, its rate of growth, and its structure. Initial income is measured at the start of the 5-year period for which conflict risk is to be estimated. It is measured using the purchasing power parity concept of income to provide reasonable comparability across countries.[4] The higher the initial income per capita, the lower the probability of a civil war breaking out during

3. The results based on the model controlling for education are very similar. These results can be provided on request.

4. All variables are described in more detail in the appendix.

TABLE 1
Is Africa More Prone to Civil War Than the Rest of the World?

	1		*2*		*3*	
ln GDP per capita	–0.950	(0.245)***	–1.053	(0.289)***	–0.965	(0.244)***
$(\text{GDP growth})_{t-1}$	–0.098	(0.041)**	–0.1027	(0.042)**	–0.098	(0.042)**
Primary commodity exports/GDP	16.773	(5.206)***	16.691	(5.175)***	15.989	(5.218)***
$(\text{Primary commodity exports/GDP})^2$	–23.800	(10.040)**	–23.532	(9.958)**	–22.942	(10.023)**
Social fractionalization	–0.0002	(0.0001)***	–0.0002	(0.0001)**	–0.0002	(0.0001)**
Ethnic dominance (45%-90%)	0.480	(0.328)	0.449	(0.331)	0.431	(0.330)
Peace duration	–0.004	(0.001)***	–0.004	(0.001)***	–0.004	(0.001)***
ln population	0.510	(0.128)***	0.473	(0.137)***	0.5473	(0.130)***
Geographic dispersion	–0.992	(0.909)	–0.994	(0.907)	–0.775	(0.933)
Sub-Saharan Africa dummy			–0.370	(0.526)		
French sub-Saharan Africa dummy					–0.885	(0.791)
Number of observations	750		750		750	
Pseudo-R^2	0.22		0.22		0.23	
Log likelihood	–146.84		–146.50		–146.10	

NOTE: All regressions include a constant. Standard errors in parentheses. GDP = gross domestic product.
*Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

the following 5 years. This can be interpreted in various ways. One way is to regard per capita income as proxying the cost of recruiting rebel labor. On this interpretation, higher recruitment costs would make rebellion more difficult. Another interpretation is that higher income proxies greater military strength of the government. Because the level of income is correlated with many other characteristics, it is the most difficult variable to interpret.

The rate of growth of income is measured for the 5-year period prior to the one for which conflict risk is estimated. More rapid growth reduces the risk of conflict. CH interpret this as proxying the difficulty that the rebel organization faces in recruiting a labor force—faster growth will be associated with more job opportunities for young males, who constitute the main recruitment pool for rebellion. Again, other interpretations are possible—for example, faster growth could be associated with greater hope and so a lower level of grievance.

The structure of income is measured as primary commodity exports relative to income at the start of the 5-year period for which conflict risk is estimated. Primary commodities include a variety of products such as oil, diamonds, metals, food, and beverages. CH investigate whether there are differences between products. They find that the only significant difference is between oil and all other primary products. Even here, the differences are not substantial, and we do not pursue this distinction further in this study. CH find that primary commodity exports have a strong effect on the risk of conflict, although the effect is nonmonotonic. Until high levels of primary commodity

dependence are reached, primary commodity exports powerfully increase the risk of conflict. Beyond a peak—of around 26%—the risk starts to decline again, but relatively few countries are in this range. CH interpret this as proxying the ability of both the rebel organization and the government to acquire finance. Because this source may be differentially important for rebels, until high levels of exports are reached, the effect favors rebellion. There is abundant case study evidence on how rebel organizations generate revenue from the informal taxation of the rents on primary commodity exports—diamonds, cocaine, and timber are notable examples. At very high levels of exports, government revenue might be sufficiently high to discourage rebellion regardless of the ready availability of finance to rebels. However, other interpretations are also possible. For example, high primary commodity export dependence is associated with greater government corruption, and this might incite rebellion. Any such explanation has to be consistent with the decline in the risk of conflict at high levels of dependence.

Whereas these three economic characteristics play an important role in the CH model, grievance is much less important. CH test three measures of objective grievance: inequality, political repression, and social divisions. Neither inequality nor political repression is significant in any variant of the model, and they are therefore not included in the baseline. This is consistent with the view that groups with grievances are sufficiently common that differences in the supply of such groups between societies are not an important influence on the risk of conflict initiation.

Social divisions are proxied by ethnic and religious fractionalization and by ethnic dominance. If intergroup hatreds are an important source of conflict, then it might be expected that homogeneous societies would be considerably safer than fractionalized societies. In fact, CH find that fractionalized societies are significantly *safer* than homogeneous societies. They explain this in terms of the difficulty that a rebel organization has in maintaining cohesion if it needs to span different social groups.[5] The exception to the greater safety of diversity is if a society is characterized by "ethnic dominance." CH define this as occurring when the largest ethnic group constitutes between 45% and 90% of the population. Such societies have about double the risk of conflict of other societies (although in the income version of the model reported in Table 1, the variable is insignificant).

The next variable in the baseline model proxies history. *Peace duration* measures the number of months since the end of the previous conflict or since 1945, if there has been no conflict subsequent to this date. This variable is significant and negative: shortly after a conflict, on average, countries face a 50% risk of renewed conflict during the next 5 years. This risk gradually fades with time.

The final variables are geographic. The size and dispersion of the population affect conflict risk. If the effect of population were neutral, we might expect that a doubling of population would approximately double the risk of conflict: for example, this would

5. Easterly and Levine (1997) find that ethnic fractionalization reduces the growth rate in a global sample and interpret this as reflecting the difficulties of cooperation. They further explain Africa's low growth in terms of its high fractionalization. However, Collier (2000a, forthcoming) shows that fractionalization only reduces growth in the context of dictatorship. Africa's problem was not its social composition but its lack of democracy.

be the expectation if two neighboring identical countries merged. In fact, CH find that the elasticity with respect to population is generally less than unity—large countries are relatively safer. If the population is more dispersed, the risk of conflict is increased. CH interpret this as a proxy for military feasibility—dispersal of the population makes it more difficult for government forces to defend the territory. It is consistent with the analysis of Herbst (2000) of the risk of conflict in Zaire.

APPLYING THE MODEL TO AFRICA

We now apply the model to Africa. First, we review the data, considering each of the variables included in the model. Table 2 presents some descriptive statistics for the entire CH sample and for two subgroups: Africa and all other developing countries.[6] All statistics were calculated over the entire time period from 1960 to 1999. We present a more detailed analysis of possible time effects below.

Consider, first, the dependent variable—the incidence of civil war. For the entire sample, the incidence of civil war was about 7% (i.e., during the entire time period, 7% of all observations experienced a start of a civil war). The incidence of civil war starts in Africa was slightly higher at about 9%. Other developing regions had an average incidence of around 7%. To summarize, these statistics show that Africa did not, on average, over this 40-year period, experience a much higher level of war starts than other developing regions.

However, the descriptive statistics of the explanatory variables used in the CH model are very different for African and non-African countries. First, the economic variables are markedly different.[7] Average per capita income is only $2,000 for Africa, but it is $3,625 for other developing countries. Average annual growth of gross domestic product (GDP) per capita was much lower (about 0.5%) than in non-African countries (about 2%). Thus, in Africa, governments had radically weaker financial bases, but the opportunity costs of joining a rebellion and the level of alternative economic opportunities were lower. The mean of the ratio of primary commodity exports to GDP was slightly lower in Africa (17%) than outside Africa (19%).

The averages of the social variables, ethnic and religious fractionalization, are also very different: Africa is more diverse than non-African countries. Africa's ethnic fractionalization is on average 61 (on a scale of 0-100), and its religious fractionalization is 51, which is much higher than the fractionalization indices of 34 and 30 measured outside the region. Therefore, on the CH analysis, the difficulties of coordinating rebellion should be greater in Africa and should make the region safer, ceteris paribus. Furthermore, due to its high ethnic fractionalization, only 40% of African countries are characterized by ethnic dominance, whereas in the other developing regions, 57% of countries are so characterized. This should also lower the risk of civil war in Africa. The remaining variables, the geographic dispersion of the population and the peace duration since the last civil war, differ little between countries inside and

6. Other developing countries are defined as non–Organization for Economic Cooperation and Development (OECD) and non-sub-Saharan African countries.

7. For a detailed discussion of Africa's economic performance, see Collier and Gunning (1999).

TABLE 2
Descriptive Statistics

	Sample					*Sub-Saharan Africa*					*Other Developing Regions*				
	M	SD	*Minimum*	*Maximum*	*Number*	M	SD	*Minimum*	*Maximum*	*Number*	M	SD	*Minimum*	*Maximum*	*Number*
War starts	0.067	0.250	0	1	1,167	0.090	0.287	0	1	332	0.073	0.26	0	1	644
GDP per capita (const. U.S. dollars)	3,921	4,245	222	33,946	1,071	2,000	916	222	6,833	343	3,625	3,535	316	33,946	536
GDP per capita growth $_{t-1}$	1.56	3.78	–22.08	14.41	918	0.47	3.78	–10.49	13.19	298	1.88	4.13	–22.08	14.409	452
Primary commodity exports/GDP	0.164	0.185	0	2.14	1,163	0.17	0.14	0	0.57	343	0.19	0.22	0	2.14	628
Social fractionalization	1,784	1,910	4	6,975	1,160	3,369	2,022	20	6,975	360	1,171	1,408	4	5,168	608
Ethnic fractionalization	40	28	0	93	1,184	61	26	4	93	360	34	25	0	89	632
Religious fractionalization	36	24	0	79	1,232	51	21	1	74	360	30	23	0	79	680
Ethnic dominance (45%-90%)	0.47	0.50	0	1	1,184	0.40	0.50	0	1	360	0.54	0.50	0	1	632
Peace duration	327	163	1	592	1,167	314	166	1	592	332	317	166	1	592	644
Population (millions)	26.1	96.0	0.014	1,200	1,266	7.8	12.9	0.04	111	356	33.4	124	0.04	1,200	718
Geographic dispersion	0.58	0.22	0	0.97	1,128	0.55	0.20	0	0.86	352	0.57	0.24	0	0.92	600

NOTE: GDP = gross domestic product; number = number of observations.

outside Africa. To sum up, during the period from 1960 to 1999, Africa had a slightly higher incidence of civil war starts but a very different structure of factors that, according to the CH model, are causal. We now test whether the model fits the African experience.

Our first test of the model is to include a dummy variable for Africa. This tests whether some omitted factor makes the continent more or less prone to conflict than predicted by the model. As reported in the second column of Table 1, the coefficient is insignificant: Africa, as a whole, has not significantly differed in its incidence of conflict from that predicted in the model. Although this establishes that Africa, as a whole, is not subject to some unobserved additional or reduced risk factors, it may still be possible that subgroups within Africa are subject to additional or reduced risk factors. We test for this by introducing a dummy variable for Francophone Africa. France has been much more willing than other former colonial powers to intervene militarily to preserve political order. Actual French military interventions or the threat of such interventions to support the government may work as a deterrent to rebellion and so be an unobserved factor reducing risk. The coefficient on this dummy is negative, indicating a lower level of risk. However, it is not significant at conventional levels (p = .26). Thus, we find little evidence that former French colonies have a smaller risk of conflict. This result also provides some justification to categorize all African countries in one group.

We next test for whether the causal factors included in the CH model have differential effects in Africa as compared to other regions: potentially, for example, Africa might be more sensitive to a given level of social fractionalization than other regions. We test for such effects by introducing the Africa dummy interacted with each of the explanatory variables in turn. None of these interactions is statistically significant. Thus, in all respects, the relationships found globally in the CH model apply equally to Africa. In the subsequent analysis, we therefore apply the CH model.

We next use the CH model to decompose the overall risk of conflict in Africa into its constituent components. In doing this, a convenient simplification is to consider the structure of risk for a hypothetical country having characteristics at the mean of the African sample and to compare it with a country with characteristics at the mean of the sample of other developing regions. This is shown in Table 3, where we take the estimated coefficients from our empirical model as presented in Table 1 and multiply them with the sample averages for each variable. We add the constant to the sum of these products,

$$Z = \hat{\beta} \cdot \overline{X} + \text{Constant}, \tag{1}$$

and calculate the probability of a war start by applying the following formula:

$$\exp Z / (1 + \exp Z) = \hat{p}. \tag{2}$$

This estimated probability gives the probability of a war start in a hypothetical country that has the sample's average characteristics.

In Table 3, we present the coefficients of the estimated model in the column (these are the same as in the first column of Table 1). In the next three columns, we present the

TABLE 3
Predicted Incidence of Civil War

	Coefficients	*Sample*	*Sub-Saharan Africa*	*Other Developing Regions*
ln GDP per capita	–0.950	–7.864	–6.656	–7.789
(GDP growth) $_{t-1}$	–0.098	–0.153	–0.046	–0.184
Primary commodity exports/GDP	16.773	2.751	2.892	3.105
(Primary commodity exports/GDP)^2	–23.800	–0.640	–0.707	–0.815
Social fractionalization	–0.0002	–0.447	–0.842	–0.293
Ethnic dominance (45%-90%)	0.480	0.227	0.192	0.261
Peace duration	–0.004	–1.231	–1.185	–1.194
ln population	0.510	8.718	0.812	0.884
Geographic dispersion	–0.992	–0.570	–0.550	–0.568
Constant	–3.438	–3.438	–3.438	–3.438
Predicted incidence, calculated at the mean of the variables		0.066	0.097	0.112
Predicted incidence, average of individual country predictions		0.069	0.095	0.077

NOTE: GDP = gross domestic product.

product of these coefficients with the relevant sample average. Summing these figures and applying the formula presented in equation (2), we obtain the first set of predictions as presented in the penultimate row of Table 3. For the entire sample and for Africa, these predictions are very close to the actual values. Africa had an incidence of war starts of about 9%, and for a hypothetical country with the average characteristics of an African country, the model predicts an incidence of about 9.7%.

The analysis of Africa by means of a hypothetical country with characteristics at the mean of the African sample is merely a convenient simplification. The risk of conflict for such a country will differ from that found in the African sample to the extent that there are any nonlinear relationships in the model. Because there are indeed nonlinear relationships, the correct way of assessing the model's predictive accuracy for the African sample as a whole is to predict the probability of a war start for each observation and then to take the average of these predictions. The predictions based on this method are presented in the last row of Table 3. The CH model predicts the risk of civil war in each region with considerable accuracy. For African countries, we predict an incidence of 9.5% (actual incidence 9%), and for countries outside the region, we predict a probability of a war start of 7.7% (actual incidence 7.3%).

The use of the hypothetical average is nevertheless useful because it provides a ready decomposition of risk, revealing that although the overall incidence of conflict has been similar in Africa to that in other developing regions, this aggregate similarity comes from two offsetting substantial differences.

Africa's economic characteristics have been highly unfavorable for conflict risk when compared with the other developing regions. Its lower per capita income and slower growth of GDP both directly and substantially increase the risk of conflict. A more complex effect is primary commodity dependence. On average, as shown in Table 2, Africa has been slightly less dependent than other developing regions on primary commodity exports. However, recall that the relationship between primary commodity dependence and the risk of conflict in the CH model is nonmonotonic: countries with both very low and very high levels of dependence are relatively safe. Although the African and non-African averages are similar, the non-African average conceals two groups of countries, one with low dependence and the other with high dependence. This is shown in Table 2 by the much higher standard deviation for the non-African group. In Table 3, there are two ways of calculating the square of primary commodity dependence for the group average—namely, as the square of the mean primary commodity dependence or as the mean of the square. When calculated as the former, which is literally consistent with the calculation showing the risk for a hypothetical country with group mean characteristics, Africa's lower primary dependence appears to make it safer than other regions, whereas once the greater dispersion of dependence in the other regions is allowed for, the opposite is the case. If we were to compare only the group means, the net effect of the difference in primary commodity dependence would be to increase *Z* for non-Africa by 0.11 more than Africa—implying that Africa was relatively safe. Allowing for the much greater dispersion of the non-African sample, the differences in primary commodity dependence reduce *Z* for non-Africa by 1.05 relative to Africa—implying that Africa is much more at risk. To summarize, all three of the economic variables are unfavorable for Africa relative to other developing regions, and each effect is substantial.

By contrast, the social characteristics of African societies make them much less prone to conflict than non-African developing countries. Africa has a much higher degree of religious and ethnic fractionalization than other regions, and this substantially reduces its risk of conflict. In addition, fewer African societies are characterized by ethnic dominance.

Hence, Africa's overall similar incidence of conflict compared with other developing regions is the result of two offsetting effects. Africa's distinctive economic structure and performance have made it considerably more prone to conflict than other regions, whereas its distinctive social structure has made it much less prone to conflict. On the basis of this analysis, Africa's problem has decidedly not been the primeval ethnic hatreds of popular imagination.

IS AFRICA BECOMING MORE DANGEROUS?

The SIPRI quote at the start of this article was concerned not just with the level of conflict in Africa relative to other regions but with its trend. SIPRI observes a rising trend in Africa but not in other regions. We now apply the CH model to these trends.

As with differences in the level of conflict between regions, differences in trends could either be explained by the variables included in the model or be an exogenous,

TABLE 4
Examination of the Incidence of Civil War over Time

	1		*2*	
ln GDP per capita	–0.935	(0.246)***	–0.947	(0.269)***
(GDP growth) $_{t-1}$	–0.108	(0.044)**	–0.097	(0.044)**
Primary commodity exports/GDP	16.932	(5.203)***	16.77	(5.208)***
(Primary commodity exports/GDP)^2	–23.961	(10.010)**	–23.810	(10.048)**
Social fractionalization	–0.0002	(0.0001)***	–0.0002	(0.0001)***
Ethnic dominance (45%-90%)	0.494	(0.329)	0.481	(0.330)
Peace duration	–0.004	(0.001)***	–0.004	(0.001)***
ln population	0.534	(0.133)***	0.511	(0.130)***
Geographic dispersion	–1.035	(0.911)	–0.992	(0.909)
Time trend	–0.064	(0.088)		
Time Trend • Sub-Saharan Africa Dummy			0.003	(0.080)
Number of observations	750		750	
Pseudo-R^2	0.22		0.22	
Log likelihood	–146.58		–146.84	

NOTE: All regressions include a constant. Standard errors in parentheses. GDP = gross domestic product.
**Significant at the 5% level. ***Significant at the 1% level.

unexplained phenomenon. We test for the latter by adding a time trend to the model. The results are shown in the first column of Table 4. First, we add a time trend for the entire sample of the whole period. The coefficient is statistically insignificant, so that globally any change in the trend incidence of conflict must be accounted for by changes in the included variables. We then test for an Africa-specific trend. Again, the variable is insignificant, so that any Africa trend must be due to trends in the underlying causal variables.

In Figure 1, we plot the predicted incidence of civil wars for African and non-African countries for each of the 5-year periods from 1965 to 1990.[8] Africa and other developing countries show a similar trend for the period from 1965 to 1985. The average risk of a civil war outbreak declined from above 11% to around 8%. However, during the last 10 years (1990-1999), the model shows an increase in the prediction of war starts for Africa. Thus, the predicted incidence of civil war as presented in Figure 1 supports SIPRI's claim that Africa is now more prone to conflict than other regions and that this is a relatively recent phenomenon.

The model thus indeed predicts the divergent trends that Africa and other developing regions have experienced and accounts for them in terms of changes in the explanatory variables. We can thus apply the same approach to the analysis of changes over time as we have used above to analyze differences between regions. In Table 5, we present descriptive statistics on the economic variables used to explain the incidence of conflict during the periods from 1970 to 1974 and 1995 to 1999. Between these two periods, the growth rate of the economy declined. As a result, per capita income stag-

8. For this figure, we use the second method of predicting the average probability of a war start for a region (i.e., we average the predictions for the individual countries in the region, rather than evaluating the risk of conflict at the mean of the variables for the region).

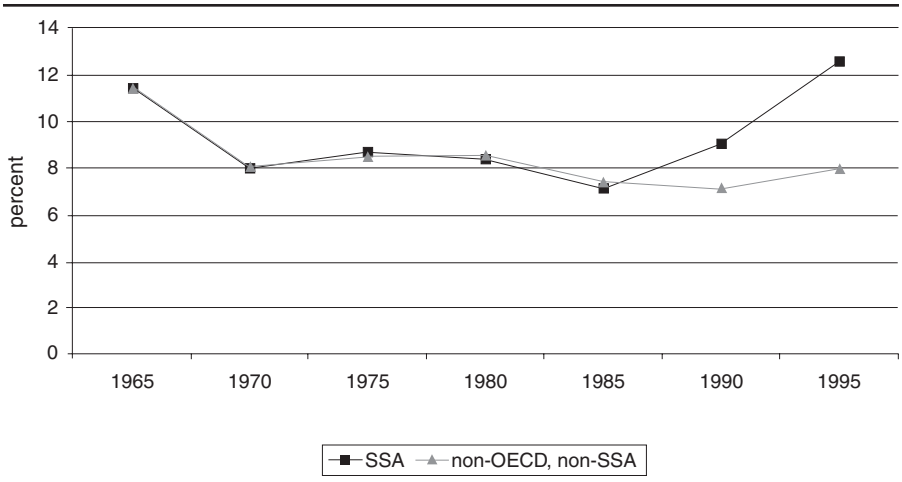

Figure 1: Predicted Incidence of Civil War
NOTE: SSA = sub-Saharan Africa, OECD = Organization for Economic Cooperation and Development.

TABLE 5
Descriptive Statistics: A Comparison of 1970 and 1995

	Sample		*Sub-Saharan Africa*		*Other Developing Regions*	
Year	*1970*	*1995*	*1970*	*1995*	*1970*	*1995*
GDP per capita (const. U.S. dollars)	3,169	5,174	1,070	1,134	2,734	4,510
GDP per capita growth $_{t-1}$	3.19	0.37	2.40	–1.21	3.48	0.97
Primary commodity exports/GDP	0.165	0.142	0.170	0.175	0.191	0.145

NOTE: GDP = gross domestic product.

nated. Just as the level of income stagnated, so did its structure: Africa remained dependent on natural resource exports for around 17% of GDP. By contrast, growth in non-African developing countries accelerated. Per capita income increased from $2,734 in 1970 to $4,510 in 1995. This higher level of income was matched by a radical change in structure: dependence on primary commodity exports declined from around 19% of GDP in 1970 to 14.5% of GDP in 1995.

These differences in economic performance account for the disparate trends of conflict incidence in Africa and the other developing regions. Table 6 shows the implied regional incidence of civil war in 1970 and 1995. The table applies the same approach as already used in Table 4. In the first column, we present these predicted risks of conflict for Africa and the other developing regions. In 1970, Africa had a lower risk of civil war, whereas by 1995, it had an atypically high risk. In the last column of Table 6, we investigate what the predicted incidence of civil wars would have been if, since

TABLE 6
Predicted Incidence of Civil War: Changes over Time

	Predicted Incidence, Calculated at the Mean of the Variables	*Predicted Incidence, Assuming That Sub-Saharan Africa Had Experienced a Better Economic Performance*
1970		
Sub-Saharan Africa	0.088	
Other developing regions	0.145	
1995		
Sub-Saharan Africa	0.086	0.047
Other developing regions	0.054	

1970, Africa had had the same economic performance as other developing regions, that is, the same per capita income growth rate and the same rate of decline in dependence on primary commodities. The result is quite dramatic. If Africa had achieved the same economic performance as other countries, its risk of conflict would have declined instead of increased. Given its more favorable social characteristics than other regions, by the 1995 to 1999 period, risk would have declined to just under 5%.

CONCLUSION

In this study, we have applied an econometric model of civil war to analyze the incidence of conflict in Africa, the only region in which, according to SIPRI, conflict has been on a rising trend. We find that Africa largely conforms to the pattern of conflict predicted by the global model.

On average, over the period from 1965 to 1999, Africa had an incidence of conflict similar to that in other developing regions. However, its structure of risk was very different. Africa's economic characteristics generated an atypically high risk of conflict, but this was offset by its social characteristics, which generated an atypically low risk. The model predicts correctly that non-African developing countries would have experienced a declining trend of conflict. The model accounts for this by their improved economic conditions. By contrast, the model correctly predicts the rising trend of African conflict observed by SIPRI. Again, this is fully accounted for by the deterioration in Africa's economic performance. The analysis suggests that the rising trend of African conflict is not due to deep problems in its social structure, as suggested by Kaplan (2000), but rather is the contingent effect of economic circumstances.

APPENDIX

The data source for all variables used in this study is Collier and Hoeffler (2000). It provides a panel data set for 161 countries and eight time periods: 1960-1964, 1965-1970, . . ., 1995-1999. Thus, it provides 1,288 potential observations.

WAR STARTS

The war start variable takes a value of 1 if a civil war started during the period and 0 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 1,000 battle-related deaths (civilian and military) occurred per year. We use mainly the data collected by Singer and Small (1994; Small and Singer 1982), and according to their definitions, Nicholas Sambanis updated their data set for the period from 1992 to 1999.

GDP PER CAPITA

We measure income as real purchasing power parity (PPP)-adjusted GDP per capita. The primary data set is the Penn World Tables 5.6 (Summers and Heston 1991). Because the data are only available from the period from 1960 to 1992, we used the growth rates of real PPP-adjusted GDP per capita data from the World Bank's World Development Indicators 1998 to obtain income data for 1995. Income data are measured at the beginning of each subperiod: 1965, 1970, . . ., 1995.

$(\text{GDP GROWTH})_{t-1}$

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 5-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 were obtained from the World Bank. Export and GDP data are measured in current U.S. dollars. The data are measured at the beginning of each subperiod: 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 subperiod.

SOCIAL FRACTIONALIZATION

We proxy social fractionalization in a combined measure of ethnic and religious fractionalization. Ethnic fractionalization is measured by the ethnolinguistic fractionalization index. It measures the probability that two randomly drawn individuals from a given country do not speak the same language. Data are 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),[9] 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 are 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 used the 1980 data. For 1975, we used the average of the 1970 and 1980 data.

The fractionalization indices range from 0 to 100. A value of 0 indicates that the society is completely homogeneous, 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 homogeneous (a value of 0) if the country is ethnically homogeneous but religiously divers, or vice versa. In Collier and Hoeffler (2000, Table 8), we show that this aggregation rule is superior to variants.

ETHNIC DOMINANCE (45%-90%)

Using the ethnolinguistic data from the original data source (Department of Geodesy and Cartography 1964), we calculated an indicator of ethnic dominance. This variable takes the value of 1 if one single ethnolinguistic group makes up 45% to 90% of the total population and 0 otherwise.

GEOGRAPHIC DISPERSION

We constructed a dispersion index of the population on a country-by-country basis. Based on population data for 400 km^2 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 are 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 that 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 5-year period.

SUB-SAHARAN AFRICA DUMMY

This variable takes the value of 1 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, Mauri-

9. We would like to thank Robert Barro for the use of his data set (Barro 1997). For some countries that were not listed in his data set, we used the data from the original source (Barrett 1982).

tania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

FRENCH SUB-SAHARAN AFRICA DUMMY

This variable takes the value of 1 for the following countries: Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Gabon, Ivory Coast, Mali, Niger, Senegal, and Togo.

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