# Conflict, Greed and Grievance in sub-Saharan Africa


## ABSTRACT

In a seminal article titled *Greed and Grievance in civil war,* Collier and Hoeffler (2004) developed two econometric models, namely the opportunity and grievance models, to test competing theoretical hypotheses concerning the determinants of intrastate armed conflict - greed versus grievance. This paper re-estimates these two models using logit regression analysis on a newly constructed panel dataset of conflict onsets - and their theoretically-informed correlates - for countries in the sub-Saharan Africa over the period 1960-2010. Upon finding that a model which combines these two models is superior in its explanatory power to either of the two models taken singly, a process of step-wise elimination of insignificant variables is conducted to arrive at a baseline regression of only statistically significant predictors of conflict onset in the region. Overwhelmingly, the baseline regression obtained reflects the importance of indicators of grievance in explaining outbreaks of civil war in sub-Saharan Africa.

## I. Introduction

In a seminal article titled *Greed and Grievance in civil war,* Collier and Hoeffler (2004), using a global dataset of civil wars for the period 1960–1999, sought to empirically test two competing theoretical hypotheses concerning the determinants of intrastate armed conflict - greed versus grievance. This work offered overwhelming support in favour of the view that rebellion is greed-motivated which, along with a broad range of issues pertaining to aspects such as choice of sample frame and questionable proxies for indicators of both greed and grievance, saw a great deal of scholarly discourse pertaining to civil war and its causes come to focus on critiquing and developing their work (Keen, 2012; Fearon, 2005; Nathan, 2005).

In addition to those who chose to focus their attention within the greed-grievance spectrum – either by applying the framework to new datasets and estimation techniques or, by disaggregating the various components of greed and grievance and making one element within either framework central to their analyses – a great deal of scholars sought to explore other determinants of conflict, particularly those not afforded the opportunity for analysis by the greed-grievance agenda. Nowhere is this move beyond greed and grievance more evident than in quantitative studies of conflict onset in sub-Saharan Africa – where the imposition of artificial state borders, living in 'bad neighbourhoods' and warmer temperatures – both prior to and increasingly so in the face of climate change – have come to take central focus as explanatory variables of interest in the econometric models employed in these studies (Burke, Dykema, Miguel & Satyanath, 2009; Hendrix & Glaser, 2007; Green, 2010).

To a large extent this scholarly movement away from studying civil wars within the greed-grievance framework is justified given that the potential set of conflict correlates it permits for analysis is far from exhaustive, particularly for those wishing to account for the specificities of sub-Saharan Africa which may make it, as a region, more likely to experience conflict outbreaks. However, despite this movement toward a focus on other determinants of conflict, these works have still drawn on the empirical framework provided by Collier and Hoeffler (2004) by including indicators of greed, grievance or both in their econometric analyses of the causes of civil wars in the region.

As such, it is hypothesized that there is great value to be gained from revisiting the debate as it pertains to the world's conflict locus, sub-Saharan Africa. This is owing to the fact that, firstly, there is general interest to see whether more years of data are able to lend as much support to the greed thesis of the causes of civil war. Undeniably, despite experiencing sustained economic growth in the new millennium, the international community still bears witness to conflict onsets in sub-Saharan Africa – predominantly,

in the form of restarts of existing wars following one or more years of peace (Themner & Wallenstein, 2014).

Additionally, there have been significant improvements in the operationalization of difficult-to-measure indicators of grievance within the study of civil war at the global level – a product of the aforementioned disaggregation of the various aspects of greed and grievance. It is therefore of interest to see whether these improvements are capable of enabling a greater understanding of the role played by grievances in sub-Saharan Africa's civil wars. Lastly, given that the movement beyond greed and grievance sought to better-explain conflict onsets in sub-Saharan Africa, it is certainly of value if the various indicators of greed and grievance, which have largely come to serve as standard controls in these econometric analyses, undergo a review. The most appropriate manner in which to conduct such a review, is by revisiting the greed-grievance debate itself.

Therefore, drawing on a dataset based on improvements in data availability, timeliness and the operationalization of certain indicators of grievance, this paper seeks to revisit the greed-grievance debate within the context of sub-Saharan Africa for the period 1960-2010. In order to do so, this paper makes use of the methodology and econometric models developed by Collier and Hoeffler (2004), namely the opportunity model and grievance model, in order to empirically test the relative strength of these competing hypotheses as they pertain to civil wars in sub-Saharan Africa. However, it must be noted that a methodological departure is made from the empirical framework provided by Collier and Hoeffler (2004) in that this paper makes use of an annual sample frame, rather than the five-year period format adopted by Collier and Hoeffler in their analysis.

In order to achieve the aforementioned objectives, this paper is organised into six sections beyond this introduction. Section II provides an overview of the literature on civil war onset as well as introduces the aforementioned Collier and Hoeffler (2004) models. The introduction of these models in this section is necessary given that the findings which they produced sparked great controversy as well as many developments within the literature on conflict onset – a review of which can only be provided following a presentation of the models. Section III presents the data used in this analysis and descriptive statistics. The empirical methodology is presented in Section IV, along with logit regression analysis. Section V extends considerably from Section IV, combining Collier and Hoeffler's greed and grievance models in order to establish a baseline regression which includes only the most statistically significant correlates from each of these competing explanations of conflict onset. Section VI subjects this specification to various robustness checks, whilst Section VII concludes this paper.

Ultimately, using 25 battle-related deaths per annum as the appropriate death-threshold for qualifying as a civil war, it is found that conflict-history, ethnic-based political

exclusion and low-levels of religious fractionalization offer the greatest explanatory power in accounting for civil war onsets in sub-Saharan Africa.

## II. Literature review

The end of the Cold War witnessed a significant shift in the study of conflict, from a focus primarily concerned with interstate wars to one centred around intrastate wars (Wallensteen, 2014:13). Interestingly, this is not owing to a sudden increase in the number of civil wars in the post-Cold War period. A point well-endorsed within the literature on civil wars indicates that their prevalence has been increasing since the 1960s (Blattman & Miguel, 2010:3; Collier, Hoeffler & Sambanis, 2005:2; Fearon & Laitin, 2003).

Scholars such as Kalyvas (2001), Lacina (2004) and Wallenstein (2014) have attempted to explain the reasons behind what Blattman and Miguel (2010:3) describe as the "… long overdue explosion of research into [civil] war's causes and consequences [in the post-Cold War period]." A common explanation appearing in all these works refers to the notable infrequency of interstate wars relative to civil wars following the end of the Cold War. Furthermore, Brown (1996) and Doyle and Sambanis (2000) point to the effects of conflict – on those in the warring state as well as neighbouring states who become affected through conflict spill-overs – and the increased scope for large-scale humanitarian operations in the post-Cold War era as causes for the increase in their study. Wallenstein (2014) notes that the increased capacity for the international community to act in order to alleviate the suffering incurred during these wars fell upon a policy-making community that was largely unprepared for this eventuality. This, in turn, resulted in an eruption of research on civil wars.

The literature on civil wars can be subdivided into three categories – each dealing with one of the three main phases of civil war: onset, duration, and post-war transition (Sambanis, 2001:218). Given the focus of this paper, only a review of the literature pertaining to civil war onset is provided. Within the onset literature, four theoretical paradigms have come to the fore. These are economic theories; political rational choice theories; international relations theories – consisting of neorealism and neoliberalism; and constructivism (Sambanis, 2001:220). However, the international relations and constructivist theories of conflict onset have not enjoyed the same attention nor prevalence in recent literature as economic and political rational choice theories. This is owing to the fact that the latter two theories form the theoretical underpinnings of the literature's dominant *greed versus grievance* debate. Thus, given the concern of this paper with the

role of greed and grievance in explaining conflict onset, the international relations and constructivist theories of conflict onset will not form part of this literature review. [1]

Economic theories of conflict onset can be divided into two generations (Sambanis, 2001:220). The first generation, commonly associated with the work of Bates (1986) and Gellner (1983), argues that conflict arises when groups excluded from social and political power begin to experience economic modernisation (Jesse, 2014:95). However, as convincingly argued by Horowitz (1985), conflict often occurs in countries with very low economic modernisation. Consequently, the efficacy of this approach to understanding the causes of civil war came under scrutiny and, economists began to look for more generalizable explanations for civil war onset (Sambanis, 2001:221).

Grossman (1991) and Hirschleifer (1995) are renowned as key contributors to the shift from the first generation of economic theories to the second (Sambanis, 2001:221). Both scholars focused on economic explanations of rebellion that are based on rational choice theory and economic theories of criminal behaviour, investigating the economic compromises that allow for the occurrence of conflict (Collier & Hoeffler, 2007:719). However, their works have made contributions to different economic approaches to the study of the causes of civil war.[2] Most relevant here is the work of Grossman (1991, 1999) who considers civil war to be the result of unusual conditions that enable the rebel group, conceived as a type of profit-seeking business organization, to be viable during what is typically a very long period of violent conflict (Collier & Hoeffler, 2007:720). In these analyses of conflict onset, greed and the potential to loot motivate rebellions to the extent that, if a profitable opportunity to rebel presents itself, it will not be passed up (Collier & Hoeffler, 2007:719). This idea is central to what is known as the 'greed hypothesis' within the literature on conflict onset.

Standing in contrast to these economic theories, are the political rational choice theories which focus on the role of institutions, regime changes and deprivation of political freedoms as causes of civil war (Sambanis, 2001:223). According to these theories, violent rebellion is a means to redress grievance of any or all the aforementioned forms (Sambanis, 2001:223). Gurr (2000) makes a significant contribution to this body of literature by factoring in seemingly constructivist elements, such as the social construction of identity

[1] A thorough review of these theories of conflict onset, as well as a discussion of the reasons as to why they have not featured as prominently in the literature as the economic and political rational choice theories, is provided by Sambanis (2001) and Blattman & Miguel (2010).

[2] Particularly, Hirscheifler (1991, 1994) focussed on the fact that conflict tends to almost always be Pareto inefficient and, given this, tried to explain why conflict it would then still occur. His work has largely been associated with what are known as game-theoretic analyses of conflict onset (Sambanis, 2001:221). Underlying such game-theoretic analyses is the assumption that rational agents can be either productive or unproductive and either strong or weak at any output-generating activity. Consequently by this view, conflicts start because agents that are unproductive, but strong, have an incentive to engage in violence against agents that are productive, but weak, in order to attain their resources (Collier & Hoeffler, 2007:719).

and the political mobilization of this identity, in order to explain civil war onset (Sambanis, 2001:224). Many have followed suit in this regard, particularly Cederman, Min and Wimmer (2010) who, focusing on the role of exclusion as a cause of civil war, argue that ethnic-based grievances should not be discounted as an explanatory variable in the study of civil war onset. Taken together, work done within the political rational choice framework emphasises motivation as an explanation for civil war onset. Rebellions occur when grievances such as ethnic or religious discrimination within society, deprivation from political rights and high inequality are so severe that people are motivated to rebel (Collier & Hoeffler, 2004:563). This idea is central to what is known as the 'grievance hypothesis' within the literature on conflict onset.

For many years grievance factors were espoused as the key causes of civil wars. This was challenged and, to some extent, changed following empirical testing of political science and economic explanations of conflict onset in a seminal work by Collier and Hoeffler (2004) titled *Greed and Grievance in Civil War*. In this work Collier and Hoeffler (2004) draw on the aforementioned distinction between political and economic explanations of civil wars. They typically assume different rebel motivation – grievance versus greed – and different explanations: atypical grievances versus atypical opportunities for rebellion. In order to test these competing hypotheses empirically, the authors develop two econometric models, namely the opportunity model and the grievance model. They apply these to a global dataset of civil war onsets over the period 1960–1999, with 1000 battle-related deaths per annum serving as the 'appropriate death threshold' to classify a conflict onset as a civil war (Collier & Hoeffler, 2004).

Both these models take a logit structure, with a binary dependent variable – civil war start – assigned a value of one if a civil war started during a five-year episode and zero otherwise (Collier & Hoeffler, 2004:572). This is owing to the fact that Collier and Hoeffler use a five-year sample framing, measuring their independent variables in intervals of five years, with variables generally being measured for the first year in a five-year episode (Collier & Hoeffler, 2004:573). The explanatory variables in the opportunity model are all quantitative indicators of opportunity for conflict onset and are chosen based on five broad categories (Collier & Hoeffler, 2004:565).

The first category pertains to opportunities arising from sources of rebel finance (Collier & Hoeffler, 2004:565). Collier and Hoeffler consider three potential sources: natural resource extortion, donations from populations living abroad, and donations from governments sympathetic to the rebel cause (Collier & Hoeffler, 2004:565). Collier and Hoeffler (2004:565) proxy natural resource abundance by the ratio of primary commodity exports to gross domestic product (GDP) for each of the countries in their sample.

Donations from diasporas are measured by the proportion of the country's population that has emigrated to the United States of America (USA) and donations to rebels from foreign governments are proxied by the Cold War. Collier and Hoeffler (2004:568) justify the use of the latter proxy by arguing that during the Cold War the superpowers supported rebellions in countries allied to the opposing power.

The second class of explanatory variables included in the opportunity model concern opportunities arising from unusually low costs of rebellion, for which Collier and Hoeffler (2004:569) choose to include measures of foregone income as a result of joining the rebel army. This is owing to the fact that recruits to the rebel army must still receive enough income to survive, and their 'reservation wage' for participation may be linked to income foregone by enlisting as a rebel (Collier & Hoeffler, 2004:569). Thus, conflict may be more likely to occur when forgone income is unusually low. Collier and Hoeffler (2004:569) identify three potential proxies for foregone income, namely average income per capita, the proportion of males that have enrolled in secondary school, and the growth rate of the economy in the preceding period.

Another class of variables included in the model are those that generate opportunities for rebellion as a result of the fact that capital required to initiate a conflict is low (Collier & Hoeffler, 2004:569). The authors proxy for such capital costs using the time duration from the most recent conflict, justifying the use of this proxy by arguing that the legacy of weapon stocks, skills and organisational capital will only depreciate gradually following the end of a conflict. Thus the shorter a peace period following a conflict, the greater the opportunity for rebels to re-arm (Collier & Hoeffler, 2004:569).

The fourth dimension of opportunity considered is that arising from weak government military capacity (Collier & Hoeffler, 2004:569). This is measured by geographical indicators, such as the proportion of the country's terrain that is mountainous, with Collier and Hoeffler (2004:570) arguing that mountains are favourable terrains for rebel groups, who mostly possess light armaments, but not necessarily for State armies that are equipped with heaver and often more cumbersome machinery. Additionally, the diffusion of populations in the country may inhibit government capability. Thus, Collier and Hoeffler (2004:570) calculate a Gini coefficient of population dispersion which can be interpreted in the same manner as the income Gini: the population Gini will be high if the population is concentrated in a small area of the country.

Lastly, social cohesion is identified as a source of rebel military opportunity (Collier & Hoeffler, 2004:570). This is owing to the observation that, ethnic or religious differences within the rebel organization may generate intra-army animosities, weakening its ability to present a unified front against the State. Thus, having a cohesive social group within a society may increase the opportunity for conflict by providing rebel leaders with a

cohesive recruitment base (Collier & Hoeffler, 2004:570). Social fractionalization is comprised of two indices, the Ethno Linguistic Fractionalization (ELF) Index and Religious Fractionalization (RF) Index. These indices are calculated according to the following general formula,

$$FRAC_i = \quad 1 - \sum_{i=1}^{n} s_{ij}^2,$$

where $s_{ij}$ is the share of group i (i =1,…, n) in country j (Alberto, Devleeschauwer, Easterly, Kurlat, & Wacziarg, 2003:159).

The ELF Index measures the probability that two randomly drawn people from the population will speak the same language (Collier & Hoeffler, 2004:570). For their ELF index, Collier and Hoeffler (2004) use data compiled in the former Soviet Union and published in the *Atlas Narodov Mira* in 1964 (Collier & Hoeffler, 2004:570). Their RF index, calculated based on the same formula, uses data on religious groups constructed by Barrett (1982), which sorts religious affiliations into nine categories. The RF index thus measures the probability that two randomly drawn people from the population will be from the same religious group (Collier & Hoeffler, 2004:570). Thus, with both indices, a value of zero suggests that all members of that particular society are homogenous in religion, and a value of one suggests that the society is completely heterogeneous (Collier & Hoeffler, 2004:595). Social fractionalization is therefore measured as the product of the ELF and RF Indexes, plus the ELF or RF Index, whichever is largest. This is done in order to avoid classifying a country as homogenous (a value of zero) if the country is religiously homogenous but ethnically diverse, or vice versa (Collier & Hoeffler, 2004:595).

Accounting for political rational choice theories of conflict onset, Collier and Hoeffler's (2004) grievance model introduces a different set of explanatory variables. These are ethnic or religious hatred, political repression, political exclusion, and economic inequality (Collier & Hoeffler, 2004:570). In order to account for ethnic hatred, Collier and Hoeffler (2004:571) include two proxies. The first is the aforementioned measure of ethnic diversity, the ELF Index. The authors justify this as a proxy for ethnic hatred by arguing that ethnic hatreds can only occur in societies that are multi-ethnic (Collier & Hoeffler, 2004:576). Religious hatred, for identical reasons, is proxied by the RF Index (Collier & Hoeffler, 2004:595). The second proxy for ethnic grievance is an ethnic polarization index which measures the extent to which individuals in a population are distributed across different ethnic groups. It is calculated according to the following formula,

$$P = K\sum_{i=1}^{n}\ \sum_{j=1}^{n}\ \pi_i^{1+\alpha}\pi_j d,$$

where P stands for polarization index, $\pi_i$ represents the share of people in a country that belong to group $i$ in the total population, such that $i=1,\ldots n$. $K$ is used for normalization and $\alpha$ is bounded, between 0 and 1.6 (Collier & Hoeffler, 2004:571). The degree of antagonism between the two groups is defined by $d$, which Collier & Hoeffler (2004) found to be immeasurable across all cases, and therefore simply coded as a binary variable such that $d=1$ if $i \neq j$ and $d=0$ if $i=j$.

Political repression is proxied by the Polity III measure of political rights, which operates on an ascending scale from zero to ten, where zero indicates that there are no political freedoms and ten indicates a high degree of political freedoms (Collier & Hoeffler, 2004:571). Political exclusion is proxied by ethnic dominance, which is in the form of a dummy variable taking a value of one if the largest ethnic group in a country constitutes 45–90% of the population and zero otherwise. Collier & Hoeffler (2004: 571) include this proxy in order to account for ethnic hatred that may stem from political exclusion, especially where access to political power is based on ethnicity and one ethnic group has a majority (Collier & Hoeffler, 2004:571). These authors (2004:572) argue that the incentive to exploit the minority tends to increase the larger that the minority is, as this provides political incumbents with a greater resource-extraction pool. Income inequality is measured by the Gini coefficient (Collier & Hoeffler, 2004:572).

Additionally, it should be noted that Collier and Hoeffler (2004) retain elements of their opportunity model in their grievance model, particularly the geographical opportunity indicators of mountainous terrain and population density. This is owing to the fact that the political science literature, whilst largely ignoring measures of economic opportunity in analyses of conflict onset, approves the assertion that geographical opportunity may come to affect the risk conflict (Collier & Hoeffler, 2004:575). Furthermore, the number of months since the previous conflict is also included in the grievance model. However, the interpretation ascribed to it is different in that when included in this model, it no longer proxies for capital costs of conflict, but rather serves as a proxy for fading hatred or the gradual dwindling of conflict-induced grievances (Collier & Hoeffler, 2004:569). Lastly, Collier and Hoeffler include the country's population size in both their greed and grievance models in order to account for the fact that both grievances and opportunities may increase with population size, and is thus – like peace duration – consistent with both the greed and grievance accounts of conflict onset (Collier & Hoeffler, 2004:572).

Upon estimating each of their models, Collier and Hoeffler (2004:577) find that whilst the opportunity model is superior to the grievance model, elements of the grievance model add to its explanatory power. Consequently they explore the possibility of a combined model, which includes all elements from both models and, through stepwise elimination of insignificant variables in this combined model, arrive at a baseline regression which consists solely of statistically significant predictors of conflict onset for the period 1960-1999. The only indicator of grievance to survive this process is their proxy for political exclusion (Collier & Hoeffler, 2004:571). All indicators of opportunity, as discussed above, find themselves in Collier & Hoeffler's baseline regression, except for mountainous terrain and population density, which were included in both the opportunity and grievance models (Collier & Hoeffler, 2004:580).

The Collier-Hoeffler model and its findings, particularly the lack of empirical support that it offered for economic and political grievances as causes of conflict, gained considerable scholarly attention – much in the way of criticisms (Davis, 2013; Jackson, 2013; Ballentine & Sherman, 2003; Cramer, 2002). Censures of the proxies chosen as indicators of grievance have been the most common, with many arguing that the use of measures of diversity such as the ELF and RF Indexes as proxies for ethnic and religious hatreds is inappropriate, as these indicators fail to capture how the status of groups divided along these lines can serve as origins of insecurity and/or hatred that could motivate conflict (Buhaug, Cederman & Gleditsch, 2014; Cederman, Min & Wimmer, 2009; Nathan, 2005). Collier and Hoeffler's proxy for political exclusion – the presence of a dominant ethnic group within society – is critiqued on similar grounds. These criticisms have led many to conclude that Collier and Hoeffler (2004) do not empirically illustrate a lack of support for the grievance hypothesis and, at most, illustrate that to a large extent the number of religious and/or ethnic groups within a country do not correlate with the likelihood of that country experiencing a conflict (Nathan, 2005:10 ; Keen, 2012:761).

Drawing on the distinction between horizontal and vertical inequalities by Stewart (2008), Collier and Hoeffler's use of the Gini coefficient as a proxy for income inequality can be said to suffer from the same flaws mentioned above to the extent that this measure of income inequality fails to capture relevant aspects of social inequality. [3]As Gamson (1992) suggests, income asymmetries do not themselves produce conflict-inducing grievances. Rather, such inequalities are more clearly linked to conflict through a process by which

[3] Vertical inequality refers to inequality amongst individuals and horizontal inequality refers to inequality across groups (Stewart, 2008:11).

members of the disadvantaged group(s) first become aware of their predicament through inter-group comparison and subsequently convince themselves that the distribution of wealth is unjust and can be blamed on the political elite or some other group within the society (Gamson, 1992). This is not captured by the Gini coefficient.

However, whilst these criticisms of the proxies for grievances have broadly been perceived as theoretically valid, until recently, more appropriate measures of indicators of grievance had not been operationalized for inclusion in econometric models of conflict onset (Cederman *et al.,* 2009:7). In terms of more appropriate proxies for ethnic-based grievances, the Minorities at Risk (MAR) Project served as the first step in this regard (Cederman *et al.,* 2009:6); however, the improvement provided by the MAR dataset was only marginal given that only groups which constituted an ethnic minority entered it. Implicit in this was the assumption that the State itself was ethnically neutral, a limiting assumption given it's the role it has played historically in defining ethnic boundaries and power relations (Cederman *et al.,* 2009:7). More recently Buhaug *et al.* (2014) appear to provide the next step forward in terms of more appropriate indicators of ethnic grievance. Not only do the authors articulate an explicitly political account of ethnic identity that characterizes the relationship between ethnic group(s) in power and those excluded from access to executive power; but, to this end construct an inter-group grievance indicator that captures systematic inequity in ethno-political opportunities within countries. [4]

Additionally, Buhaug *et al.* (2014) construct an inter-group measure of income inequality whereby, upon identifying the richest and poorest ethnic groups in each country, they obtain a measure of the relative gap between mean national income and income level for the poorest and richest groups. In doing so, these authors are able to study conflict risk as a function of the relative discrepancy in wealth or privileges between the national average and the most marginalized group in society, and are therefore better able to account for the social disparities between groups in society that theory has suggested can explain the link between economic grievances and conflict (Stewart, 2008; Gamson, 1992).[5]

Both these newly-devised intergroup measures of grievance are found to be statistically significant in their model of civil war onset, which is based on a global dataset of civil wars for the period 1960–2005, whereas the individualist measures of income and ethnic inequality adopted by Collier & Hoeffler (2004) are not (Buhaug *et al.,* 2014:425). Yet, given the recent nature of these developments, they have not yet been explored explicitly in the context of sub-Saharan Africa. Indeed, making use of the same, inappropriate grievance proxies as Collier & Hoeffler (2004), studies of civil war onset in the region

[4] Discussion of the construction of this variable is postponed to Section III of this paper. Briefly, however, Buhaug et al. (2014) are able to construct such a measure by generating country-aggregated indicators of ethnic grievance from group-specific datasets.
[5] A more detailed discussion of this variables construction is postponed until Section III.

typically fail to find a significant link between indicators of grievance and civil war onset in sub-Saharan Africa (Elbadawi & Sambanis, 2000). As such, substituting traditional indicators of economic and ethnic grievances with these improved measures may enhance scholarly understanding of the role that grievances play in explaining civil war outbreaks in the region – an important way in which this paper seeks to contribute to the study of civil war onset in sub-Saharan Africa.

Additionally, it is important to note that Collier and Hoeffler (2002a) purport to demonstrate the applicability of their model to sub-Saharan Africa by including a sub-Saharan Africa dummy in the aforementioned baseline regression - which consists of only statistically significant predictors of conflict onset – as they had established in an earlier iteration of *Greed and Grievance in Civil War* (2004).[6] The dummy is found to be insignificant, which suggests that there is no peculiar 'Africa effect' not accounted for in their model explaining the occurrence of civil wars in the region (Collier & Hoeffler, 2002a:10).

Interestingly, this appears to have served as both a starting point as well as a point of departure for many econometric studies of civil war onset in sub-Saharan Africa. In relation to its role as a starting point, scholars studying the onset of civil war in this region often tend to specify some combination of Collier and Hoeffler's (2004) opportunity and grievance models – making use of the same proxies for indicators of grievance and greed as presented in Collier and Hoeffler (2002a, 2004) (Devitt & Tol, 2012). From here, however, begins the departure. The rhetoric of greed and grievance seems to have largely subsided and there has been an increasing trend for work on the determinants of conflict in sub-Saharan Africa to focus attention on other, more region-specific, correlates of conflict onset. Most recently this has been done by introducing variables pertaining to drought and climate change in conflict onset models, which has itself sparked a new academic debate (Hendrix & Glaser, 2007 and Burke, Dykema, Lobel, Miguel & Satyanath, 2009).

Whilst this shift is to be lauded given that the empirical framework provided by the greed-grievance framework is to no extent exhaustive in terms of the determinants of conflict it is able to analyse, it has also been detrimental to the extent that whilst indicators of greed

[6] *On the Incidence of Civil War in sub-Saharan Africa*, is the title of the paper in which Collier and Hoeffler (2002a) sought to examine civil wars as they pertain to sub-Saharan Africa. This work is based on the 2002 working paper version their 2004 paper, also titled *Greed and Grievance in Civil War* (Collier & Hoeffler, 2002b). The proxies for greed and grievance and the baseline regression arrived at in Collier & Hoeffler (2002b) mirror the proxies included and the baseline results obtained in the paper released in Collier & Hoeffler (2004).

and grievance are included as standard controls in many of these models, the framework from which these 'standard controls' stem - the greed-grievance debate – has not itself undergone the type of scrutiny that is permitted by new data.

Thus perhaps more crucial than ascertaining whether the recent developments in quantifying indicators of grievance provides more support for the grievance hypothesis *per se*, is the value to be gained by revisiting the greed-grievance debate such that scholars seeking to draw from its empirical, rather than theoretical, framework can be made aware of what more recent data suggest as to the relative importance of the variables which they are introducing as 'standard controls' in their more region-specific analyses of conflict onset. Perhaps important controls found within the greed-grievance framework are missing from such analyses and, in revisiting the greed-grievance debate, any omissions of this nature can be determined. Furthermore, knowledgeable of their importance, their inclusion in future analyses of the determinants of conflict onset in sub-Saharan Africa may not only provide such models with greater explanatory power but also provide policy-makers, seeking to implement effective policies to prevent the re-occurrence of conflicts by targeting their causes, with a more accurate understanding of the interventions required.

Lastly, it should be noted that in terms of conducting empirical analyses of civil war onset, there has been a shift toward an annual sample framing, or country-year format, as opposed to the five-year period format used by Collier and Hoeffler (2004). The justification for doing so is most clearly stated by Fearon (2005), who argues that availability of data on conflict onset and other economic data such as GDP, GDP growth and population in yearly intervals, as well as the time-invariant nature of many grievance indicators, makes the study of conflict onset well-suited to an annual sample framing. Additionally, Fearon (2005:497) notes that an annual sample framing may actually be more favourable to the study of conflict onset as it permits the coding of quickly renewed wars which, in Collier and Hoeffler's (2004) framework, would be lost due to occurring within the same five-year period as another conflict onset.

However, Fearon (2005:496) does note that whilst the choice of five-year sample framing by Collier and Hoeffler (2004) is arbitrary, it may be a result of the fact that prior to the 2000s data on primary commodity exports – the kingpin variable of their analysis – were only measured at five-year intervals, beginning in 1960. Nevertheless, Fearon (2005:496) finds that in Collier and Hoeffler's (2004) sample the ratio of primary commodity exports to GDP in year t is highly positively correlated with this ratio in year t – 5 ($p = .85$). Subsequently he uses this finding to justify filling in the missing years of data by linear interpolation (Fearon, 2005:496). Doing so, makes an annual sample framing less subject

to list-wise deletion of conflict onsets due to missing data, and provides a strong case for the use of a country-year format when one considers that whilst there are 79 onsets in Collier and Hoeffler's (2004) sample, 27 of these are not used in their analysis because of missing data on an explanatory variable (Collier & Hoeffler, 2004:563).

The motive behind Fearon's (2005) adaptation of Collier and Hoeffler's (2004) dataset to an annual sample framing was to test the robustness of Collier & Hoeffler's central finding – that there exists a statistically significant positive relationship between primary commodity exports and the risk of civil war. However, in transforming the data in the aforementioned manner, Fearon (2005) finds that the strength of this relationship stems largely from both list-wise deletion and the idiosyncrasies of Collier & Hoeffler's (2004) five-year period format. Interestingly, Collier (2006:17) argues that, as a result of their finding, in order to reduce the risk of future conflicts countries ought to diversify their economies away from primary commodities. However, in light of Fearon's (2005) findings, this policy prescription may be misguided. It is thus of interest to see what new data and an annual sample frame say about the strength of this relationship, and that of others found by Collier & Hoeffler (2004), in the context of sub-Saharan Africa.

Hence, with the aforementioned developments in the literature in mind, this paper now turns to a discussion of the data that will be used in order to investigate empirically the roles of greed and grievance in explaining civil wars in sub-Saharan Africa.

## III. Data, Measurement and Descriptive Statistics

The analysis conducted in this paper is based on a dataset constructed from a variety of sources. It examines 45 sub-Saharan African countries over the period 1960–2010, using an annual sample framing. This provides a potential 2295 observations. This paper makes use of the most inclusive definition of civil war, counting all conflicts between a State and one or more rebel groups that generated at least 25 battle-related deaths in a calendar year, with data on these conflicts having been obtained from the Uppsala Conflict Data Programme/Peace Research Institute Oslo's Armed Conflict Dataset (UCDP/PRIO ACD) (Themnér & Wallensteen, 2014). This permits an analysis of 100 conflict onsets, details of which are presented in Table A.1 of Appendix A. Importantly, whilst this section provides a description of the data used and the sources from which the data are obtained, certain variables required reconstruction; the process underlying such reconstructions is detailed in Appendix B. The reader is alerted as to when to refer to the appendix by way of a footnote.

In terms of opportunities arising from sources of rebel finance through natural resource extortion, this paper makes use of the same proxy as Collier and Hoeffler (2004) - the ratio of primary commodity exports to GDP. Data on primary commodity exports and GDP are available from the World Bank African Development Indicators (WBADI) (World Bank, 2014). Following Collier & Hoeffler (2004:595), GDP and export data are measured in current US dollars. [7]

The proxy chosen for diaspora funding differs markedly from that used by Collier and Hoeffler (2004). Recall, Collier and Hoeffler (2004) use the proportion of a countries population living in the United States as their proxy for diaspora funding. This proxy does not address the specificities of the sub-Saharan Africa, particularly when one considers that most emigrations occur within the region - with many people frequently crossing-borders in search of job opportunities (Nordic Africa Institute, 2007:13). Furthermore, using the proportion of people who have emigrated as a proxy for diaspora funding suffers from the critique that it does not actually capture financial contributions from diasporas and, as suggested by Nathan (2005:11), is perhaps more suitable as a proxy for the level of dissatisfaction of citizens with the state of affairs in their home country. As such, the diaspora variable included in this paper makes use of data on remittance payments from the WBADI (World Bank, 2014). [8]

Collier and Hoeffler's (2004) measure of funding to rebels from outside governments hostile to the incumbent government, the post-Cold War dummy, is retained in this analysis. In terms of finding proxies to measure the low cost of rebellion, real PPP-adjusted GDP per capita and the growth rate of the economy are obtained from the Penn World Tables version 7.1 (Aten, Heston & Summers, 2012). Data on male secondary education enrolment are available from the WBADI (World Bank, 2014). However, much of the data are missing. Thus, in addition to male secondary school enrolment, the dataset employed in this paper includes a variable for male secondary school completion rates from Barro and Lee (2010).[9] Whilst male secondary school enrolment and attainment rates are distinct measures, both appropriately proxy some kind of opportunity cost of participating in a rebellion. Particularly for those enrolled in school, rebellion must be weighed against future benefits which may stem from remaining in school and completing their education; for those who have completed secondary school, rebellion must be weighed against benefits from perhaps emigrating to another country where their qualification could permit them to gain decent employment.

In order to proxy for unusually cheap conflict-specific capital, this paper employs the same proxy as Collier and Hoeffler (2004), measuring the length of the peace period (in months)

[7] Refer to Appendix B.
[8] Refer to Appendix B.
[9] Refer to Appendix B.

since the end of the previous civil war. Following Collier and Hoeffler (2004:595), the first observation for this variable calculates the number of months of peace since the end of World War II. This data is obtained from Version 4 of the UCDP/PRIO ACD (Themner & Wallenstein, 2014).

In terms of the opportunity for rebellion stemming from weak government military capability, the same geographical indicators used by Collier and Hoeffler (2004) are employed. Data on mountainous terrain are obtained from Collier & Hoeffler's (2004) dataset and, given the time-invariant nature of this variable, the values are simply replicated for each country-year for the period 2000–2010 and for the 'between' years included in this analysis, but not in Collier & Hoeffler's owing to their five-year period sample framing. Data on geographic dispersion of the population are obtained from the WBADI, measuring the midyear population divided by land area in square kilometres (World Bank, 2014).

Lastly, in terms of the rebel military opportunity stemming from social cohesion, this paper employs the same social fractionalization proxy as Collier and Hoeffler (2004). However, whilst the underlying formula used to calculate its constituent measures of heterogeneity (the ELF and RF Indexes) is the same, this paper makes Fearon's (2002) measure of the ELF and Fearon & Laitin's (2003) measure of the RLF – where more up-to-date data compiled by these respective authors were applied to the general formula presented in Section II.

The developments made in the operationalization of grievance variables discussed in the literature review, particularly the importance of group-based indicators of grievance, are going to be used as proxies in this paper. In order to proxy for ethnic hatreds, this paper makes use of the indicator of systematic inequality in ethno-political opportunities amongst ethnic groups developed by Buhaug *et al.* (2014), rather than Collier & Hoeffler's ELF and Polarization Indexes.[10] Naturally, this variable does not capture all potential sources of ethnic grievance, focussing only on political exclusion along ethnic lines. However, for the reasons outlined in Section II, it indeed offers an improvement on the measures used by Collier and Hoeffler (2004) and many others in their study of the determinants of intrastate conflict.

In order to proxy for political repression, this paper makes use of the Polity IV dataset's Polity Score which is constructed by subtracting a country's autocracy score from its democracy score (Gurr, Jaggers & Marshall, 2013:16). This yields a number between –10 and +10 for each country-year, which is interpretable on an ordinal scale ranging from strongly autocratic regimes (–10) to strongly democratic regimes (+10) (Gurr *et a*l.,

[10] Refer to Appendix B.

2013:16). Income inequality as an economic grievance is proxied by the measure of horizontal income inequality developed by Buhaug *et al.* (2014). [11] As such, two variables are included to proxy for economic inequality in the dataset used in this paper. These capture the relative discrepancy in wealth between the national average and the richest (poorest) group in society, what Buhaug *et al.* refer to as positive horizontal inequality (negative horizontal inequality) (Buhaug *et al.,* 2014:422).

The variables peace duration, mountainous terrain, geographical dispersion and population are identical to those used in the opportunity model. Table 1 presents the means of each of the aforementioned variables for years with no onsets and years with an onset of civil war.

**Table 1** Descriptive Statistics

| | No civil war | Civil war |
|---|---|---|
| | *n*=2195 | *n*=100 |
| War starts | 0 | 1 |
| Primary commodity exports/GDP | 0.167 | 0.182 |
| GDP per capita (constant USD) | 1650 | 1261 |
| Diaspora funding† | 3.837 | 1.733 |
| Male secondary school attainment(% of population aged 15 and over) | 10.573 | 9.027 |
| GDP growth per capita growth in preceding period | 0.008 | 0.013 |
| Peace duration (months since last conflict) | 272.173 | 165.47 |
| Mountainous terrain (%) | 12.225 | 18.524 |
| Geographic dispersion (midyear population/land area in square km) | 57.649 | 45.906 |
| Democracy (index,-10 – +10) | -2.147 | -2.312 |
| **Horizontal measures of grievances** | | |
| Ethnic-based political exclusion (index, 0-1) | 0.078 | 0.212 |
| Positive horizontal inequality †† | 1.217 | 1.353 |
| Negative horizontal inequality ††† | 1.169 | 1.244 |
| **Vertical measures of grievances** | | |
| ELF (index,0-1) | 0.717 | 0.749 |
| RF (index, 0-1) | 0.483 | 0.499 |
| Income inequality (Gini) | 0.474 | 0.432 |
| Ethnic dominance (main ethnic group constitutes 45-90%) | 0.368 | 0.313 |

Notes: All summary statistics are rounded to three decimal places, except for GDP per capita (which has been rounded to the nearest whole number).

† Average annual remittances for the period 1960-2010 as a percentage of GDP.

†† Mean per capita income for richest group/country-level GDP per capita.

†††Country-level GDP per capita /mean per capita income for poorest group.

[11] Refer to Appendix B.

It is interesting to note that both conflict episodes and peace episodes were preceded by positive growth rates in GDP per capita; even more striking is the fact that conflict episodes were preceded by higher growth rate than peace episodes. However, conflict episodes started, on average, with lower levels of GDP per capita than peace episodes. Table 1 also makes evident that peace episodes are preceded by far longer periods of peace than conflict episodes and that, on average, political regimes tended to be more autocratic than democratic in both periods of conflict and periods of peace.

## IV. Empirical Methodology and Regression Results

In this section the greed and grievance models (as described in Section II) will be empirically tested, using the data described in Section III. However, at the outset it is important to note that given the choice of annual sample framing as opposed to the five-year format used by Collier and Hoeffler (2004), additional controls, particularly controls for endogeneity of various independent variables and time year-effects, must be introduced. The opportunity and grievance models are thus run without these controls using a pooled logit estimation technique in order to establish a reference point from which the aforementioned controls are added.

Additionally, it is important to note that given that Section V combines the two models estimated in this section, parsimony in terms of the potential regressors that will be eligible for inclusion in this combined model is not an objective of the proceeding analysis. As such, the use of a fixed-effects estimation technique is not employed to control for unobserved heterogeneity amongst countries. Indeed, because fifteen countries (one-third of the countries in the sample) did not experience a conflict onset they would be dropped from the analysis were this to be done. Furthermore, several regressors in the grievance model are time-invariant within each cross-sectional unit, and would thus be dropped from the analysis.

Thus the objective of this section (and the next) is to establish under the set of the most necessary but least stringent controls, the most important explanatory variables of conflict onset in sub-Saharan Africa over the period 1960-2010 afforded by the opportunity and grievance models. These result are subject to robustness tests for problems of unobserved heterogeneity and others in Section VI.

The opportunity model may thus be stated as follows,

$$\Pr(\text{onset}=1|\mathbf{F, L, E, C, W,} S)= \lambda [ \beta 0 + \beta 1\mathbf{F}_{it} + \beta 2\mathbf{L}_{it} + \beta 3\mathbf{C}_{it} + \beta 4\mathbf{W}_{it} + \beta 5S_{it} + u_{it}]$$

Where *t* and *i* are time and country indicators, respectively. Onset is a dummy variable equal to 1 if conflict started in a given year and zero otherwise, with an onset also being

coded as a positive outcome if a conflict restarts following more than one year of conflict inactivity. Pr(onset=1|...) indicates that the logit estimation will yield the log-odds of war. **F** is a vector of variables for rebel finance, **L** is a vector of variables that measure low costs of rebellion, **C** is a vector of variables for low capital costs, **W** is a vector of variables indicating weak government capacity and S represents social cohesion, all measured as previously discussed. The regression output presented in Table 2 is based on several variations of this model.

**Table 2** Opportunity model

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Primary commodity exports/GDP | -1.814<br>(4.033) | -2.042<br>(3.874) | 3.818<br>(3.828) | 3.126<br>(2.769) |
| Primary commodity exports/GDP$^2$ | 4.326<br>(5.886) | 4.867<br>(5.672) | -1.916<br>(4.779) | -0.820<br>(3.627) |
| Post-Cold War | 0.158<br>(0.477) | 0.046<br>(0.442) | 0.223<br>(0.422) | -0.022<br>(0.304) |
| Male secondary schooling (attainment) | -0.012<br>(0.020) | -0.013<br>(0.019) | | |
| GDP growth | -0.846<br>(2.162) | -0.247<br>(2.111) | 1.299<br>(2.510) | 1.683<br>(1.624) |
| Peace duration | -0.001<br>(0.001) | -0.0014*<br>(0.001) | -0.002**<br>(0.001) | -0.002***<br>(0.001) |
| Mountainous terrain | -0.001<br>(0.013) | -0.0042<br>(0.012) | 0.009<br>(0.009) | 0.010<br>(0.007) |
| Geographic dispersion | 0.0002<br>(0.004) | 0.001<br>(0.003) | -0.008*<br>(0.004) | -0.003<br>(0.003) |
| Social fractionalization | -0.487<br>(0.697) | -0.312<br>(0.670) | -0.213<br>(0.743) | -0.450<br>(0.569) |
| Ln population | 0.408*<br>(0.238) | 0.482**<br>(0.221) | 0.490**<br>(0.230) | 0.610***<br>(0.164) |
| Diaspora | -0.023<br>(0.035) | | | |
| Male secondary schooling (enrolment) | | | -0.022<br>(0.014) | |
| Ln GDP per capita | | | | -0.161<br>(0.244) |
| Observations | 1054 | 1104 | 744 | 1477 |
| Pseudo R-squared | 0.0398 | 0.0476 | 0.0961 | 0.0946 |
| Log likelihood | -140.947 | -157.500 | -138.254 | -255.099 |

Notes: Standard errors in parentheses. All regressions include a constant (not reported). ***, **,* indicate significance at the 1%, 5% and 10 % level respectively.

Collier and Hoeffler (2004:574) note that in their global sample, secondary school enrolment and per capita income are too highly correlated to be included in the same regression ($\rho$= 0.8). In sub-Saharan Africa, the relationship is not as strong ($\rho$ = 0.64) but, for consistency these variables are included in two separate regressions.

Column 1 of Table 2 reports the results from running the opportunity model using male secondary schooling as opposed to the logarithm of GDP per capita. The only proxy for opportunity that is of statistical significance is (the log of) population size – which increases conflict risk at the 10 percent significance level. The proxy for diaspora funding, the average of annual remittances over the period 1960-2010, is statistically insignificant which may lead one to infer that a country's conflict-risk is not tied to whether or not it receives high or low levels of remittances from diasporas. However, this result must be interpreted with caution given that the insignificance of this variable may stem from measurement error.[12]

To test whether the proxy for diaspora funding may be distorting the significance of other indicators of opportunity, column 2 displays the results obtained from re-running the model in column 1, excluding the diaspora variable: population retains its sign and significance, now at the 5 percent significance level, and the proxy for the cost of conflict specific capital (peace duration) is now, with the expected negative sign, statistically significant at the 5 percent level. [13]

The other proxies for rebel finance, the end of the Cold War and the ratio of primary commodity exports to GDP remain statistically insignificant. The insignificance of the latter is consistent with Fearon's finding at the global level and is also intuitive in terms of the types of natural resources are included in the measure of country's primary commodity exports.[14] In order to benefit from their country's natural resource abundance as a means to finance a rebellion, rebels would need to control the national distribution or production system of cash crops and oil, which typically is not the case (Fearon, 2005; Ross 2004).

Ross (2004) suggests that rebels may be able to benefit from the profits of natural resource abundance by selling future resource exploitation rights to foreign companies or States, using these revenues to then finance a rebellion. Historically, however, Ross (2004) only finds only one case in which rebel looting based on legal agricultural commodities or oil

[12] Reasons as to why there may be measurement error in this variable are discussed in Appendix B.
[13] A likelihood ratio test confirms that it is justified to drop the average diaspora variable, $\chi^2_{df=1} = 0.58$, Prob > $\chi^2$ = 0.4444. Thus, one fails to reject the null hypothesis that the coefficient on this variable is zero.
[14] This is detailed in Appendix B.

helped finance rebel start-up cost. [15] Nonetheless, it may be suggested that rebels may be motivated to rebel in order to gain control of the State as a means to access the revenues which come from these resources. However, if this is the case, this underlying greed motive appears to be ill-proxied by the ratio of primary commodity exports to GDP, which returns an insignificant coefficient in the sub-Saharan African context.

Secondary school attainment has the expected sign, but is insignificant. This may stem from the way in which the variable has been constructed. Column 3 explores this possibility using data from the WBADI (2014) on secondary school enrolment, retaining all other proxies used in column 2. Missing data for this variable severely reduce the sample size from 1104 to 744, and the effect of male secondary schooling is still statistically insignificant. Thus, available measures of education are unable to suggest any strong association between the educational status of males and the likelihood of conflict onset in sub-Saharan Africa.

Column 4 replaces male secondary schooling with (the log of) per capita income and retains the same measures of opportunity as presented in column 2. This variant of the opportunity model offers the largest sample of 1477 observations. The costs of conflict specific capital and population are still statistically significant, both now at the 1 percent level. The change of variable and subsequent sample expansion have no effect in terms of the statistical significance of other measures of opportunity, although the coefficient on primary commodity exports now attains the positive sign that Collier and Hoeffler's (2004) findings would suggest (but remains statistically insignificant).

Table 3 presents the results obtained after introducing controls for various factors that may be distorting the results obtained thus far. It is important to note, however, that at this point the education-opportunity model (Table 2, column 2) is dropped from any further analysis. This is owing to the fact that, firstly, like Collier & Hoeffler (2004), it is found that the per-capita model permits a much larger sample. Secondly, the measure of education used had to be constructed based on data available every five years (Barro & Lee, 2010), and is thus less likely to reflect the actual level of male secondary school attainment achieved by a country for these 'between years' than the measure of GDP per capita obtained directly from the Penn World Tables (Aten *et al.,* 2012).

Column 1 presents the results from the same regression of column 4 of Table 2, but includes year-lags of the logarithm of population, the growth rate of GDP and GDP per capita in order to control for any potential endogeneity (most likely arising due to reverse causality between any one or all three of these independent variables and the dependent

[15] This was done in the Congo republic (1997), where, what Ross (2004) refers to as "booty futures" in oil, helped finance the rebel group's start-up costs

variable) which may be distorting the results obtained thus far.[16] Only the lag on the log of population is statistically significant.

**Table 3** Opportunity model with controls for endogeneity and time

| | 1 | 2! | 3 |
|---|---|---|---|
| Primary commodity exports/GDP | 1.738<br>(2.651) | 1.492<br>(2.726) | 1.630<br>(2.670) |
| Primary commodity exports/GDP$^2$ | 0.484<br>(3.504) | 1.243<br>(3.665) | 0.994<br>(3.542) |
| Post-Cold War | 0.192<br>(0.285) | -1.046<br>(1.291) | -0.069<br>(0.305) |
| Peace duration | -0.002***<br>(0.001) | -0.002***<br>(0.001) | -0.002**<br>(0.001) |
| Mountainous terrain | 0.013**<br>(0.006) | 0.012*<br>(0.006) | 0.012*<br>(0.006) |
| Geographic dispersion | -0.004<br>(0.003) | -0.004<br>(0.003) | -0.003<br>(0.003) |
| Ln population$_{t-1}$ | 0.437***<br>(0.126) | 0.486***<br>(0.136) | 0.476***<br>(0.130) |
| Ln GDP per capita$_{t-1}$ | -0.155<br>(0.239) | -0.183<br>(0.251) | -0.165<br>(0.246) |
| GDP growth$_{t-1}$ | 1.498<br>(1.575) | 1.944<br>(1.541) | 2.181<br>(1.550) |
| Social fractionalization | -0.320<br>(0.573) | -0.417<br>(0.601) | -0.426<br>(0.582) |
| Year91 | | | 1.412**<br>(0.603) |
| Year94 | | | 1.633***<br>(0.560) |
| Observations | 1595 | 1241 | 1595 |
| Pseudo R-squared | 0.096 | 0.135 | 0.114 |
| Log likelihood | -262.399 | -235.3201 | -257.280 |

Notes: All regressions include a constant (not reported). Standard errors in parentheses. ***, **, * indicate significance at the 1%, 5% and 10 % level respectively. !Coefficients on time dummies not reported.

[16] It is important to note that implicit in the use of lagged variables in order to control for potential endogeneity is the assumption that actors do not anticipate the onset of a civil war and, as a result, do adjust not economic activity accordingly (Miguel, Satyanath & Sergenti, 2004). This is a somewhat strong assumption and calls into question the validity of using lagged independent variables as a solution to the endogeneity problem. Instrumental variable approaches have been devised in order to control for endogeneity by scholars studying civil war onset in sub-Saharan Africa such as the use of annual rainfall variation as an instrument for economic growth (Miguel *et al.,* 2004). However, data on rainfall variation do not go as far back as the 1960s. Thus this somewhat better control for endogeneity cannot be employed in the present analysis. Indeed, most scholars studying civil war onset at a regional and global level have introduced lagged dependent variables as a way to control for the reverse causality that may lead to problems of endogeneity (Buhaug *et al.,* 2014; Fearon, 2005; Elbadawi & Sambanis, 2002).

Peace duration retains its statistical significance at the one percent level and mountainous terrain increases the likelihood of conflict onset at the 5 percent significance level.
All other indicators of opportunity still remain statistically insignificant. A likelihood ratio test is conducted in order to ascertain whether omitting any of these lags singly or in combination reduces the fit of the model. Adding one year lags offers an improvement on the fit of the model without any lags at all ($\chi^2_{df=3} = 0.58$, Prob > $\chi 2 = 0.0008$).[17] This warrants the retention of the year-lags for each of the aforementioned variables in subsequent analyses of the opportunity model to be conducted in this paper.

Column 2 introduces controls for the effects of time by introducing year dummies for each year except a base year (1961).[18] The core results presented in Column 1 remain significant, albeit mountainous terrain is now only increases the likelihood of conflict onset at the 10 percent significance level. All indicators of opportunity that were previously statistically insignificant remain as such. Only two years displayed significant coefficients (at the 10 percent level), 1991 and 1994, both with positive coefficients. Collier, Hoeffler and Rohner (2008:17), using a global dataset of civil war onsets and a five-year sample framing also find that there was a temporary increase in the risk of civil war in the first half of the 1990s.

A likelihood ratio test is conducted to determine whether the inclusion of all the year dummies improves the explanatory power of this model. It is found that one cannot reject the null hypothesis that the coefficients on all year dummies are zero ($\chi^2_{df=35} = 19.67$, Prob> $\chi^2 = 0.9829$). Another likelihood ratio test is run to compare the model specification including the two years found to be statistically significant (1991 and 1994) against the model that does not control for these two years - one rejects the null hypothesis that the coefficients on these two year-dummies is zero ($\chi^2_{df=2} = 10.24$, Prob > $\chi^2 = 0.0060$).

Column 4 presents the results from the regression which includes the two year-dummies for 1991 and 1994. It is found that whilst their inclusion improves the statistical fit of the model, they do not alter the results in any sense that offers more support to greed motivations of conflict onset in sub-Saharan Africa. Only the lag of population, the number of months since previous conflict and mountainous terrain are significant determinants of conflict risk in sub-Saharan Africa over the period 1960-2010.

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[17] In all future discussion of likelihood ratio tests in this paper, $\chi^2$ serves to indicate the likelihood-ratio test statistic. Prob> any value, indicates the p-value of the test.

[18] Lagging of the aforementioned observations causes the loss of these observations in 1960. Given that Stata, the statistical software package being used, performs list-wise deletion on missing data - all observations for the year 1960 in any regression which includes these lagged variables is lost. Hence 1961 is chosen as the base year. The coefficients on the year dummies are not reported.

What is perhaps most striking about the opportunity model results presented thus far is the lack of statistical significance of key proxies of foregone income – real GDP per capita and its growth rate. This is not the first study to find the coefficients on either or both of these variables to be insignificant when studying civil war onset in sub-Saharan Africa (Anyanwu, 2004; Moradi, 2004), suggesting that the statistical significance of the coefficients on these variables, when studied within the context of Sub-Saharan Africa, are not robust to the different estimation techniques and model specifications.[19] Nevertheless, in this paper the lack of support lent to the opportunity thesis within the context of Sub-Saharan Africa is robust to standard corrections for endogeneity and the effects of time (Table 2, column 3). As such, this paper now turns to an empirical examination of the alternative, grievance model of civil war onset, which may be written as follows:

$$\Pr(\text{onset} = 1 | \mathbf{E}_{it}, \text{relfrac}_{it}, \mathbf{I}_{it}, \text{polrepression}_{it}, \mathbf{W}_{it}) = \lambda [\beta 0 + \beta 1 \mathbf{E}_{it} + \beta 2 \textit{relfrac}_{it} + \beta 3 \mathbf{I}_{it} + \beta 4 \textit{polrepression}_{it} + \beta 5 \mathbf{W}_{it} + u_{it}]$$

Where $t$ and $i$ are time and country indicators, respectively. $\boldsymbol{E}_{it}$ includes all measures of ethnic grievances - both vertical and horizontal. $\textit{Relfrac}_{it}$ is the traditional measure of religious fractionalization, the RF Index for country $i$ in year $t$. $\mathbf{I}_{it}$ is a vector containing all measures of income inequality, both vertical and horizontal measures, and $\text{polrepression}_{it}$ refers to political repression. Lastly, $\mathbf{W}_{it}$ includes the vector of variables that were also included in the opportunity model. All proxies used to estimate this equation are as discussed in Section III. The results from estimating various versions of this equation are presented in Table 4.

Column 1 reports the results from a traditional grievance regression which includes demographic measures of fractionalization and population composition as (despite not

[19] What is most interesting is that Anyanwu (2004) employs the same opportunity model being explored in this paper, also using a pooled logit estimation technique, but using a five-year sample framing and the introduction of a Sub-Saharan Africa dummy in Collier & Hoeffler's (2004) dataset and also finds that the risk of civil war onset is not significantly associated with per capita income. However, the other proxy for earnings forgone – economic growth– is found to be negatively associated with war onset in sub-Saharan Africa at the 5 percent significance level (Anyanwu, 2004:8). The fact that neither of the coefficients on GDP per capita and GDP per growth were statistically significant in the analysis conducted in this paper became of great interest and several possibilities were explored. Firstly, it was found that the only way for the log of GDP per capita to attain statistical significance (albeit at the 10 percent significance level), with the expected negative coefficient sign was to remove both peace duration and the log of population from the regression run in Table 1, column 4. However, a likelihood test of the null hypothesis that the coefficients on both peace duration and population are zero, reveals that one must reject the null hypothesis at the (less than) one percent significance level ($\chi^2_{df=2} = 27.86$; Prob > $\chi^2 = 0.0000$). Thus, one cannot warrant excluding these two explanatory variables from the model. The possibility that multicollinearity between real GDP per capita and population size was the source of the lack of statistical significance of GDP per capita was also explored. This is not the case ($p = -0.3224$). Lastly, it was considered that reasons for not finding a statistically significant coefficient on either of these proxies of foregone income in this paper may stem from the use of a pooled logit estimation technique as opposed to dynamic panel data methods given that the annual sample framing has added a more heavily-weighted time dimension than if, following Collier and Hoeffler (2004), a five-year sample framing were to be used. This possibility is discussed in more detail later in this paper in a section on future work.

adequately proxying for the inter-group hatreds that can actually lead to conflict) the link between the demographic composition of a country and the risk of conflict onset is still of interest in its own right (Fearon, Kasara & Laitin, 2007:187).

**Table 4** Grievance model

| | 1 | 2 | 3 | 4† |
|---|---|---|---|---|
| Religious Fractionalization | -1.707* | -1.667** | -1.674** | -1.665** |
| | (0.909) | (0.751) | (0.751) | (0.764) |
| Ethnic-based political exclusion | | 1.588*** | 1.541*** | 1.844*** |
| | | (0.414) | (0.420) | (0.468) |
| Democracy | | | 0.021 | 0.015 |
| | | | (0.021) | (0.024) |
| Peace duration | -0.001 | -0.001** | -0.001** | -0.001** |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Mountainous terrain | 0.010 | 0.006 | 0.006 | 0.006 |
| | (0.006) | (0.005) | (0.005) | (0.005) |
| Population density | -0.001 | -0.004 | -0.004 | -0.004* |
| | (0.003) | (0.002) | (0.002) | (0.002) |
| Ln population$_{t-1}$ | | | 0.492*** | 0.505*** |
| | | | (0.123) | (0.126) |
| Negative horizontal inequality | | 0.581* | 0.583* | 0.467 |
| | | (0.339) | (0.339) | (0.345) |
| Ethnic Fractionalization | 0.220 | | | |
| | (1.229) | | | |
| Ethnic dominance | -0.019 | | | |
| | (0.298) | | | |
| Democracy | 0.016 | 0.016 | | |
| | (0.023) | (0.021) | | |
| Ln population | 0.483*** | 0.495*** | | |
| | (0.139) | (0.122) | | |
| Income Inequality(Gini) | -0.032** | | | |
| | (0.015) | | | |
| Positive horizontal inequality | | 0.190 | 0.171 | |
| | | (0.192) | (0.195) | |
| Observations | 1711 | 1924 | 1913 | 1666 |
| Pseudo R-squared | 0.0787 | 0.0885 | 0.0882 | 0.1360 |
| Log likelihood | -277.957 | -334.048 | -330.934 | -302.548 |

Notes: All regressions include a constant (not reported). Standard errors in parentheses. ***,**,* indicate significance at the 1%, 5% and 10% level, respectively.
† Coefficients on year dummies not reported.

The results suggest that religious fractionalization is negatively and statistically significantly related to civil war onset at the 10 percent significance level. That is, in sub-Saharan Africa, countries with fewer religious groups are at greater risk of experiencing a conflict onset. Ethnic fractionalization is found to have no impact on the likelihood of conflict onset, nor is the presence of a dominant ethnic group within society. Again,

population displays a positive coefficient and is significant at the 1 percent level. Mountainous terrain is also positive and statistically significant at the 10 percent level. A likelihood ratio test suggests that the three demographic measures, traditionally used to proxy for ethnic and religious grievances, are not jointly significant.[20] At this point traditional analyses of conflict onset in sub-Saharan Africa – and the world – generally conclude that ethnic and religious tensions are unimportant for explaining conflict onset (Collier & Hoeffler, 2004; Fearon & Laitin, 2003). However, as has been emphasised throughout this paper, this claim is unfounded as these variables do not actually proxy any type of grievance.

Column 2 presents the results from estimating the grievance model with horizontal measures of ethnic inequality and income inequality. No such equivalent measure exists for religious affiliation.[21] Thus, the RF Index is retained in this regression in order to control for some aspect of the role played by religion in conflict onset, and also to ascertain whether the significance of religious fractionalization still holds when appropriate proxies for ethnic and income inequalities are included.

The differences between the results presented in columns 1 and 2 are striking. First off, ethnicity matters – the coefficient on the ethnic grievance indicator, which measures systematic inequality in ethno-political opportunities, is positive and statistically significant at the one percent significance level. Additionally, of the horizontal measures of economic inequality, the relative gap between the country-level GDP per capita and the mean per capita income for the poorest ethnic group in a given country is positive and statistically significant at the 10 percent level, suggesting that sub-Saharan African countries with one or more ethnic group(s) radically poorer than the national average have a higher risk of conflict onset.

Religious fractionalization retains its significance and sign and, as in the greed model, mountainous terrain, population and the number of years of since the previous conflict are all statistically significant with the expected signs. Importantly, the interpretation of peace duration differs in this model in that it no longer proxies for capital costs of conflict,

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[20] $\chi^2_{df=3} = 4.08$, Prob > $\chi^2$ =0.2528. One fails to reject the hypothesis that the coefficients on these three variables are jointly equal to zero.

[21] This conclusion was drawn based on personal correspondence with Halvard Buhaug, co-author of *Square Pegs in Round Holes: Inequalities, Grievances and Civil War* (SPRH) (2014) in which it was asked whether a similar measure of horizontal inequality, as presented in SPRH was available for religion. Buhaug indicated that data on religious discrimination may be found in the MAR dataset (Gurr, 2000). However, a review of the comments on the data by scholars interested in the study of the role of religion in civil war onset made it evident that the MAR dataset suffers from fundamental flaws, stemming largely from selection of cases and errors in the coding of existing variables (Fearon & Laitin, 2000:3; Duursma, Forsberg & Grant, 2012:4). Thus, to preserve the integrity of the results presented in this paper, a measure which adequately proxies for religious discrimination in the grievance model with 'improved proxies' is not included.

but rather, serves as a proxy for fading hatreds or the gradual dwindling of conflict-induced grievances (Collier & Hoeffler, 2004:569). Hence the data suggest that in sub-Saharan Africa the longer the time since a previous conflict, the less likely it is that an onset of conflict will occur.

As was done for the opportunity model, controls or endogeneity and the independent effect of time are employed. The results of estimating the grievance model as specified in column 2 but with a year-lag on the proxy for political repression and the log of population are presented in column 3. The core results are unchanged except for the coefficient on on mountainous terrain, which loses its statistical significance. Column 4 introduces year dummies to the model, and all variables found to be significant in columns 2 and 3 remain so. The key impact of controlling for time is that population density now increases the likelihood of conflict onset at the 10 percent significance level. Unlike in the opportunity model, none of the year dummies is found to be individually significant, nor are they jointly significant ($\chi^2_{df=42}= 31.72$; Prob > $\chi^2= 0.875$), one therefore fails to reject the null hypothesis that the coefficients on all year dummies is zero). Thus, future reference to the grievance model will refer to the model as specified in column 3 (with the year-lag on both Democracy and the log of population).

## V. Formulating the Baseline

This section aims to ascertain which model – opportunity or grievance – is superior in terms of explaining conflict onset in sub-Saharan Africa. Collier and Hoeffler (2004:577) do this for their sample by way of Davidson and MacKinnon's (1981) J-test for non-nested econometric models and this paper follows suit. As shown in Table 5, columns 1 and 2, the predicted value of the grievance model ($\hat{p}^{\text{grievance}}$) is statistically significant at the one percent level in the opportunity model, as is the predicted value of the opportunity model ($\hat{p}^{\text{opportunity with time}}$) in the grievance model. Recall that peace duration, mountainous terrain and the lag of population are included in both models. This suggests that irrespective of these three variables (which were consistently the only variables found to offer statistically significant explanations of conflict onset in sub-Saharan Africa in the opportunity model), the opportunity model may be adding explanatory power to the grievance model of conflict onset (Collier & Hoeffler, 2004:577).

However, there is the possibility that the key explanatory power being added to the grievance model is a result of the inclusion of year-dummies (Year91 and Year94) in the opportunity model and not actually any indicator of what Collier & Hoeffler (2004) deem to be consistent with the explanation of conflict as greed-motivated. This possibility is

explored by excluding these year dummies and placing the predicted values of this regression into the grievance model. [22] The results are presented in Column 3.

**Table 5** The Combined opportunity and grievance model

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Primary commodity exports/GDP | -0.426 | | | -1.423 |
| | (2.607) | | | (2.751) |
| Primary commodity exports/GDP$^2$ | 2.381 | | | 3.355 |
| | (3.477) | | | (3.599) |
| Post-Cold War | 0.384 | | | 0.418 |
| | (0.297) | | | (0.347) |
| Peace duration | -0.001 | -0.001 | -0.000 | -0.002** |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Mountainous terrain | -0.003 | -0.005 | -0.007 | 0.004 |
| | (0.008) | (0.006) | (0.007) | (0.007) |
| Population dispersion | -0.001 | -0.001 | -0.000 | -0.004 |
| | (0.002) | (0.002) | (0.002) | (0.003) |
| Ln population$_{t-1}$ | 0.114 | 0.210 | 0.374*** | 0.387** |
| | (0.155) | (0.152) | (0.141) | (0.154) |
| Ln GDP per capita$_{t-1}$ | -0.122 | | | -0.164 |
| | (0.244) | | | (0.267) |
| GDP growth$_{t-1}$ | 1.476 | | | 1.441 |
| | (1.592) | | | (1.527) |
| Social fractionalization | 0.195 | | | 0.739 |
| | (0.609) | | | (1.065) |
| Ethnic-based political exclusion | | 2.031*** | 2.101*** | 2.181*** |
| | | (0.573) | (0.564) | (0.606) |
| Religious fractionalization | | -1.399 | -1.429 | -1.266 |
| | | (0.946) | (0.922) | (0.943) |
| Democracy$_{t-1}$ | | 0.033 | 0.020 | 0.023 |
| | | (0.027) | (0.028) | (0.029) |
| Positive horizontal inequality | | 0.146 | 0.230 | 0.276 |
| | | (0.323) | (0.310) | (0.330) |
| Negative horizontal inequality | | 0.229 | 0.226 | 0.111 |
| | | (0.545) | (0.550) | (0.565) |
| $\hat{p}^{\text{grievance}}$ | 12.293*** | | | |
| | (3.596) | | | |
| $\hat{p}^{\text{opportunity with time}}$ | | 9.061*** | | |
| | | (2.349) | | |
| $\hat{p}^{\text{opportunity without time}}$ | | | 10.987*** | |
| | | | (4.125) | |
| Observations | 1464 | 1464 | 1464 | 1464 |
| Pseudo R-squared | 0.1143 | 0.1381 | 0.1218 | 0.1237 |
| Log-likelihood | -235.134 | -237.13347 | -241.620 | -232.647 |

Notes: All regressions include a constant (not reported). Standard errors in parentheses.***,**, * indicate significance at the 1%, 5% and 10 % level, respectively.

[22] Recall, the inclusion of these year dummies did not change the practical significance of the opportunity model, it merely provided a better statistical fit.

As can be seen, this is not the case, with the positive coefficient on $\hat{p}^{\text{opportunity without time}}$ being positive and statistically significant at the one percent level. This significant coefficient on $\hat{p}^{\text{opportunity without time}}$ suggests that there is a strong possibility that elements (not related to time, or geographic opportunity) from the opportunity model may add to the grievance model's explanatory power (Davidson & MacKinnon, 1981).

As such, a combination of the two models is explored and the results are presented in column 4. This regression excludes the two year-dummies for 1991 and 1994 in order for it to be ascertained whether actual indicators of opportunity and not the independent effect of time can explain civil war onset in Sub-Saharan Africa. In the combined model peace duration and the lag of population are statistically significant at the five percent significance level, and the measure of ethnic-based political exclusion is statistically significant at the one percent level. All the coefficients of these variables have the expected sign. No other indicators of opportunity or grievance display any statistical significance.

Using the sample provided by the combined model ($n$= 1464) a likelihood ratio test is conducted in order to determine whether the combined model is superior (Collier & Hoeffler, 2004:577). The first hypothesis tested is the null that all indicators of grievance are zero in the combined model. The null hypothesis is rejected at the one percent significance level. The second hypothesis tested is the null that all coefficients on indicators of opportunity in the combined model are zero. One fails to reject this hypothesis.[23] Collier and Hoeffler (2004:577), facing the same situation (albeit for the opposite case) take this to be indicative of the fact that the combined model is indeed superior to the opportunity and grievance models. Despite this, many variables in the combined model are insignificant and, following Collier and Hoeffler (2004:577), they are dropped one at a time in order to arrive at a baseline regression which includes only statistically significant predictors of conflict risk over the period of interest.

The rule employed in this elimination process is to start by eliminating insignificant variables with the largest p-values. After every drop a likelihood ratio test is run in order to ascertain whether or not the drop was indeed justified. The evolution of the combined model following the dropping of each variable is recorded in Table C.1, to be found in Appendix C, with the results of the likelihood ratio tests conducted placed under every column in which the variable dropped is not presented. Column 1 of table A.1 merely represents the combined model as it appears in column 4 of Table 5 for ease of comparison. The first variables dropped from the combined model are primary commodity exports and its square (column 2), having been statistically insignificant throughout and displaying

[23] The results of the likelihood ratio tests are as follows: opportunity model versus combined model, $\chi^2_{df=5}$ =15.68 (p= 0.0078). Thus, the combined model is an improvement on than the opportunity model. The same procedure is conducted for the grievance model: 5 degrees of freedom, $\chi^2_{df=5}$ =4.82 (p= 0.4382).

the largest p-values in the combined model. The next variable to be dropped is social fractionalization, displaying the largest p-value and also having been insignificant throughout (column 3). Subsequently, the lagged proxy for political repression (democracy) (column 4), lagged GDP per capita (column 5), positive horizontal inequality (column 6), mountainous terrain (column 7), the lag of GDP growth (column 8), population density (column 9), and lastly negative horizontal inequality (column 10) are dropped sequentially. Column 10 displays the baseline regression arrived at, which consists of only statistically significant predictors of conflict onset in sub-Saharan Africa for the period 1960-2010. By way of a likelihood ratio test it is ascertained that no further reductions are accepted. The baseline regression in column 10 of Table C.1 is reproduced below (Table 6).

**Table 6** Baseline regression

| | 1 |
|---|---|
| Post-Cold War | 0.550** |
| | (0.242) |
| Peace duration | -0.001* |
| | (0.001) |
| Ethnic-based political exclusion | 1.883*** |
| | (0.401) |
| Religious fractionalization | -1.393** |
| | (0.631) |
| Ln population$_{t-1}$ | 0.447*** |
| | (0.104) |
| Observations | 2071 |
| Pseudo R-squared | 0.0893 |
| Log-likelihood | -351.137 |

Notes: This is a replication of the final result obtained in Table C1. The regression included a constant (not reported). Standard errors in parentheses. ***, **,* indicate significance at the 1%,5% and 10 % level, respectively.

The baseline regression arrived at includes the proxy for rebel finance from external governments hostile to the incumbent government (the post-Cold War dummy), the number of months since the previous war (which proxies either cheap costs of conflict-specific capital or fading hatreds), the lag of the log of population, religious fractionalization and the proxy for ethnic discrimination. This differs markedly from the baseline regression found by Collier & Hoeffler (2004), which has often been used by scholars as a starting point when aiming to add to the literature on conflict onset by finding new correlates of conflict onset in sub-Saharan Africa. Particularly in that these scholars exclude proxies for ethnic-based political exclusion or proxy for this by making use of less-appropriate measures of ethnic diversity.

Of particular interest is the positive coefficient on the post-Cold War dummy which, interpreted within the framework provided by Collier & Hoeffler (2004), suggests countries in Sub-Saharan Africa are more at risk of conflict onset in the post-Cold War era as a result of increased financing to rebels from governments hostile to the incumbent government in the warring state. Considered within the confines of this interpretation, this result seems counter-intuitive. Indeed, one would expect the lack of financing from the Cold War super powers to impair the ability of rebels to actually finance a rebellion.

However, the positive coefficient on the post-Cold War dummy is likely to be telling a different story.[24] Balcells and Kalyvas (2010) make the observation that not only did the politics of the Cold War provide assistance to rebels, but also that it may have served to raise the capacity of states via superpower economic and military aid. Consequently, following the end of the Cold War, the outbreak of violent conflict may have become more likely in residually feeble states that lost superpower support after the end of the Cold War.

Such an indicator of state capacity is definitely in line with the opportunity thesis proposed by Collier and Hoeffler (2004): rebels, unwilling to pass up any profitable opportunity to rebel, may be more incentivised to do so following the end of the Cold War based on perceptions of the state being weaker in terms of military and financial capacity to thwart their attempts. However, such an indicator is not included in Collier and Hoeffler's (2004) opportunity model. One possible suggestion is that such a measure may be correlated with the end of the Cold War, causing the positive and statistically significant coefficient on the post-Cold War dummy.

In addition, the results indicate a strong, negative relationship between the number of months since a previous conflict and the likelihood of conflict. Indeed, most conflict onsets in Sub-Saharan Africa appear to be in the form of war restarts following at least one year of conflict inactivity. The last country in sub-Saharan Africa to experience its first-ever armed conflict was Cote D'Ivoire in 2002 (Themner & Wallenstein, 2014). This suggests that a prevailing legacy of conflict in Sub-Saharan Africa is, in fact, more conflict. Thus, given the persistently strong negative relation between peace duration and conflict onset, it is of interest to examine the robustness of the results obtained in the baseline regression by changing the independent variable to examine only first-time wars. This and other robustness checks are the subject of the next section.

[24] At this point, it is perhaps useful for the reader to be made aware that forty-nine of the 100 conflict onsets in the dataset used in this paper have occurred after the year 1990, compared to the forty-eight in years preceding 1990 (three onsets are coded in the year 1990) (UCDP, 2014).

## VI. Robustness Checks

Table 7 reports the results of various robustness tests of the baseline regression arrived at in Section V.

**Table 7** Robustness checks

| | 1<br>Baseline | 2<br>Fixed effects | 3<br>Random effects | 4<br>Baseline (first-time wars only) | 5<br>Fixed effects (first-time wars only) |
|---|---|---|---|---|---|
| Post-Cold War | 0.550** | 1.138*** | 0.534** | -0.829 | 1.718** |
| | (0.242) | (0.433) | (0.247) | (0.518) | (0.858) |
| Peace duration | -0.001* | 0.002** | -0.001* | 0.005*** | 0.022*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.005) |
| Ethnic-based political exclusion | 1.883*** | 1.544*** | 1.921*** | 2.666*** | 3.884 |
| | (0.401) | (0.587) | (0.435) | (0.715) | (2.441) |
| Religious fractionalization | -1.393** | | -1.500** | -1.741 | |
| | (0.631) | | (0.714) | (1.216) | |
| Ln population$_{t-1}$ | 0.447*** | -0.289 | 0.468*** | 0.412** | -3.794** |
| | (0.104) | (0.564) | (0.121) | (0.192) | (1.486) |
| Observations | 2071 | 1500 | 2071 | 2071 | 1350 |
| Pseudo R-squared | 0.0893 | | | 0.0966 | |
| Log likelihood | -351.137 | -276.116 | -350.471 | -130.097 | -64.894 |

Notes: All regressions include a constant (not reported). Standard errors in parentheses. ***, **, * indicate significance at the 1%, 5% and 10 % level, respectively.

Column one re-presents the baseline regression for ease of comparison. Column 2 introduces controls for country-specific fixed effects. Of course, countries which have not experienced an onset are excluded from this analysis - amounting to a loss of 15 countries (one-third of the countries in the sample) that did not experience a conflict onset over the period 1960-2010. Furthermore, religious fractionalization does not vary over time within countries and so is dropped from the fixed effects regression.

Still, for the 30 countries that did experience one or more onsets, the coefficients on the measure of ethnic-based political exclusion, the post-Cold War dummy and the number of months since previous conflict remain highly significant. The lag of population size changes sign and loses significance, this suggests that the effect of population size on

conflict onset in sub-Saharan Africa is coming from the cross-section comparison of countries of different size, rather than from population growth within a country. Column 3 controls for random effects and, unlike the fixed effects estimation technique, does not eliminate information from countries that have avoided armed conflicts all together. In terms of statistical significance and coefficient sign, the results remain unchanged when compared to the baseline regression.

Lastly, it remains to test whether these statistically significant predictors of conflict onset in sub-Saharan Africa (as established in the baseline regression) remain as such when the dependent variable considers only first-time wars.[25] The results are presented in column 4. The post-Cold War dummy is now insignificant and religious fractionalization loses its statistical significance. The positive coefficient on peace duration is only indicative of the fact that civil wars in sub-Saharan Africa have increased in number since the end of World War II.[26] Interestingly, the coefficient on ethnic-based political discrimination maintains its significance at the one percent level. However, when one controls for country fixed-effects in the case where the dependent variable is first-time war (column 5) as opposed to conflict onset, the indicator for ethnic based political discrimination completely loses its statistical significance. This did not occur when the dependent variable coded all conflict onsets as positive outcomes (column 2). This highlights an important finding, namely that the variables that this paper has found to explain conflict onsets is sub-Saharan Africa do not explain first-time wars, suggesting that these phenomenon should be studied separately.

## VII. Conclusion

As has been made evident, a significant amount of work has been conducted in the study of conflict onset since Collier and Hoeffler (2004) brought the greed-grievance debate to the fore. Indeed, finding that the model did not account for many specificities of sub-Saharan Africa, scholars interested in the study of conflict in the region have contributed greatly to this work, particularly by exploring other, more region-specific, correlates of conflict onset. However, despite the importance of these developments, and their movement away from the theoretical confines of the greed-grievance framework, these works still draw extensively on indicators of greed and grievance as presented by Collier and Hoeffler (2004).

As such, this paper sought to revisit the greed-grievance debate within the context of sub-Saharan Africa. To this end, Collier and Hoeffler's (2004) opportunity and grievance

[25] Countries that experienced a civil war prior to 1960 were not considered to have experienced a first-time war in if war re-occurred during the period 1960-2010.
[26] This is owing to the fact that, like Collier & Hoeffler (2004), the first country-year record for the variable peace duration records the number of months since the end of World War II.

models were tested empirically on a dataset of sub-Saharan African countries covering the period 1960-2010. Following their methodology, a combined model was arrived at and through stepwise elimination of insignificant variables a baseline regression was formed, which became the subject of various robustness tests.

Of the findings made, the most robust to different estimation techniques was the indicator of ethnic grievance – which marks a significant contrast to the insignificance of the commonly used ELF Index found in even the most recent studies of conflict onset in sub-Saharan Africa. Other strong correlates of conflict onset in the region were found to be the number of months since a previous war and low levels of religious fractionalization – the negative coefficient on the former, coupled with the reality that most conflict onsets in sub-Saharan Africa are re-starts of a previous war following one or more years of peace, suggests either that conflicts occur in sub-Saharan Africa because ethnic or religious-based hatreds between rebels and the group occupying State power fade slowly, or that the occurrence of a previous war is enough to incentivise greedy rebels – unwilling to pass up any profitable opportunity to rebel - to re-arm given the opportunity to exploit readily available war-technology that remains following a previous conflict. However, a robustness check which changed the dependent variable from all conflict onsets experienced within a country to only the first onset in a country's history, found that the significance of those variables explaining the 'aggregated' onset variable to vanish when controls were introduced for country fixed-effects. This suggests that scholars and policy-makers wishing to understand the role of greed and grievance in explaining first-time wars will need to study this phenomenon separately.

Overall, this paper has found more support for indicators of grievance than is usually accounted for in analyses of conflict onset in sub-Saharan Africa. This not only indicates the value of re-examining longstanding debates with new data, but also may serve to improve future quantitative studies of conflict onset in sub-Saharan Africa by highlighting which indictors of both greed and grievance cannot be excluded from any empirical analysis seeking to adequately explain conflict onset in the region. That said, the lack of support for indicators of greed commonly included in these analyses – particularly, GDP per capita and its growth rate - should not be taken as indicative of the fact that these variables are unimportant determinants of sub-Saharan Africa's civil wars, for two reasons. Firstly, these indicators of greed may offer greater explanatory power for explaining first-time wars, which the baseline regression arrived at in this paper failed to explain.

Furthermore, whilst it was noted that the link between conflict onset, GDP per capita and GDP growth does not appear to be robust across studies of conflict onset in the

region, the lack of support for these two indicators of opportunity may have stemmed from the imposition of only the most necessary controls - for endogeneity and the external effects of time - in order to adhere to the estimation technique adopted by Collier & Hoeffler (2004), whilst adopting an annual sample frame, which this paper argued to be more beneficial to the study of conflict onset as opposed to the five-year period format adopted by Collier & Hoeffler (2004). Future work could look to less strictly adhering to the pooled logit estimation technique adopted by Collier and Hoeffler (2004) and, instead, utilise the time-dimension associated with an annual sample frame by adopting dynamic panel data methods at the outset and exploring the implications of doing so for the robustness of the results obtained in this paper.

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## Appendix A

### Table A.1 Conflict Onsets in Sample

| Country | Start Date | War Onset | End of War Episode |
|---|---|---|---|
| Angola | 1975-11-11 | 1975-11-11 | 1995-12-31 |
| Angola | 1975-11-11 | 1998-05-02 | |
| Angola | 1991-05-18 | 1991-06-03 | 1991-12-31 |
| Angola | 1991-05-18 | 1994-12-31 | 1994-12-31 |
| Angola | 1991-05-18 | 1996-12-31 | 1998-12-31 |
| Angola | 1991-05-18 | 2002-12-31 | 2002-12-31 |
| Angola | 1991-05-18 | 2004-12-31 | 2004-12-31 |
| Angola | 1991-05-18 | 2007-12-31 | 2007-12-31 |
| Angola | 1991-05-18 | 2009-12-31 | 2009-12-31 |
| Burkina Faso | 1987-10-15 | 1987-10-15 | 1987-10-15 |
| Burundi | 1965-10-18 | 1965-10-19 | 1965-10-19 |
| Burundi | 1965-10-18 | 1991-11-27 | 1992-12-31 |
| Burundi | 1965-10-18 | 1994-10-18 | 2006-09-07 |
| Burundi | 1965-10-18 | 2008-03-01 | 2008-12-04 |
| Cameroon | 1960-01-31 | 1960-01-31 | 1961-12-31 |
| Cameroon | 1960-01-31 | 1984-04-06 | 1984-04-09 |
| Central African Republic | 2001-05-27 | 2001-06-01 | 2002-12-31 |
| Central African Republic | 2001-05-27 | 2009-12-07 | |
| Chad | 1966-07-31 | 1966-07-31 | |
| Chad | 1966-07-31 | 1976-02-28 | |
| Chad | 1966-07-31 | 1989-03-03 | 1994-12-31 |
| Chad | 1966-07-31 | 1997-10-30 | 2003-12-14 |
| Chad | 1966-07-31 | 2005-12-18 | 2010-04-28 |
| Comoros | 1989-11-27 | 1989-11-29 | 1989-11-29 |
| | 1997-09-03 | 1997-09-05 | 1997-12-13 |
| Congo | 1993-11-03 | 1993-11-11 | 1993-12-27 |
| Democratic Republic of Congo | 1960-07-31 | 1960-07-31 | 1962-12-28 |
| Democratic Republic of Congo | 1960-08-31 | 1960-08-31 | 1962-12-31 |
| Democratic Republic of Congo | 1964-01-18 | 1964-01-18 | 1965-12-31 |
| Democratic Republic of Congo | 1964-01-18 | 1967-07-05 | 1967-11-05 |

| | | | |
|---|---|---|---|
| Democratic Republic of Congo | 1964-01-18 | 1977-04-30 | 1978-06-15 |
| Democratic Republic of Congo | 1964-01-18 | 2006-11-28 | 2008-10-29 |
| Democratic Republic of Congo | 1998-07-02 | 2007-02-01 | 2008-12-31 |
| Côte d'Ivoire | 2002-09-19 | 2002-09-20 | 2004-12-31 |
| Djibouti | 1991-11-12 | 1991-11-13 | 1994-12-26 |
| Djibouti | 1991-11-12 | 1999-07-24 | 1999-12-31 |
| Ethiopia | 1960-12-17 | 1960-12-17 | 1960-12-17 |
| Ethiopia | 1960-12-17 | 1976-06-02 | 1991-05-28 |
| Ethiopia | 1961-09-30 | 1964-03-15 | 1991-05-28 |
| Ethiopia | 1964-01-11 | 1964-01-11 | 1964-12-31 |
| Ethiopia | 1964-01-11 | 1976-10-31 | |
| Ethiopia | 1964-01-11 | 1993-10-13 | 1994-12-31 |
| Ethiopia | 1964-01-11 | 1996-01-18 | 1996-12-31 |
| Ethiopia | 1964-01-11 | 1998-12-31 | |
| Ethiopia | 1974-08-31 | 1977-12-31 | 1978-12-31 |
| Ethiopia | 1974-08-31 | 1980-12-31 | 1981-12-31 |
| Ethiopia | 1974-08-31 | 1983-07-31 | |
| Ethiopia | 1974-08-31 | 1987-11-01 | 1992-12-31 |
| Ethiopia | 1974-08-31 | 1994-01-31 | 1995-12-31 |
| Ethiopia | 1974-08-31 | 1998-01-31 | |
| Ethiopia | 1975-06-30 | 1975-06-30 | 1976-12-31 |
| Ethiopia | 1975-06-30 | 1996-06-30 | 1996-12-31 |
| Ethiopia | 1977-12-31 | 1977-12-31 | |
| Ethiopia | 1982-12-31 | 1983-04-30 | 1983-12-31 |
| Ethiopia | 1991-10-10 | 1991-10-10 | 1991-10-10 |
| Guinea | 2000-09-01 | 2000-09-17 | 2001-12-31 |
| Ghana | 1966-02-24 | 1966-02-24 | 1966-02-24 |
| Ghana | 1966-02-24 | 1981-12-31 | 1981-12-31 |
| Ghana | 1966-02-24 | 1983-06-19 | 1983-06-19 |
| Kenya | 1982-08-01 | 1982-08-01 | 1982-08-21 |
| Liberia | 1980-04-12 | 1980-04-12 | 1980-04-14 |
| Liberia | 1980-04-12 | 1989-12-26 | 1990-09-10 |
| Liberia | 1980-04-12 | 2000-05-31 | 2003-08-18 |
| Madagascar | 1971-12-31 | 1971-12-31 | 1971-04-01 |

| | | | |
|---|---|---|---|
| Mali | 1990-06-28 | 1990-07-21 | 1990-12-31 |
| Mali | 1990-06-28 | 1994-10-04 | 1994-12-31 |
| Mali | 1990-06-28 | 2007-08-31 | 2009-01-22 |
| Mauritania | 1975-12-10 | 1975-12-19 | 1978-12-31 |
| Mozambique | 1977-12-31 | 1977-12-31 | 1992-10-04 |
| Niger | 1991-10-31 | 1991-12-31 | 1992-12-31 |
| Niger | 1991-10-31 | 1997-10-19 | 1997-11-29 |
| Niger | 1991-10-31 | 2007-04-30 | 2008-10-30 |
| Niger | 1994-01-19 | 1994-05-16 | 1994-10-09 |
| Niger | 1995-03-23 | 1995-07-10 | 1995-07-10 |
| Nigeria | 1966-01-15 | 1966-01-15 | 1966-07-29 |
| Nigeria | 1966-01-15 | 2009-07-26 | 2009-07-30 |
| Nigeria | 1967-07-06 | 1967-07-06 | 1970-01-12 |
| Nigeria | 2003-12-31 | 2004-09-23 | 2004-10-30 |
| Nigeria | 2004-06-04 | 2004-06-04 | 2004-09-29 |
| Rwanda | 1990-10-01 | 1990-10-03 | 1994-07-19 |
| Rwanda | 1990-10-01 | 1996-07-12 | 2002-12-31 |
| Senegal | 1988-12-31 | 1990-08-31 | 1990-12-31 |
| Senegal | 1988-12-31 | 1992-09-30 | 1993-07-08 |
| Senegal | 1988-12-31 | 1995-04-27 | 1995-12-31 |
| Senegal | 1988-12-31 | 1997-03-23 | 1998-12-31 |
| Senegal | 1988-12-31 | 2000-04-11 | 2001-12-31 |
| Senegal | 1988-12-31 | 2003-01-31 | 2003-12-31 |
| Sierra Leone | 1991-03-23 | 1991-04-01 | 2001-12-20 |
| Somalia | 1982-01-18 | 1982-12-31 | 1984-12-31 |
| Somalia | 1982-01-18 | 1986-03-03 | 1996-12-31 |
| Somalia | 1982-01-18 | 2001-05-12 | 2002-12-31 |
| South Africa | 1966-08-26 | 1966-12-31 | 1988-08-08 |
| South Africa | 1978-02-01 | 1981-08-07 | 1983-12-31 |
| South Africa | 1978-02-01 | 1985-06-26 | 1988-12-31 |
| Sudan | 1963-12-31 | 1963-12-31 | 1972-01-31 |
| Sudan | 1971-07-22 | 1971-07-22 | 1971-07-22 |
| Sudan | 1971-07-22 | 1976-07-02 | 1976-07-02 |
| Sudan | 1971-07-22 | 1983-05-17 | |
| Togo | 1986-09-23 | 1986-09-23 | 1986-09-24 |

| | | | |
|---|---|---|---|
| Uganda | 1971-01-25 | 1971-01-29 | 1972-09-20 |
| Uganda | 1971-01-25 | 1974-03-23 | 1974-03-23 |
| Uganda | 1971-01-25 | 1979-01-22 | 1992-12-31 |
| Uganda | 1971-01-25 | 1994-02-21 | |
| | | | |
| Zimbabwe | 1966-04-29 | 1967-09-05 | 1968-12-31 |
| Zimbabwe | 1966-04-29 | 1973-04-04 | 1979-12-21 |

Source: Constructed based on Themner & Wallenstein (2014).

Notes: Start Date gives the date of the first battle-related death, indicating when a given conflict came to fulfil all criteria required in the definition of an armed conflict, except for the number of deaths. War onset gives the date when a given episode of conflict activity reached 25 battle-related deaths and thus, came to fulfil all criteria in the definition of civil war employed in this paper, where an episode is defined as continuous conflict activity. By comparing Start Date with the date in the column labelled Conflict Onset, the reader is able to ascertain whether several conflict onsets form part of the same conflict episode. A new onset is coded whenever a conflict restarts after one or more year(s) of inactivity. The column labelled End of Conflict Episode, indicates the date that violence stopped and is determined by whether a conflict-year is followed by at least one year of conflict inactivity. In cases where only the year of a particular conflict is known- the date of occurrence is written as being the 31$^{st}$ of December of that year. This applies to start date, conflict onset and end of war episode.

## Appendix B

### Primary Commodity Exports/GDP

Prior to the 2000s, data on a country's primary commodity exports was only collected every five years (World Bank, 2014). Thus this paper makes use of the aforementioned country-year dataset developed by Fearon (2005), who provides an annualized version of Collier & Hoeffler's measure of primary commodity exports to GDP ratio by employing linear interpolation to fill in the missing 'between years' in each five-year episode (Fearon, 2005:505). However, Fearon's (2005) annualized data only cover the period 1960-1999. Fortunately, post-2000 the World Bank has published data on primary commodity exports and GDP for most countries annually (World Bank, 2014). As such, the ratio of primary commodity exports to GDP for these years was calculated and appended to Fearon's interpolated primary commodity exports to GDP ratio variable. This approach is justifiable given that the additional years added are based on the same original data source used by both Fearon (2005) and Collier and Hoeffler (2004).

### Diaspora funding

Ideally, one would be able to use data on remittance payments for each country-year in the sample. However, data on remittance payments, even from reputable sources such as the World Bank (2014), suffer severely from missing data problems. In order to circumvent missing data problems in the World Bank's remittances data, the average of all years with remittance data over the period 1960–2010 was taken and this average level of remittances (as a percent of GDP) was used for all country-years. Whilst the static nature of this variable over all years is unfortunate, given that one would expect the remittance payments to change on an annual basis, in theory, its coefficient will still provide an indication of whether or not countries with higher diasporas on average have been more likely to experience a conflict onset over the period 1960-2010.

### Male secondary school attainment

In order to obtain values for the 'between years' separating each five-year record of data on male secondary school attainment, a fixed average between the first year with data in each five year episode and the data at the beginning of the next five year period for each country was created. Dividing this growth rate by five gives the annual growth rate (g) in every five year period. Thus, the first period in a five year episode is multiplied by (1 x g) in order to obtain the secondary school completion rate for that next year, the same process is repeated until the next five year episode begins. [27]

[27] The World Bank's measure of male secondary enrolment rates is not systematically missing and there are significant jumps in data availability and missing-ness within countries that cannot actually be 'filled in' according to any logical method. Thus, Barro and Lee's (2010) data set was turned to as an alternative. Given the availability of this dataset as an alternative, it was not required to construct some

For example, Barro and Lee (2010), record that the percentage of males who had completed secondary school in 1960 was 1.77 % of the population aged 15 and over. In 1965, this was 2.08 percent. Thus, to 'fill-in' the missing years, the following calculation was made:

Growth rate over the entire period: $(2.08 - 1.77)/1.77 = 0.1751412429$

Dividing this by 5 to get an estimate of the annual growth rate, $g = 0.0350282824859$

Taking multiplying the first year by 1.77 by $(1+g) = 1.832$. This is the percentage of males that had completed secondary schooling in 1961.

To obtain information for this variable in 1962 the value of obtained for 1961, was multiplied by $(1 + g)$: $1.832 *(1 + 0.0350282824859) = 1.$ 894 % of males had completed secondary schooling (as a proportion of the population older than 15 years).

The same process was repeated until 1965, where Barro & Lee (2010) recorded that 2.08 % of males in Benin had completed secondary school. Upon reaching 1965, a new five-year growth rate was calculated, which was again divided by 5 (to obtain the annual growth rate, $g$) and the first year, this time 1965, was multiplied by $(1 + g)$ in order to obtain a value for 1966 etcetera. This was done for all countries in the sample using Excel.

### Ethnic-based Political Exclusion

Despite not having to modify this variable for inclusion in the dataset employed in this paper, it is important to understand the data sources and method used by Buhaug *et al.* (2014) in order to construct it so that the coefficient returned on this variable can be properly understood.

In order to construct this variable, Buhaug *et al.* (2014) use data from the Ethnic Power Relations dataset – a dataset which identifies the political status of politically-relevant ethnic groups for all countries from 1946 onwards (Cederman et al., 2009). The EPR data set classifies politically relevant ethnic groups into one of seven possible categories according to their extent of access to central statepower: monopoly, dominant, senior partner, junior partner, regional autonomy, powerless, and discriminated (Buhaug *et al.,* 2014). Focussing explicitly on political discrimination along ethnic lines, Buhaug *et al.* (2014) generate a variable bounded between 0 and 1 which takes into consideration the demographic size of the largest discriminated ethnic group relative to the joint size of the discriminated group and the group(s) in power (Buhaug *et al.,* 2014:424). The higher the

kind of average measure of educational attainment or each country over all year in the sample as was the case with the data on remittance payments for which no alternative measure could be found.

value of the variable – the more a country's regime is founded on political discrimination of sizable ethnic groups.

### Income inequality

Despite not having to modify this variable for inclusion in the dataset employed in this paper, it is important to understand the data sources and method used by Buhaug *et al.* (2014) in order to construct it, so that the coefficient returned on this variable can be properly understood. The measure of horizontal inequality devised by Buhaug *et al.* (2014) was generated through several steps. Firstly, Buhaug et al. (2014) calculated group-level data on wealth for all ethnic groups in each country by joining the G-Econ gridded data set on economic activity with the GeoEPR data set on ethnic group settlements (Buhaug et al., 2014:423). [28] Then, Buhaug et al. (2014) identified the wealthiest and most indigent group in each country, from which country-level inequality indicators that capture the relative gap between the mean national income and the income level for the poorest and richest group, respectively are constructed. This leaves them with two variables, which they name negative horizontal inequality (NHI) and positive horizontal inequality (PHI), where NHI = country-level GDP per capita/mean per capita income for poorest group and PHI = mean per capita income for richest group/country-level GDP per capita (Buhaug et al., 2014:423). Importantly, given that the G-Econ data represent the year 1990 and do not vary over time, the measures of economic inequality developed by Buhaug *et al.* (2014) do not vary over time.

[28] The G-Econ dataset estimates gross output at a 1-degree longitude by 1-degree latitude resolution at a global scale, placing explicit focus on measuring the *geographical* intensity of economic activity (Nordhaus, 2006:4). The GeoEPR dataset geo-codes all politically relevant ethnic groups assigning, every politically relevant group one of six settlement patterns (Cederman, Girardin, Weidermann, Wimmer & Wucherpfennig, 2011).

## Appendix C

Note: Table C.1 spans two pages

**Table C.1** Formulating the baseline

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary commodity exports/GDP | -1.423 | | | | | | | | | |
| | (2.751) | | | | | | | | | |
| Primary commodity exports/GDP$^2$ | 3.355 | | | | | | | | | |
| | (3.599) | | | | | | | | | |
| Post-Cold War | 0.418 | 0.706** | 0.663** | 0.663*** | 0.663*** | 0.647** | 0.616** | 0.603** | 0.512** | 0.550** |
| | (0.347) | (0.275) | (0.283) | (0.255) | (0.254) | (0.257) | (0.254) | (0.250) | (0.244) | (0.242) |
| Ln GDP per capita $_{t-1}$ | -0.164 | -0.069 | -0.148 | 0.001 | | | | | | |
| | (0.267) | (0.195) | (0.209) | (0.187) | | | | | | |
| GDP growth $_{t-1}$ | 1.441 | 1.289 | 1.797 | 1.314 | 1.315 | 1.314 | 1.344 | | | |
| | (1.527) | (1.395) | (1.405) | (1.376) | (1.372) | (1.379) | (1.381) | | | |
| Social fractionalization | 0.739 | 0.874 | | | | | | | | |
| | (1.065) | (0.777) | | | | | | | | |
| Peace duration | -0.002** | -0.001** | -0.001** | -0.001* | -0.001* | -0.001* | -0.001* | -0.001** | -0.001** | -0.001* |
| | (0.001) | (0.001) | (0.00) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Mountainous terrain | 0.004 | 0.006 | 0.008 | 0.006 | 0.006 | 0.005 | | | | |
| | (0.007) | (0.006) | (0.006) | (0.005) | (0.005) | (0.005) | | | | |
| Population density | -0.004 | -0.005** | -0.004** | -0.005** | -0.005** | -0.005* | -0.004* | -0.003 | | |
| | (0.003) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | | |
| Ethnic-based political exclusion | 2.181*** | 2.093*** | 2.137 | 2.095*** | 2.095*** | 2.102*** | 2.180*** | 1.985*** | 1.904*** | 1.883*** |
| | (0.606) | (0.462) | (0.474) | (0.429) | (0.429) | (0.429) | (0.416) | (0.407) | (0.401) | (0.401) |
| Religious fractionalization | -1.266 | -1.463* | -2.401* | -1.346** | -1.346** | -1.358** | -1.360** | -1.360** | -1.519** | -1.393** |
| | (0.943) | (0.761) | (1.254) | (0.655) | (0.654) | (0.651) | (0.648) | (0.636) | (0.636) | (0.631) |
| Democracy $_{t-1}$ | 0.023 | 0.007 | 0.014 | | | | | | | |
| | (0.029) | (0.023) | (0.023) | | | | | | | |
| Ln population $_{t-1}$ | 0.387** | 0.407*** | 0.354*** | 0.437*** | 0.437*** | 0.476*** | 0.496*** | 0.510*** | 0.495*** | 0.447*** |
| | (0.154) | (0.131) | (0.147) | (0.128) | (0.121) | (0.120) | (0.119) | (0.116) | (0.114) | (0.104) |
| Positive horizontal inequality | 0.276 | 0.229 | 0.274 | 0.224 | 0.224 | | | | | |
| | (0.330) | (0.196) | (0.197) | (0.194) | (0.187) | | | | | |
| Negative horizontal inequality | -0.111 | 0.591 | 0.527 | 0.625 | 0.624* | 0.552 | 0.603* | 0.433 | 0.315 | |
| | (0.565) | (0.412) | (0.424) | (0.402) | (0.348) | (0.337) | (0.332) | (0.314) | (0.304) | |
| Observations | 1464 | 1860 | 1875 | 1969 | 1969 | 1969 | 1969 | 2071 | 2071 | 2071 |
| Pseudo R-squared | 0.1188 | 0.1021 | 0.1017 | 0.1007 | 0.1007 | 0.0990 | 0.0978 | 0.0942 | 0.098 | 0.0893 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Log-likelihood | -242.431 | -318.199 | -308.977 | -336.928 | 336.927 | -337.575 | -338.007 | -349.253 | -350.575 | -351.137 |
| $\chi^2$ (df) | | 1.42 (2) | 1.31 (1) | 0.10 (1) | 1.30(1) | 0.10(1) | 0.86 (1) | 0.95 (1) | 2.64 (1) | 1.12 (1) |
| Prob > $\chi$2 | | 0.4912 | 0.2531 | 0.7562 | 0.2551 | 0.9955 | 0.3530 | 0.3298 | 0.1040 | 0.2892 |

Notes: All regressions include a constant (not reported). Standard errors in parentheses. ***, **, * indicate significance at the 1% 5% and 10 % level respectively. All likelihood ratio tests calculated based on the sample size of the regression preceding the omission.