

**Poverty, Inequality, and Conflict**

**Using Within-Country Variation to Evaluate Competing Hypotheses\***

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**Abstract**

Numerous studies have demonstrated a negative relationship between civil war and national level per capita income. However, the specific theories or mechanisms that have been offered as explanations for this relationship vary considerably, and many theoretical arguments offered – ranging from the role of state strength to opportunity costs for potential insurgents – are not necessarily consistent with one another. Moreover, poverty and inequality are rarely uniformly distributed within countries, and conflicts are often confined to atypical areas of a country that may not be adequately represented by national level averages or aggregates. We show that findings from existing studies at the country level are ambiguous and lack the ability to distinguish between different income distributions and rival interpretations. We consider propositions on the relationship between poverty, inequality, and conflict at the level of smaller geographical units entail different mechanisms and implications, and explore these hypotheses empirically using geographically disaggregated data on income and conflict.

## **Introduction: Why do poor countries see more civil wars?**

Civil war is by far the most common form of conflict in the contemporary global system, and the human and social impacts of civil war are substantial (Collier et al. 2003), especially as many civil wars are persistent and last several years, some even several decades. Despite intense scientific study of civil war over the latest years, we still lack good insights into why civil war occurs, or where and when we are most likely to see conflict onset. One of the strongest findings in the existing civil war literature is that poorer countries are more likely to experience civil war, as exemplified by e.g., Collier and Hoeffler (2004) and Fearon and Laitin (2003). However, there is no consensus on the underlying mechanisms producing this relationship. In this paper, we reevaluate the links between poverty, inequality and civil war. We argue that analyses of the link between GDP per capita and conflict at the country-level are more ambiguous than often assumed, and show that these cannot distinguish between a number of possible relationships between income, income distribution and conflict, each of which have very different implications for the risk of violent conflict. We then use geographically disaggregated data on GDP, population, and conflict to evaluate possible explanations.

## **Income, poverty, and conflict: The conventional wisdom and the need for disaggregation**

The emphasis in recent studies of civil war is often placed heavily on economic factors. Collier et al. (2003) argue that although the older civil war literature emphasized how grievances could motivate rebellions, greed or opportunities for mobilization appear much more important in accounting for which countries see civil war. More specifically, Collier et al. (2003) find little evidence that higher inter-individual income inequality, which they see as a possible measure of grievances, is associated with a greater risk of conflict in a state. By contrast, they find that a country's risk of civil war appears to be negatively related to a country's per capita income, which they see as bolstering their argument about the key role of opportunities in explaining resort to violence. Civil wars become less likely with higher income and a growing economy, since the opportunity costs for insurgents from participating in rebellion are high relative to what they can earn in regular economic activities. The risk of civil war is high when potential insurgents have little to lose from taking up arms, and rebellion can be sustained by crime or looting valuable national resources. Since grievances are ubiquitous, they are not by themselves closely associated with conflict, and efforts to understand conflict must focus on greed or opportunities to resort to conflict.

The negative relationship between GDP per capita income and conflict has been replicated in many country-level comparative studies. However, other studies such as Fearon and Laitin

(2003) have offered very different interpretations for the same empirical finding. In particular, Fearon and Laitin see GDP per capita as a measure of state strength. Wealthier states see less conflict because they are better able to deter rebellion or conduct efficient counterinsurgency.

A third interpretation that has received relatively little attention so far in research on civil war is that poverty in and of itself may motivate resort to violence (see, e.g., Rice, Graff, and Lewis 2006). Dissatisfaction with current material conditions may lead to increased support for efforts to replace an existing government or for efforts to seek secession in particular areas if a sufficient number of actors or groups believe that an area could do better by severing its ties to the larger state. Some explanations, which sometimes echo classical theories of relative deprivation (e.g. Gurr, 1970; Hechter 1975), are often dismissed *en block* with the argument that grievances are ubiquitous and hence do not allow accounting for why some grievances result in conflict while others do not. However, a link between poverty as grievance and conflict is equally consistent with the observed empirical relationship as the more commonly offered explanations. Moreover, the alternative interpretations are as vulnerable to the same critique, since not all low income societies actually see civil war, and GDP per capita at best is a crude proxy for the other postulated mechanisms.

We believe that studies relating conflict to country-level characteristics suffer from a general conceptual problem since they aggregate and average features that typically vary considerably within countries. Conflict is almost invariably a localized phenomenon that does not engulf entire countries, but normally takes place in particular regions in the periphery of a country that may be quite atypical and often very different from the rest of the country. By aggregating features up to country-level, cross-national studies risk a number of aggregation fallacies in making inferences about factors affecting the likelihood of conflict. Consider for example the conflict in Chechnya; Whereas fighting is mainly confined to the province of Chechnya and neighboring areas in the Caucasus, country comparative studies would treat all of Russia as “at war” and examine to what extent this can be explained by characteristics of the country at large or national averages. To cite an extreme example, Russia could be considered a supporting case for the Collier et al. claim about the role of natural resources as it since encompasses both civil war (in Chechnya) and diamonds (in Siberia), even though there is no physical overlap between the two.<sup>1</sup> Since the Chechens comprise a negligible part of the population of Russia, this area would have only negligible impact on national statistics. Hence, national level figures tell us little about the situation in province of Chechnya

<sup>1</sup> Lujala et al. (2005), Buhaug and Lujala (2005), and Ross (2004) discuss the role of possible aggregation problems in country-level analyses of conflict and natural resources, and localized data on natural resources have been developed to examine the link between resources and conflict (see Gilmore et al. 2005).

itself, where economic grievances may have combined with demands for national autonomy in the onset of the conflict. Although we lack reliable data on income for Chechnya prior to the conflict, existing research suggests very large geographical differences in income in the Soviet Union.

Similar problems arise in the study of inequality of conflict, where the predominant existing measures of income inequality, such as the Deininger and Squires (1996), data are based on individual (i.e. vertical) income differences and do not reflect spatial or group-based variations within countries. One strain of research has emphasized the role horizontal inequalities for conflict, or inequalities that coincide with ethnic or regional cleavages in society (see Stewart 2002; Østby 2008). Country level measures cannot distinguish between situations where large inequalities follow group lines and situations where income distributions are similar across groups. Similar problems arise with respect to geographic inequality, as there is no logical basis for assuming that the characteristics of conflict zones should be well approximated by national aggregates or averages.

To understand why groups may engage in rebellion, we need to consider local characteristics and relative differences within states. In this paper we advocate a geographically disaggregated approach to evaluate whether the factors believed to predispose towards violence are indeed present in the geographical locations where conflict occurs.

### **Disaggregating income, poverty, and conflict linkages: Theory**

Whether aggregation problems and lack of attention to agency plague existing analyses of GDP per capita and violent conflict are obviously dependent on the specific mechanisms linking low average income to conflict. As we have alluded to previously, there are a number of possible relationships that are compatible with the existing empirical findings at the national level, but which entail quite distinct mechanisms. Existing work generally has little to say about the specific economic patterns of the locations that are likely to experience conflict as well as which groups are most likely to rebel. In the following section, we develop plausible strategies for identifying possible linkages between income, poverty, inequality, and conflict at the local level.

For the time being we look only at geographic income differences, and not its relationship to ethnic groups or other social cleavages. We defer this task to a later paper, due to the uncertainty on how to best identify ethnic groups and cleavages, as well as the problem of getting group specific data, especially when groups are not clearly geographically separated. Ethnic inequality figures can be politically sensitive, and national governments are likely to suppress such information altogether or report biased data. In many countries, ethnic groups are regionally concentrated so that regional inequality may be a suitable proxy for ethnic inequality. In other cases, where ethnic groups are not geographically concentrated or there are large differences between ethnic groups in the same locale,

the use of regional inequalities as a proxy for inequality between ethnic groups can be misleading (Brown and Stewart 2006).<sup>2</sup>

We believe that spatial variation in income and wealth is interesting in its own right as an influence on violent conflict. For example, inequalities between coastal and hinterland regions can sharpen as new economic activities are spatially concentrated (Kanbur and Venables 2005). Moreover, the state may choose to favor regions which are dominated by its kin or supporters, and the distribution of state patronage, welfare and political influence can result in marked spatial differences. In this paper, we develop standardized spatially disaggregated measures identifying income (in absolute and relative terms) by geographic cells, based on data developed by Nordhaus (2005). We will describe these data in greater detail later in a separate data section.

A plausible case can be made for studying administrative or politically determined regions rather than purely geographically defined areas. However, using country regions as the unit of analysis is complicated by a number of factors. Region characteristics and their role in political life differ dramatically across countries, with many countries having no subdivisions while others having entities that see substantial autonomy. Moreover, data for regions are generally not collected by similar definitions or easily standardized, and hence difficult to compare between countries. Furthermore, regions may be delineated in ways that may be partially related to conflict and inequality. Whereas some countries try to create increasingly more autonomous regions, others seek to set boundaries so as to prevent any one group from being too dominant or generate cross cutting cleavages. Although the relationship between regional autonomy and conflict is interesting in its own right (see Reynolds 2002), we defer this task to future research and focus only on spatial variation.

In this paper we focus on a number of characteristics of spatial income distribution which we expect to influence the risk of civil conflict. A first possibility is that areas with lower levels of absolute development or income are more likely to experience violence, which we state as H1 below. We know that not all poor societies experience conflict, that levels of income inequality differ within countries, and that areas of low income may be located within countries of different level of average per capita income. This hypothesis is compatible with the notion that grievances may motivate conflict. It could also be seen as compatible with the Collier et al.'s (2001) argument for lower economic opportunities increasing the prospects for mobilization, since the

<sup>2</sup> In such instances, individual survey data which include information on both ethnic identity and socioeconomic indicators would be more suited for constructing measures of group-based inequalities, but such survey data only exist for a limited number of countries (see Østby, Nordås, and Rød 2009).

opportunity costs for participating in rebellion would be lower and the wage that would need to be paid would be much lower. Moreover, forced recruitment may be easier in poorer regions, if security infrastructure is particularly weak in such areas.

*H1: Poorer areas are more likely to experience armed civil conflict.*

A second possibility is that pockets of wealth within poor societies become targets of insurgencies. Collier et al. argue that violence is likely when potential rebels have little to lose from participating in regular economic life, but much to gain from rent-seeking activities in conflict such as crime and looting. de Soysa (2002) similarly discusses the so-called “honey pot” effect. However, no empirical study so far has explicitly considered subnational geographical variation. This in turn suggests the following observable hypothesis:

*H2: Pockets of wealth in poor countries are more likely to experience armed civil conflict.*

A third possibility is that regional income inequalities are more important for the risk of conflict than absolute income levels. General theories of relative deprivation argue that whereas absolute poverty may lead to apathy and inactivity, comparisons with those who do better may inspire radical action and even violent political mobilization, especially in cases of actual exploitation and discrimination (Gurr 1970). Even in situations where redressing grievances is not the basis of a conflict, regional inequalities can be exploited and exaggerated by group leaders and conflict entrepreneurs who strive to achieve their own political or economic goals (Stewart 2002).<sup>3</sup> As we have previously discussed, there is no reason why measures of inter-individual income inequality for the country at large should reflect the characteristics of conflict areas or the geographical distribution of income. Regional inequalities are often large in developing societies (Kanbur and Venables 2005). Since peripheral regions tend to be scarcely populated, they will often exert little influence on national level income statistics. Since most insurgencies take place in the periphery, and mobilization typically takes place in local networks, concentrated regional inequalities are likely to be more strongly related to violent conflict than general social inequalities, affecting many disconnected individuals.

<sup>3</sup> We use the term regional inequality to represent differences across space within countries. It is analytically distinct from horizontal inequality, which denotes differences between groups in a society.

Regional inequality and limited economic integration can exacerbate regional competition for the bounties of the state which may lead to armed conflict. Inter-regional inequality in per capita income can be destabilizing for two different reasons (Sambanis and Milanovic 2004). First, large inter-regional differences may fuel dissatisfaction and grievance among the poorer regions, particularly when regional divisions coincide with ethnic or religious divisions. This might provide incentives for violent mobilization. Second, inter-regional income differences are often associated with inter-regional transfers of revenue from richer to poorer regions. If richer regions view these transfers as too large, the donors may attempt to secede or push poorer regions to exit by insisting on a lower transfer rate. Case studies have shown that both rich and poor regions can mobilize against the state to challenge the geographical distribution of resources and socio-economic welfare (e.g. Humphreys and Mohamed 2005; Tadjoeeddin 2003). Both scenarios lead to the same expectation:

*H3: Areas with larger deviations in economic activity from the national average are associated with higher risks of armed civil conflict*

### **Disaggregating income, poverty, and conflict linkages: Research design**

We propose a geographically disaggregated research design to discriminate between the possible relationship between poverty, inequality, and conflict at a disaggregated, subnational level. These linkages have not been explored in existing country-level research, which by definition must rely on averages or aggregated measures over a country's territory, but can be assessed empirically using new geographically disaggregated data collections and innovative methodologies in geographically disaggregated analysis, combining information from different scales.

To test the hypotheses in an appropriate manner, we need a spatially disaggregated research design that captures subnational variation in conflict, economic activity, and other key variables. Several alternatives exist. One option would be to focus on first- or second-order administrative entities (states, provinces, districts, etc) within countries (see Østby, Nordås and Rød 2009). The main advantage of that procedure is that such units intuitively make sense. Administrative regions are by definition politically relevant, and they are often shaped to capture important underlying social and cultural structures in society. Subnational socioeconomic data also tend to be released at the province level. However, the function of subnational regions varies between countries, and their roles as well as their geographic extent and boundaries may shift over time. Indeed, new provinces sometimes emerge as a direct result of social conflict. Developing a structurally coherent time-series cross sectional dataset with a consistent set of units thus becomes a non-trivial challenge.

Alternatively, we might focus on spatially defined groups within society (see Buhaug, Cederman and Rød 2008). This solution is analytically appealing, since armed conflict by definition is a form of collective violence conducted by people, not regions. Yet, with the sole exception of ethnicity, we are aware of no dataset with spatial information on social groups. Limiting our sample to ethnic groups implies limiting the number of conflicts to those where the state and the opposition organization are ethnically distinct. This is problematic when looking at differences in income and wealth, in particular since many violent conflicts involve groups that do not have a clear ethnic basis or aims (e.g., Marxist insurgencies). Moreover, ethnic identity is a non-tangible characteristic that is subject to individual interpretation (and manipulation), and the geographic location of ethnic groups may also shift over time.

Instead, we opted for a third alternative, namely geographical grid cells (see Buhaug and Rød 2006). While such units are artificially constructed and bear no immediate political meaning, they can be applied without consideration of differences in political and demographic patterns across space and time. For this reason, the developed dataset is given as a global grid with a resolution of 0.5 decimal degrees, which corresponds to roughly  $50 \times 50$  km at the equator.<sup>4</sup> More than 62,000 unique observations are included in a single cross section, covering virtually all inhabited land mass of the Earth. The complete grid is stored in a geographic information system (GIS) format and consists of one shapefile per calendar year, 1946–2007. In this paper, we concentrate on the decade 1991–2000 as our data of prime interest, local economic development, represent the situation in 1990. Moreover, as the economic data lack a temporal dimension and therefore are unsuited to explain the timing of conflict outbreak, we decided to let the sample period be represented by a single grid. Cells in states that emerged after 1 January 1991 (e.g., Azerbaijan, Bosnia-Herzegovina, Eritrea, Slovakia) were assigned to the home country at the outset of observation (e.g., Soviet Union, Yugoslavia, Ethiopia, Czechoslovakia).<sup>5</sup>

We define the full population at risk of civil conflict as all populated grid cells in all member states according to the Gleditsch and Ward (1999) system definition. Only very small islands, which fail to be represented in the GIS country layer, are omitted. Defining the population as above, we have a total of 62,441 cells. Only XX of these experienced an armed conflict onset

<sup>4</sup> The grid is based on a pseudocylindrical projection (Eckert VI), which gives a less distorted two-dimensional representation of the world than e.g. an equal area projection, although it implies that cells along the equator cover a larger geographic area than cells near the poles.

<sup>5</sup> We only observe whether there was conflict onset or not in a cell in the years preceding the creation of a new state. We disregard conflicts breaking out in states appearing after 1990 not in our data.

during the investigation period 1991–2000 (see below). Such extreme rareness of events can pose problems for statistical estimation and lead to biased coefficients, typically underestimating the probability of an event occurring (King and Zeng 2001).<sup>6</sup> We use classic case-control sampling to address the potential problem of rare events bias. More specifically, we keep all the onset observations, and compare these to a random sample drawn from the observations with no onset. Five non-onsets are selected for every onset observation. Since the fraction of onsets to non-onsets in the total population is extremely small, there is no need for prior correction or weighting of the estimates (King and Zeng 2001: 1413).

Whereas most data on civil conflict contain little information on the characteristics of conflict beyond stating that country X experienced a civil war over some time interval, the UCDP/PRIO Armed Conflict Data – originally developed at the Department of Peace and Conflict Research at the University of Uppsala (see Harbom et al. 2007) – have recently been expanded by various researchers to include additional information on conflict, including the location where armed conflict takes place, provided as conflict polygons in a geo-referenced database (see Buhaug and Rød 2006). Geo-referenced data enable researchers to switch from using the country at large as the unit of analysis to analyze separate geographical grids, or cells, as the units of analysis. Analysts can then examine whether cells with certain characteristics (or cells in close proximity to particular patterns or characteristics) are more likely to experience the onset of violent conflict.

The dependent variable is outbreak of armed intrastate conflict, 1991–2000, based on Strand (2006) and in correspondence with the definition of the UCDP/PRIO Armed Conflict Dataset (Gleditsch et al. 2002). The early 1990s witnessed a surge in new armed conflicts; yet, the XX registered conflict onsets in this period constitute a minuscule portion of all units of observation in the data. The conflict data were imported into the grid using point coordinates representing the exact location of fighting on the first day of each conflict (such as capital city, village, military airfield, etc.).<sup>7</sup> Each conflict is assigned to the grid cell to which the point coordinates correspond only.<sup>8</sup> In order to control for ongoing conflict – which is important here, since cells that are already in conflict by definition are very unlikely to see a new conflict onset – we use polygon data on the geographic extent of conflict, derived from the PRIO Conflict Site dataset (see Buhaug and Gates

<sup>6</sup> Logit regression coefficients may also be biased due to rareness in limited samples, although to a less certain extent (King and Zeng 2001:153).

<sup>7</sup> Unpublished data by one of the authors.

<sup>8</sup> 12 onsets are dropped because it was not possible to assign a precise location within the country.

2002). All cells that fall within a conflict polygon in a given year are coded as having a conflict that year. As our world is captured through a single cross section, we then measured the total number of ongoing conflict years per cell for the sample period. Finally, we generated a cell-specific count of the number of years since the end of the previous armed conflict prior to 1991, to capture duration dependence in the data and possible endogenous relationships between conflict and some of the independent variables.

Our key explanatory variables are various measures of the local level of economic development. Unlike national statistics of economic output, disaggregated, geo-referenced economic data are still rare. Short of constructing instruments from more easily available data (see Miguel et al. 2004 for an example based on using rainfall as a measure of economic growth in societies reliant on rain fed agriculture), we are only aware of two sources of data with global coverage. The first is the Global Poverty Data from CIESIN, Columbia University, which contains two proxies for local poverty: malnutrition and infant mortality. These indicators are constructed from a variety of sources including household surveys and could in principle be ideal for the purpose of this paper. However, the data represent the year 2000, which severely restricts the possible temporal span of subsequent conflict, and thus gives very few observations of conflict onset. Using 2000 values with prior conflict is problematic, as some values could be the result of conflict.

Instead, we use the G-Econ dataset (Nordhaus 2005), which measures the amount of economic output per 1 degree grid cell with global coverage for the year 1990. The gross cell product (GCP) is the local equivalent of gross domestic product (GDP) and summarizing the GCPs by country cells gives the GDP. As one might expect, the reliability of the data in G-Econ varies considerably across space. We exclude observations that are coded as having “major inconsistencies” (quality<0), although we note that no armed conflict onsets were among these observations. The remaining data are still of varying quality. For European countries, the underlying economic data are highly disaggregated (up to the third-level administrative division), but for other countries the underlying data are given only at the first-level administrative entities. For 57 countries, only national-level economic data are available.<sup>9</sup> Including these observations will necessarily decrease the differences between (local) GCP per capita and (national) GDP per capita, and make it more difficult to detect any possible relationship between within-country inequality and conflict towards zero. The quality of the data clearly appears to be correlated with economic

<sup>9</sup> In some cases, lack of subnational variation may plausibly be explained by their small geographic size, but for most countries it seems more likely that the lack of variation simply reflects a lack of disaggregated data.

development, and all the states with zero within-country variation have a mean GDP per capita of less than half of the remaining sample. This may well lead to problems with selection bias or unbalanced samples. As such, we remove these countries from the sample. In future versions of the paper, we will consider matching as a possible way to ensure greater comparability between conflict and non-conflict cases.

In preparation for analysis, we disaggregated the G-Econ data into 0.5 degree resolution and further divided the cell-specific economic product on the population size in the cell to obtain GCP per capita estimates. As the G-Econ data focus on economic activity rather than household income or other aspects more directly linked to standards of living, they are not necessarily well suited to discriminate between aspects relating to opportunity, grievance, or counterinsurgency capability. Among other things, the GCP includes income generated from mining and mineral production in the cell, most of which may be distributed to other cells in the country. However, all these issues apply to national level GDP per capita as well, and we believe the G-Econ data represent the best available measure with large-N coverage to disaggregate below the level of nation state and examine the relationship between spatial variation in local economic development and conflict.

In order to test H1, a straight-forward measure of (log-transformed) Gross Cell Product is sufficient. H2 proposes a “honey pot” effect, in which relatively affluent areas in poor regions are more at risk. This is tested by measuring the positive deviation in GCP per capita between a cell and the average GCP capita score for proximate cells in the same country in interaction with a dummy for less developed countries, which is where this effect should be most pronounced. We test H3 by including a measure of the deviation between the local GCP per capita and the national GDP per capita.

We also consider a series of local control variables that may plausibly be associated with variation in local economic development and conflict. Population density is known to influence the risk of conflict and may be related to important influences on wealth such as urbanization. We generated cell-specific estimates of (logged) population size from CIESIN’s Global Rural – Urban Mapping Project (GRUMP) data, measured for 1990. Conflict is more common in the periphery, and areas further away from core areas of the country are also likely to be less developed. The relative location of the cell is captured by means of distance to the capital city and distance to the nearest neighboring country (log km), calculated in ArcINFO. Since large countries may be more likely to see conflict and country size could influence both development and spatial inequality, we also calculate the geographic size of the land area of each cell, as well as the share of that area covered by mountains (data from UNEP) and forests (data from FAO). We also add a control for the number of years at risk for each cell within the ten-year sample period, subtracting years of

ongoing conflict as well as years with deviating country identity (for new states). Finally we control for (logged) total country population and qualities of the political regime using the Scalar Index of Polities data (Gates et al. 2006).

**Empirical Analysis**

*Note: the results reported here are preliminary, from an earlier version of the data. Results presented at ISA will be based on updated data with higher spatial resolution, a larger sample of onsets, and with more control variables.*

Table 1 displays the means of the gross product per capita (GCP pc) and the gross national product per capita (GDP pc) for cells without onset and cells with onset, respectively for the full sample. As can be seen, both GCP per capita and GDP per capita is lower for the onset cells than the non-onset cells. More interestingly, we see that the onset cells have a somewhat lower cell product per capita than their respective country’s GDP per capita. Moreover, not surprisingly, we see a higher variance for GCP pc than for country level GDP per capita.

**Table 1. Mean GCP per capita and GDP per capita for onset and non-onset observations, full sample**

Variable	Non-onset observations		Onset observations	
	Mean	Std. Dev.	Mean	Std. Dev.
GCP pc	10512.71	15557.96	2920.241	3542.736
GDP pc	8686.785	7863.517	3476.111	530.8333
N	15320		38	

Table 2 lists the onset cells, ordered by GCP pc, along with the respective countries’ GDP per capita. As can be seen, most of the onsets take place in low income countries, with the exception for some conflict-prone middle income countries such as Iran, Iraq, and Russia, as well as conflicts in high income countries such as Israel and Spain. However, we see that almost all the conflict locations have a GCP pc value that is lower than the country’s GDP per capita. For example, although Russia may be a middle income country, the conflicts in the Caucasus take place in very poor regions with a per capita cell income a fraction of the country average. However, there are some examples of conflicts taking place in comparatively wealthy areas in very poor states, such

as the Cabinda exclave of Angola. Moreover, urban conflicts and initial attacks in cities generally correspond to above-average income locations.

**Table 2: List of onset locations, sorted by GPC pc**

<b>Country</b>	<b>Onset location</b>	<b>GPC pc</b>	<b>GDP pc</b>
Ethiopia	Oromiya region	476.49	530.83
Ethiopia	NA	491.03	530.83
Ethiopia	Ogaden (region)	495.09	530.83
Ethiopia	Afar region	495.12	530.83
Chad	Biltine	521.31	717.66
Yemen	Sanaa province	555.56	664.41
Niger	Agadez (region)	797.83	798.50
Indonesia	East Timor	860.88	2047.82
Angola	Bie	1013.86	1594.03
Russia	Chechnya	1022.02	7763.22
DR Congo	Sud-Kivu	1055.01	1351.48
India	Tripura (state)	1170.30	1537.82
Niger	Agadez (region)	1212.60	798.50
Niger	Air mountains	1212.60	798.50
India	Assam (state)	1305.72	1537.82
India	Manipur (state)	1324.20	1537.82
India	Nagaland	1387.69	1537.82
Burma	Arakan (Rakhine) state	1628.38	1774.48
Burma	Shan state	1704.13	1774.48
Burma	Kayin state	1734.40	1774.48
Burma	Karenni (Kayah) state	1746.92	1774.48
Pakistan	Sind	1855.13	1504.63
Russia	Dagestan	1947.00	7763.22
Indonesia	Aceh province	1999.22	2047.82
Philippines	Mindanao	2067.38	3419.98
Russia	Dagestan, Buinaksk district	2161.61	7763.22
Israel (West Bank/Gaza)	Jerusalem District	2597.33	11060.73
Mexico	Chiapas	2948.22	6965.38
Iran	Western Iran (near Iraq)	3310.00	4175.82
Mali	Gao	3733.91	5063.84
Iran	Iraqi Kurdistan	3951.36	4175.82
Iran	Iran-Iraq Kurdistan region	4062.83	4175.82
Iraq	Kurdistan (region of Iraq)	4581.72	6082.70
Angola	Cabinda	7425.60	1594.03
Russia	Moscow district	8006.28	7763.22
Iraq	Muhafazat al Basrah	9283.19	6082.70
Slovenia	Slovenia	10774.65	5930.98
Spain	Basque country	18052.59	14615.68

## Regression Analysis

We assess the hypotheses using logistic regression models. The first model in Table 2 includes only GDP per capita and the population control variables. As expected, GDP per capita is negatively associated with the risk of armed conflict. In Model 2.2 GCP per capita is added to the equation. Both the GCP per capita and the GDP per capita coefficients are negative, but they are not significant due to the high correlation between the variables ( $r = 0.82$ ). A likelihood ratio test (not reported in table) between the two first models also shows that adding GCP per capita to the model with GDP per capita does not increase the model's fit. In the third model we add a square term of GCP per capita. GCP per capita and its square term now become significant at the 5% and 10% level, respectively. A likelihood ratio test comparing Model 1 and Model 3 also shows that the two coefficients are jointly significant at the 10 % level.

**Table 2. Logit regressions of civil conflict onset on economic development and population**

VARIABLES	Model 1	Model 2	Model 3
ln GDP pc	-0.633*** (0.190)	-0.390 (0.332)	-0.145 (0.379)
ln GCP pc		-0.268 (0.303)	-1.049** (0.532)
ln GCP pc Squared			-0.348* (0.179)
ln Population (cell)	0.414*** (0.109)	0.403*** (0.111)	0.355*** (0.113)
ln Population (country)	-0.302** (0.118)	-0.272** (0.123)	-0.309** (0.125)
Constant	4.167* (2.509)	1.654 (3.801)	1.061 (3.927)
Observations	228	228	228
Pseudo R2	0.207	0.211	0.233
LR test Model 2.2 vs Model 2.3	chi2(2) = 5.27 p > chi2 = 0.072		

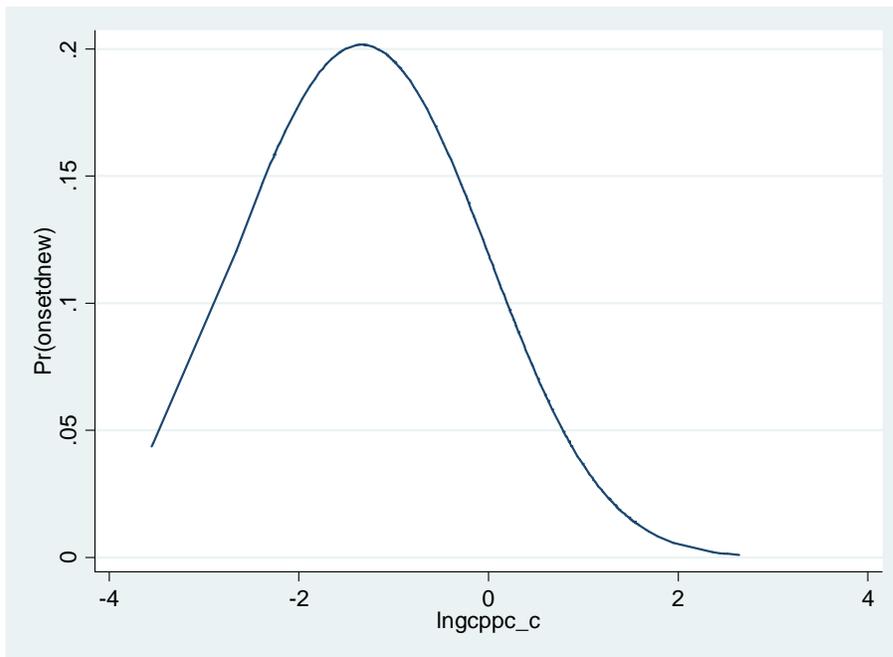
Standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Figure 1 shows a graph of the predicted probability of onset by the natural log of GCP per capita (centered at its mean), holding the other variables constant at their means. The relationship between GCP per capita and the risk of conflict displays an inverted U-shape, with the highest risk

of conflict found for cells with approximately 1300 \$ per capita (around the 20<sup>th</sup> percentile). It must be noted, however, that there are very few observations at the far left end of the horizontal axis. Only 3 observations have less than -2.5 ln GCP per capita (390\$ per capita). In sum, we find a notable difference in the risk of conflict between cells with low per capita income and cells with high per capita income. The difference in risk is only statistically significant for large changes in GCP per capita, though. Moving from a GCP per capita at the 10<sup>th</sup> percentile to a GCP per capita at the 95<sup>th</sup> percentile reduces the chance of onset by ca. 2 %, and is significant at the 5 % level.<sup>10</sup>

**Figure 1. Graph of predicted probability of onset by ln GCP per capita (centered)**



## Conclusion

These (very preliminary) results suggest that differences in economic development is strongly associated with where we see conflict onset, and that the spatial distribution of income within countries provide additional information beyond country level averages. We find evidence that conflict onsets are more likely within poorer areas of a state, although the limited spatial variation

<sup>10</sup> Estimated by simulation using Clarify (King et al. 2000)

we record for many countries can make it difficult to distinguish this from differences between countries.

## References

- Bapat, Navin A. 2005. Insurgency and the Opening of Peace Processes. *Journal of Peace Research* 42 (6):699–717.
- Brown, Graham, and Frances Stewart. 2006. The Implications of Horizontal Inequality for Aid, CRISE Working Paper Number 36, University of Oxford, <http://www.crise.ox.ac.uk/pubs/workingpaper36.pdf>.
- Buhaug, H and S. Gates, 2002. The Geography of Civil War, *Journal of Peace Research* 39 (4): 417-433.
- Buhaug, Halvard, and Päivi Lujala. 2005. Accounting for Scale: Measuring Geography in Quantitative Studies of Civil War. *Political Geography* 24 (4):399–418.
- Buhaug, Halvard, and Jan Ketil Rød. 2006. Local Determinants of African Civil Wars, 1970-2001. *Political Geography* 25 (3):315-335.
- Buhaug, Halvard; Lars-Erik Cederman and Jan Ketil Rød, 2008. Disaggregating Ethno-Nationalist Civil Wars: A Dyadic Test of Exclusion Theory, *International Organization* 62(3): 531–551.
- Collier, Paul, and Anke Hoeffler. 2004. Greed and Grievance in Civil War. *Oxford Economic Papers* 56 (4):563–595.
- Collier, Paul, Lani Elliott, Håvard Hegre, Anke Hoeffler, Marta Reynal-Querol, and Nicholas Sambanis. 2003. *Breaking the Conflict Trap: Civil War and Development Policy*. Oxford University Press and Washington, DC: World Bank, online at <http://econ.worldbank.org/prr/CivilWarPRR/>.
- Deininger, Klaus, and Lynn Squire. 1996. A New Data Set: Measuring Income Inequality, *World Bank Economic Review* 10 (3):565–591.
- de Soysa, Indra. 2002. Paradise is a Bazaar? Greed, Creed, and Governance in Civil War, 1989–99. *Journal of Peace Research* 39 (4):395–416.

- Fearon, James D., and David D. Laitin. 2003. Ethnicity, Insurgency, and Civil War. *American Political Science Review* 97 (1):75-90.
- Gilmore, Elisabeth, and Nils Petter Gleditsch, Päivi Lujala, and Jan Ketil Rød. 2005. Conflict Diamonds: A New Dataset. *Conflict Management and Peace Science* 22 (3):257–292.
- Gleditsch, Kristian S., and Michael D. Ward. 1999. Interstate System Membership: A Revised List of the Independent States since 1816. *International Interactions* 25: 393-413
- Gleditsch, N. P. et al., 2002. Armed conflict 1946-2001: A new dataset. *Journal of Peace Research* 39(5): 615-637.
- Gates, Scott, Håvard Hegre, Mark Jones and Håvard Strand. 2006. Institutional Inconsistency and Political Instability: Polity Duration, 1800–2000. *American Journal of Political Science* 50(4): 893–908
- Gurr, Ted Robert. 1970. *Why Men Rebel*. Princeton, NJ: Princeton University Press
- Harbom, Lotta, and Peter Wallensteen. 2007. Armed Conflict 1989-2006. *Journal of Peace Research* 44 (5):623-634.
- Hechter, Michael. 1975. *Internal Colonialism: The Celtic Fringe in British National Development, 1536-1966*. Berkeley, CA: University of California Press.
- Hegre, Håvard, and Clionadh Raleigh. 2005. Population Size, Concentration, and Civil War: A Geographically Disaggregated Analysis: Typescript, Centre for the Study of Civil War, <http://folk.uio.no/hahegre/Papers/populationsizewarKonstanz.pdf>.
- King, Gary, Michael Tomz, and Jason Wittenberg, 2000. Making the Most of Statistical Analyses: Improving Interpretation and Presentation." *American Journal of Political Science* 44 (2): 347-61.
- Lujala, Päivi, Nils Petter Gleditsch, and Elisabeth Gilmore. 2005. A Diamonds Curse: Civil War and a Lootable Resource. *Journal of Conflict Resolution* 49 (4):583-562.

- Miguel, E. S. Satyanath, E. Sergenti (2004). Economic Shocks and Civil Conflict: An Instrumental Variables Approach. *Journal of Political Economy* 112 (4): 725-753.
- Nordhaus, William D. 2005. Geography and Macroeconomics: New Data and New Findings: Typescript, Department of Economics, Yale University.
- Nordhaus, William, Qazi Azam, David Corderi, Kyle Hood, Nadejda Makarova Victor, Mukhtar Mohammed, Alexandra Miltner, and Jyldyz Weiss (2006). The G-Econ database on gridded output: methods and data. Yale University, May 12, 2006. URL: [gecon.yale.edu](http://gecon.yale.edu)
- Østby, Gudrun. 2008. Polarization, Horizontal Inequalities and Violent Civil Conflict. *Journal of Peace Research* 45 (2):143–162.
- Østby, Gudrun, Ragnhild Nordås, and Jan Ketil Rød. 2009. Regional Inequalities and Civil Conflict in Sub-Saharan Africa. *International Studies Quarterly* 53(2): XXX-XXX (forthcoming).
- Rice, Susan E., Corinne Graff, and Janet Lewis. 2006. Poverty and Civil War: What Policymakers Need to Know: Brookings Institution, Global Economic Development, Working Paper #02.
- Ross, Michael. 2004. What Do We Know About Natural Resources and Civil War? *Journal of Peace Research* 41 (2):337-56.
- Sambanis, Nicholas, and Branko Milanovic. 2004. Explaining the Demand for Sovereignty, Typescript, Yale University and World Bank, [www.yale.edu/macmillan/globalization/Sambanis-Milanovic\\_May2004.pdf](http://www.yale.edu/macmillan/globalization/Sambanis-Milanovic_May2004.pdf).
- Strand, Håvard. 2006. Onset of Armed Conflict: A New List for the period 1946–2004, with Applications. Under journal review.
- Reynolds, Andrew Reynolds, ed. 2002. *The Architecture of Democracy: Constitutional Design, Conflict Management, and Democracy*. Oxford: Oxford University Press.
- Stewart, Frances. 2002. Horizontal Inequalities: A Neglected Dimension of Development, Queen Elizabeth House Working Paper Series 81, University of Oxford, <http://www.qeh.ox.ac.uk/pdf/qehwp/qehwps81.pdf>.

Tadjoeddin, Mohammad Zulfan 2003. *Aspiration to Inequality: Regional Disparity and Centre-Regional Conflicts in Indonesia*, paper presented to the UNI/WIDER Project Conference on *Spatial Inequality in Asia*, Tokyo, 28-29 March.