

## CHAPTER 8

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# INEQUALITY, POLARIZATION, AND CONFLICT

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JOSE G. MONTALVO  
AND  
MARTA REYNAL-QUEROL

### 1. INTRODUCTION

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THE empirical study of conflict has recently generated an increasing interest among social scientists and, in particular, economists. Many factors have been proposed as likely causes of civil wars. This set of variables frequently includes measures of economic inequality and, more recently, polarization. This chapter aims at reviewing the theory and evidence on the effect of inequality and polarization, in different versions, on the likelihood of social conflicts, civil wars, and periods of extreme violence. The original empirical research adopted a macroeconomic perspective (cross-country), although recent research has taken a microeconomic approach (within countries). Most of the literature is quite recent and thus this will be a very fruitful line of research in years to come.

The dynamics of conflict should be understood as a process, ignited by a shock and propagated by many alternative mechanisms. For instance, one of the shocks could be an abrupt change in the price of the primary commodity, a natural disaster, the assassination of a political leader, etc. The taxonomy of potential propagation mechanisms includes economic inequality, social differences, ethnic polarization, and bad institutions, among others. In all cases the propagation mechanisms are crucial to understand which countries are resilient to conflicts in the presence of

shocks. Poverty, bad institutions, ethnic differences, and abundance of natural resources, among others, could be important propagation mechanisms. Inequality and polarization should be understood as particular propagation mechanisms that could be present together with other propagating elements.

This chapter is organized as follows. First, we discuss some conceptual issues in the measurement of inequality and polarization. Section 2 explains the theoretical relationship among different measures of inequality and polarization. It also considers the empirical implementation of measures based on a dichotomous (belong/do not belong) criterion. Section 3 analyzes the empirical measure of inequality, polarization, and other measures of social heterogeneity, and discusses the effect of using alternative databases and classifications of ethnic/religious groups on the measurement of inequality and polarization. Section 3 also presents a novel comparison of the effects on the level of fractionalization and polarization of using alternative datasets to calculate these indices. Section 4 summarizes the relevant research on the empirics of inequality, polarization, and the likelihood of conflicts. The final section presents conclusions and ideas for future research.

## 2. CONCEPTUAL ISSUES ON THE MEASUREMENT OF INEQUALITY AND POLARIZATION

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The measurement of inequality has a long tradition in economics. The topic is immense, therefore we are going to restrict ourselves to concepts and measures of inequality that have been used in connection with conflict or civil wars. First, and even though in recent times some have proposed to measure new concepts of inequality, like inequality of opportunities (Roemer 1998), we are going to work with the usual concept (inequality of outcomes). The equality of opportunities has been operationalized (see, for instance, World Bank 2006), but until now it has not been used to explain the likelihood of conflicts. Second, there are many possible measures of inequality: quantile based (for instance, income of the highest 5% over income of the lowest 25%), the standard deviation of income, the Gini index, the Atkinson index, the Theil index, etc. Since we want to relate the concept of inequality with the measure of polarization, and we need the flexibility to accommodate dichotomous categories, this chapter relies heavily on the use of the Gini index. Finally, there are other measure that do not belong, strictly speaking, to the category of inequality measures or to any class of polarization indicators that have been used in the analysis of the causes of conflict. However, these variables reflect diversity in a specific dimension. For instance, in the case of discrete categories, the size of the dominant groups has been used as a predictor of the probability of conflict. Strictly speaking, this indicator is not an index of inequality or polarization, but measures a dimension of diversity, or dominance. In this chapter we consider some

of those adhoc measures, although the emphasis is on measures of inequality and polarization.

The basic distinction used in this section is the difference between euclidean-based-measures of inequality (polarization) and discrete distance measures. The first class of measures (based on the euclidean distance) is used mostly in the context of continuous variables like income or wealth. The second class of indicators (based on discrete distances) is used to calculate inequality and polarization in dimensions that are discrete, like being part of an ethnic or religious group. In this case we do not try to measure the difference in income between two individuals, but instead if they belong or not to the same ethnic/religious/cultural group. For this reason we have a discrete measure of distance (belong or do not belong to a particular group).

## 2.1 The Euclidean distance case

Although we commonly use the word “income,” these measures apply to any social dimension that can be ordered along the real line, for example, income, ideology, wealth, etc. Most of the time we use income inequality as a canonical example.

### 2.1.1 Income inequality

One of the most popular measures of inequality is the Gini index,  $G$ , that has the general form

$$G = \sum_{i=1}^N \sum_{j=1}^N \pi_i \pi_j |y_i - y_j|,$$

where  $y_i$  represents the income level of groups  $i$  and  $\pi_i$  is its proportion with respect to the total population. This formulation is specially suited to measure income and wealth inequality. As we argued before, there are many other measures of inequality, but the Gini index is the most popular and it is also quite common as an explanatory variable in empirical studies of the causes of conflict. The formulation of the Gini index is closely related with the index of polarization.

### 2.1.2 Income polarization

The concept of polarization is more elusive. One of the reasons is that it was not formally characterized until recently, while the indices of inequality have a long tradition in economics. The measurement of polarization in a one-dimensional setup was initiated by Wolfson (1994) and Esteban and Ray (1994). But what do they mean by polarization? Esteban and Ray (1994) provide a particular conceptualization of polarization, emphasizing the difference between inequality and income polarization. A population of individuals may be grouped according to some vector of characteristics into “clusters” such that each cluster is similar in terms of the attributes of its members, but different clusters have members with “dissimilar” attributes. Such a society is polarized even though the measurement of inequality

could be low. The following example gives an intuition on the meaning of polarization: suppose that initially the population is uniformly distributed over the deciles of income. Suppose that we collapse the distribution in two groups of equal size in deciles 3 and 8. Polarization has increased since the “middle class” has disappeared, and group identity is stronger in the second situation. Inequality, measured by the Gini index or by any other inequality measure, has decreased.

By using three axioms, Esteban and Ray (1994) narrow down the class of allowable polarization measures (in a one-dimensional setup) to only one measure,  $P$ , with the following form:

$$P = k \sum_{i=1}^N \sum_{j=1}^N \pi_i^{1+\alpha} \pi_j |y_i - y_j| \quad (1)$$

[for some constants  $k > 0$  and  $\alpha \in (0, \alpha^*]$ , where  $\alpha^* \simeq 1.6$ . When  $\alpha = 0$  and  $k = 1$ , this income polarization measure is precisely the Gini coefficient. The fact that the share of each group is raised to the  $1 + \alpha$  power, which exceeds one, is what makes the income polarization measure different from inequality measures. The parameter  $\alpha$  can be viewed as the degree of “polarization sensitivity.” The dependence of the measure with respect to  $\alpha$ , the number of groups, and the discretization of income groups generates many alternative empirical indices for the same distribution of income. Esteban, Gardín, and Ray (2007) show an application of the index of polarization to income distributions.

Duclos, Esteban, and Ray (2004) developed a measurement theory of polarization for the case of income distributions that can be described using density functions. The main theorem uniquely characterizes a class of polarization measures that fits into what they call the “identity-alienation” framework, and simultaneously satisfies a set of axioms. Second, they provide sample estimators of population polarization indices that can be used to compare polarization across time or entities. Distribution-free statistical inference results are also used in order to ensure that the ordering of polarization across entities is not simply due to sampling noise. An illustration of the use of these tools using data from 21 countries shows that polarization and inequality ordering can often differ in practice.

## 2.2 The discrete distance case

Both the income polarization (a particularly important case of one-dimensional polarization) and the Gini index assume that distances among groups are measured along the real line. Going from the real line to a discrete metric has important implications. In a context where distances are naturally discrete (belong/do not belong to a particular group) the groups cannot be ordered on the real line, as in the case of income.

Would it be possible to measure “distance” across, for instance, ethnic groups? In principle it would be possible, but in contrast to the case of income, it will be quite

a subjective exercise. In addition, the dynamics of the “we” versus “you” distinction is more powerful than the antagonism generated by the “distance” between them.

In addition, any classification of ethnic groups requires a criterion to transform the differences of the characteristics of ethnic groups into a discrete decision rule (for instance, same family–different family). For example, following the classification of the *World Christian Encyclopedia*, the ethnic subgroups of the Luba, the Mongo, and the Nguni belong to the Bantu ethnolinguistic group. The Akan, the Edo, and the Ewe belong to the Kwa ethnolinguistic group. This implies that the “cultural distance” (defined informally by the encyclopedia) between the subgroups of the Bantu group is smaller than the difference between one of the subgroups of the Bantu family and one of the Kwa family. In terms of a discrete metric, by using the family classification as the basis for the difference across groups means that the subgroups of the Bantu family are inside the ball of radius  $r$  that defines the discrete metric while the subgroups in the family Kwa are outside that ball. Therefore any classification of ethnic groups involves implicitly a concept and a measure of “distance” that is discretized. For this reason we may want to consider only if an individual belongs or does not belong to an ethnic group.

Moreover, in the case of ethnic diversity, the identity of the groups is less controversial than the “distance” between different ethnic groups, which is much more difficult to measure than income or wealth. Then, it is reasonable to treat the “distance” across groups,  $\delta(.,.)$ , as generated by a discrete metric (1–0). There are two measures, analogous to the Gini index and the index of polarization, that are suitable for the discrete world: one of them is the index of fractionalization, and the other is the discrete polarization index. In section 2.3 we will show how these measures in the discrete world can be compared with the measures in the euclidean world.

### 2.2.1 The index of fractionalization

The index of fractionalization is the discrete version of the Gini index.<sup>1</sup> One particular indicator of this kind is the index of ethnolinguistic fractionalization (ELF), which has been used extensively as an indicator of ethnic heterogeneity.<sup>2</sup> In general, any index of fractionalization can be written as

$$FRAC = 1 - \sum_{i=1}^N \pi_i^2 = \sum_{i=1}^N \pi_i(1 - \pi_i), \quad (2)$$

where  $\pi_i$  is the proportion of people that belong to the ethnic (religious) group  $i$  and  $N$  is the number of groups. The index of ethnic fractionalization has a simple interpretation, as the probability that two randomly selected individuals from a given country will not belong to the same ethnic group.<sup>3</sup>

### 2.2.2 The index of discrete polarization

We can derive also an index of polarization based on a discrete metric. The issue of how to construct such an index, which is appropriate to measure polarization,

is the basic point discussed in Montalvo and Reynal-Querol (2005c, 2008). Let us imagine that there are two countries, A and B, with three ethnic groups each. In country A the distribution of the groups is (0.49, 0.49, 0.02), while in the second country, B, the distribution is (0.33, 0.33, 0.34). Which country will have a higher probability of social conflicts? Using the index of fractionalization, the answer is B. However, Montalvo and Reynal-Querol (2005c, 2008) have argued that the answer is A. In this case we find two large groups of equal size, and therefore we are close to a situation where a large majority meets a large minority (in this case both have the same size). A formal approach to capture this kind of situations is the index of ethnic polarization RQ, originally constructed by Reynal-Querol (2002). The proposed index of ethnic heterogeneity, RQ, aims to capture polarization instead of fractionalization using a discrete metric:

$$RQ = 1 - \sum_{i=1}^N \left( \frac{1/2 - \pi_i}{1/2} \right)^2 \pi_i. \quad (3)$$

The original purpose of this index was to capture how far is the distribution of the ethnic groups from the (1/2, 0, 0, ..., 0, 1/2) distribution (bipolar), which represents the highest level of polarization.

The RQ index considers, implicitly, that the distances are zero (an individual belongs to the group) or one (it does not belong to the group), like the fractionalization index.

### 2.3 Comparing measures

In the previous subsections we presented a discussion of alternative measures of inequality and polarization in two cases: the case of continuous variables and the discrete (or discretized) variables case. The difference between these two types of measures is related to the possibility of ordering the variable of interest along the real line. For instance, if we deal with income we can order individuals along the real line by their income. But when we are dealing with ethnicity, the distance across groups is discrete (described by the criterion belong/do not belong to a particular ethnic group). In this section we compare the measures according to their main purpose (measuring inequality or polarization) and not, as in the previous section, according to the continuous/discrete nature of the variables of interest. Montalvo and Reynal-Querol (2002, 2005c) show that the index of fractionalization can be interpreted as a Gini index with a discrete distance. Moreover, they also show that the measure of ethnic polarization, RQ, can be interpreted as the index of polarization of Esteban and Ray (1994) with discrete distances, by analogy to the relationship between the Gini index and the index of fractionalization. The rest of the section clarifies these relationships.

### 2.3.1 Income inequality versus ethnic fractionalization

The index of fractionalization has, at least, two theoretical justifications based on completely different contexts. In industrial organization, the literature on the relationship between market structure and profitability has used the Herfindahl–Hirschman index to measure the level of market power in oligopolistic markets. The second theoretical foundation for the index of fractionalization comes from the theory of inequality measurement. One of the most popular measures of inequality is the Gini index,  $G$ , that has the general form

$$G = \sum_{i=1}^N \sum_{j=1}^N \pi_i \pi_j |y_i - y_j|,$$

where  $y_i$  represents the income level of groups  $i$  and  $\pi_i$  is its proportion with respect to the total population. If we substitute the euclidean income distance  $\delta(y_i, y_j) = |y_i - y_j|$ , by a discrete metric (belong/do not belong)

$$\begin{aligned} \delta(y_i, y_j) &= 0 && \text{if } i = j \\ &= 1 && \text{if } i \neq j. \end{aligned}$$

Then the discrete Gini ( $DG$ ) index can be written as

$$DG = \sum_{i=1}^N \sum_{j \neq i}^N \pi_i \pi_j.$$

It is easy to show that the  $DG$  index calculated using a discrete metric is simply the index of fractionalization:

$$DG = \sum_{i=1}^N \sum_{j \neq i}^N \pi_i \pi_j = \sum_{i=1}^N \pi_i \sum_{j \neq i}^N \pi_j = \sum_{i=1}^N \pi_i (1 - \pi_i) = (1 - \sum_{i=1}^N \pi_i^2) = \text{FRAC}.$$

### 2.3.2 Income polarization versus discrete polarization

We can perform a similar exercise to the one described in the previous section using the index of polarization. If we substitute the euclidean metric  $\delta(y_i, y_j) = |y_i - y_j|$ , by a discrete metric

$$\begin{aligned} \delta(y_i, y_j) &= 0 && \text{if } i = j \\ &= 1 && \text{if } i \neq j. \end{aligned} \tag{4}$$

The class of indices of discrete polarization,  $DP$ , can be described as

$$DP(\alpha, k) = k \sum_{i=1}^N \sum_{j \neq i} \pi_i^{1+\alpha} \pi_j, \quad (5)$$

which depends on the values of the parameters  $\alpha$  and  $k$ .

Embedding a discrete metric into Esteban and Ray's (1994) polarization measure  $P$  alters the original formulation of the index as a polarization measure. It is known that the discrete metric and the euclidean metric are not equivalent in  $R$ . For this reason the apparently minor change of the metric implies that the discrete polarization measure does not satisfy the properties of polarization<sup>4</sup> for all the range of possible  $\alpha$  values. Therefore, for each possible  $\alpha$  we have a different shape for the  $DP$  index. Montalvo and Reynal-Querol (2008) show that the only family of  $DP$  measures that satisfies the polarization properties is the one with  $\alpha = 1, DP(1, k)$ . If we fix  $\alpha = 1$ , and choose  $k = 4$  (which means the range of the index  $DP(1, k)$  lies between 0 and 1), then we obtain the RQ index:<sup>5</sup>

$$\begin{aligned} DP(1, 4) &= 4 \sum_{i=1}^N \sum_{j \neq i} \pi_i^2 \pi_j = 4 \sum_{i=1}^n \pi_i^2 [1 - \pi_i] = \sum_{i=1}^n \pi_i [1 - (1 + 4\pi_i^2 - 4\pi_i)] \quad (6) \\ &= \sum_{i=1}^n \pi_i - 4 \sum_{i=1}^n (0.5 - \pi_i)^2 \pi_i = 1 - \sum_{i=1}^N \left( \frac{0.5 - \pi_i}{0.5} \right)^2 \pi_i = RQ. \end{aligned}$$

## 2.4 Other measures of ethnic heterogeneity

There are other indices that can measure different dimensions of ethnicity. For instance, Collier and Hoeffler (1998) introduce the index of dominance as a dummy variable that takes value 1 if the size of the largest group is between 45% and 60%.<sup>6</sup> Other authors have used the size of the largest ethnic group as a single index of ethnicity. But many alternative indices are variations of the index of fractionalization. Fearon (2003) constructs an index of cultural fractionalization that uses the structural distance between languages as a proxy for the cultural distance between groups in a country. Cederman and Girardin (2007) propose a star-like configuration of ethnic groups that rejects the symmetric interaction topology implied by the index of fractionalization. Using two assumptions, namely that the state plays a central role in conflict and that conflict happens among groups and not among individuals, Cederman and Girardin (2007) construct the  $N^*$  index, which is a star-like configuration centered around the ethnic group in power. Bossert, D'Ambrosio and La Ferrara (2011) should be characterize an index that is informationally richer than the commonly used ELF index. Their measure of fractionalization takes as a primitive the individuals, as opposed to ethnic groups, and uses information on the similarity among them. Compared to existing indices, their measure does not require that individuals be preassigned to exogenously determined categories or



groups.<sup>7</sup> Desmet, Ortuño-Ortin, and Wacziarg (2009) propose a new method to measure ethnolinguistic diversity and offer new results linking such diversity with a range of political economy outcomes—civil conflict, redistribution, economic growth, and the provision of public goods. They use linguistic trees, describing the genealogical relationship between the entire set of 6,912 world languages, to compute measures of fractionalization and polarization at different levels of linguistic aggregation. By doing so, they let the data inform them on which linguistic cleavages are most relevant, rather than making ad hoc choices of linguistic classifications. They find drastically different effects of linguistic diversity at different levels of aggregation: deep cleavages, originating thousands of years ago, lead to measures of diversity that are better predictors of civil conflict and redistribution than those that account for more recent and superficial divisions. The opposite pattern holds when it comes to the impact of linguistic diversity on growth and public goods provision, where finer distinctions between languages matter.

The data described in the previous section can allow the calculation of fractionalization and polarization at the country level. Recent studies propose to consider the spatial distribution of ethnic groups when calculating indices of ethnic diversity. Alesina, Easterly, and Matuszeski (2011) compute measures of “artificiality” of states based on how straight borders split ethnic groups into two different adjacent countries. They are able to show that this measure is correlated with their economic and political success. Matuszeski and Schneider (2006) construct a new index of ethnic diversity and clustering (EDC) that measures the clustering or dispersion of ethnic groups within a country using digital maps over 7,000 linguistic groups and 190 countries. They argue that to focus on ethnic diversity at the country level misses the fact that the geographical overlap between different ethnic groups is the likely source of conflict. Imagine that country 1 has two groups of equal size, but one of them is in the east of the country and the other in the west without having any geographic overlap. Country 2 also has two groups of equal size, but they share the same geographic area. The pattern of distribution of groups within the geographical area of those two countries is very different, which may have important consequences for political stability, redistributive policies, public expenditure, etc. Even though this new regional approach is very interesting, in this section we compare only the traditional datasets on differences across countries without considering the within-country pattern of distribution of ethnic groups.

### 3. THE EMPIRICAL IMPLEMENTATION OF MEASURES OF ETHNIC FRACTIONALIZATION AND POLARIZATION

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In the previous section we discussed conceptual issues related with the measurement of inequality and polarization. In this section we consider the empirical questions

that arise when we try to implement a measure of fractionalization or polarization based on discrete classifications.<sup>8</sup> We argued before that the measure of income polarization, for instance, is complicated by the fact that you have to establish a priori the intervals of income that define each group. In principle, when groups are defined *ex ante*, without any need to discretize, there should be no problem. Therefore the calculation of discrete polarization or fractionalization does not suffer from this inconvenience. However, the *ex ante* nature of groups (ethnic, religious, cultural, etc.) does not isolate the discrete measures completely from problems derived from classifications. For instance, if we want to measure language fractionalization, what is the appropriate level of language aggregation to be used for the calculation of indices of fractionalization or discrete polarization? There are a few linguistic families, but there are thousands of languages and dialects. Are they different ethnic groups if they speak the same language but different dialects? Should people that belong to the same racial subfamily be considered as separate ethnic groups or the same?

The issue of alternative classifications depending on the level of aggregation can be solved by using several levels of aggregation (see Desmet, Ortuño-Ortín, and Wacziarg (2009)). Other dimensions of ethnicity are difficult to classify or complicated to implement in empirical terms. For instance, in Latin America there are three basic ethnic groups: white, mestizo, and indigenous. However, the line separating white and mestizo, or mestizo and indigenous, is vague.<sup>9</sup> Fearon (2003) proposes coding ethnic groups using surveys (when available) to determine the degree of social consensus about the definition of a particular ethnic group (including self-identity)<sup>10</sup>. This approach would potentially generate a different list of ethnic groups for countries otherwise identical in the structure of their ethnic groups. This is an interesting proposal, which is also in Caselli and Coleman (2006). Posner (2004) proposes an index of fractionalization of politically relevant ethnic groups. But if the resulting groups are used to construct indices to be used in a regression, then there is an important drawback: the classification of groups will be endogenous to the intensity of conflict between groups. An appropriate measure of ethnic diversity or ethnic polarization should measure potential conflict and not actual conflict or animosity across groups. Therefore the level of aggregation/disaggregation of ethnic groups should not mix families, subfamilies, peoples, etc., as a function of their actual level of conflict, but should stick to a particular level of aggregation. Otherwise it would be like trying to explain the causes of conflict using conflict as an explanatory variable.

There is also the issue of salience of ethnic characteristics. For instance, when a country has many ethnic groups, several religions, and several languages, which dimension should be considered in order to construct the relevant indices? The delineation of ethnic groups is complex because ethnicity is basically a multidimensional concept. Ethnicity covers, at least, language, race, color, and religion. These different dimensions do not have to overlap perfectly, which implies that we can have as many ethnic classifications as convex combinations of the characteristics that we can construct. Some classifications may be based only on linguistic

differences, others on race, etc., and some classifications may mix linguistic and race differences, or linguistic and color, etc., Montalvo and Reynal-Querol (2002) mix different dimensions of ethnicity in an indicator that calculates the maximum level of fractionalization (polarization) in any dimension (race, language, or religion). Therefore they argue the salient dimension is the one with the maximum level of fractionalization (polarization). Caselli and Coleman (2006) consider that any characteristic (like color) that is easy to perceive by other individuals and difficult to change should be more important than mutable or difficult to assess characteristics.

### 3.1 Data sources and classification criteria

Having presented the caveats of empirical implementation, we now move to the data available to measure heterogeneity. Many authors have recently turned to the construction of datasets on a state's ethnic groups to test the empirical predictions of alternative hypotheses. The purpose of this section is to clarify and compare the similarities and differences between alternative datasets on ethnolinguistic diversity. Additionally, we present a comparative analysis of the most popular indices of diversity or aggregators of the ethnolinguistic groups into a single index. The final objective of this section is to answer several questions: Are these alternative classifications very different from each other? Does it matter for the construction of a single index if one uses one particular classification or another?

Researchers have used several sources of data on ethnic diversity. The most popular are the Atlas Nadorov Mira (ANM), the CIA World Factbook, the British Encyclopedia, the Minorities at Risk Project, and the World Christian Encyclopedia. Using combinations of these datasets and specific classification criteria, different authors have constructed datasets on ethnic groups and ethnic diversity across countries.

The ANM is the oldest and most popular source of information on ethnolinguistic groups across countries. It was constructed by Soviet scientists and published in 1964. It uses mainly the linguistic dimension to classify groups, although occasionally it also uses race or national origin to distinguish ethnic groups. The ANM has been the main source of data on ethnic diversity for many years. In fact, the fractionalization index constructed by Taylor and Hudson (1972) using these data was the standard measure of ethnic diversity for a long period of time (also called the ELF). The traditional index of ethnolinguistic fragmentation (see, for instance, Easterly and Levine 1997) uses the ANM dataset.

Recently several researchers have constructed datasets on ethnic diversity, alternative or complementary, to the ANM. Fearon (2003) uses a combination of sources: the basic is the CIA's *World Factbook*, which is compared with the *Encyclopedia Britannica* and, if possible, with the Library of Congress County Study and the Minorities at Risk data set. The basic criterion to define an ethnic group was to reflect the actual degree of social consensus on the identity of ethnic groups of a

particular country. It includes political relevance as a criterion for the classification. The *World Factbook* includes only large groups and it is unclear about the criteria for classification in many countries. For information on noncitizens not provided in the *World Factbook*, Fearon (2003) uses census figures for Organisation for Economic Co-operation and Development (OECD) countries and other sources for the Persian Gulf states. The case of Africa is also special. The *World Factbook* provides a classification that is not consistent across countries and it is incomplete even within a country. For 48 countries of Africa, Fearon (2003) uses the list of Scarritt and Mozaffar (1999), based on “contemporary and past political relevance,” and Morrison, Mitchell, and Paden (1989) when the sum of the percentage of the groups in Scarritt and Mozaffar (1999) was less than 95%.

Alesina et al. (2003) classify the different dimensions of ethnicity in specific lists of groups for each country. The basic objective was to collect data at the most disaggregated level. They use the *Encyclopedia Britannica* as the primary source of their linguistic classification for 124 countries. The CIA’s *World Factbook* was used for 25 cases, Levinson (1998) was the basis for 23 cases, and Minorities at Risk was used to calculate the classification in 13 countries. Alesina et al. (2003) used national censuses for France, Israel, the United States, and New Zealand. The rule of selection of sources was precisely specified: if two or more sources were identical, then they consider the classification in the *Encyclopedia Britannica*. Where there were differences, Alesina et al. (2003) used the source that covered the greatest share of the population. If several sources covered 100% of the population but had different shares for the groups, then they used the most disaggregated data.

Montalvo and Reynal-Querol (2005a,c) use as a basic source the *World Christian Encyclopedia* (WCE), which is one of the most detailed sources of data on ethnic diversity. The WCE presents a classification that is neither purely racial nor linguistic nor cultural, but ethnolinguistic. In that respect it is close to the basic criterion of the ANM. The WCE classification is based on the various extant schemes of nearness of languages plus nearness of racial, ethnic, cultural, and cultural-area characteristics. It combines race, language, and culture in a single classification, denominated ethnolinguistic, that includes several progressively more detailed levels: 5 major races, 7 colors, 13 geographical races and 4 subraces, 71 ethnolinguistic families, 432 major peoples (subfamilies or ethnic cultural areas), 7,010 distinct languages, 8,990 subpeoples, and 17,000 dialects. It is difficult to be consistent in the classification of ethnic groups on a global scale because in different countries their respective censuses have different emphases on each dimension of ethnicity. The main criterion adopted by the WCE in ambiguous situations is the answer of each person to the question: “What is the first, or main, or primary ethnic or ethnolinguistic term by which persons identify themselves, or are identified by people around them?”

The WCE details for each country the most diverse classification level. In some countries the most diverse classification may coincide with races while in others it may be subpeoples. Vanhanen (1999) argues that it is important to take into account

only the most important ethnic divisions and not all the possible ethnic differences or groups. He uses an informal measure of genetic distance to separate different degrees of ethnic cleavage. The proxy for genetic distance is “the period of time that two or more compared groups have been separated from each other, in the sense that intergroup marriage has been very rare. The longer the period of endogamous separation the more groups have had time to differentiate.”

### 3.2 The measurement of fractionalization and polarization: Results from different datasets

We have seen that there are several datasets that can be used to calculate fractionalization and discrete polarization. In this subsection we discuss the effect on the indices of using each of these datasets. We consider the ANM, the combination of sources in Montalvo and Reynal-Querol (2005a,c) (MRQ), the combination of sources in Fearon (2003) (FEA), and the classification in Alesina et al. (2003) (ADEKW). We also distinguish between the largest available sample of countries and the standard sample. The largest sample includes all the countries covered by the dataset, or combination of sources, used by each researcher. The standard sample determines the countries that are included effectively in the regressions that researchers use to assess the statistical effect of social fractionalization (polarization) on the likelihood of civil conflicts. This means that the samples are additionally restricted by the availability of the explanatory variables. One of the most restrictive explanatory variables is gross domestic product (GDP) measured in homogeneous terms across countries. For this reason we take as the reference regression sample the set of countries included in the Barro–Lee sample. We defined the standard sample as the one that represents the minimum common denominator of countries in the four datasets conditional on being present in the Barro–Lee sample.

Table 8.1 shows the basic characteristics of the distribution of ethnic groups by countries in each dataset for the largest sample and the standard sample. The sample of MRQ is the largest, including 190 countries, followed closely by the sample of ADEKW. The smallest sample is the old ANM (147 countries). The average number of ethnic groups by country is included in the third column. The highest average is associated with the data of MRQ, although, as we can see in the standard sample, the average for the ANM dataset is almost double. The data of FEA have the smallest average number of ethnic groups. It is interesting to notice that the average number of groups is similar in both samples (largest available and standard) for the MRQ dataset, but it is very different in the case of FEA and ADEKW. Corresponding to these averages, the maximum number of groups is the highest (44) in the ANM dataset and lowest in the ADEKW dataset (20). Figures 8.1–8.7 depict the detailed distribution of ethnic groups in each dataset in the full sample (Figures 8.1–8.4) and the standard sample (Figures 8.5–8.7).

**Table 8.1** Basic statistics by data source and type of sample

	Number countries	Average number groups	Minimum	Maximum	Median
<b>Largest sample</b>					
ANM	147				
MRQ	190	9.711	2	44	8
ADEKW	186	7.086	1	20	5
FEA	160	5.143	0	22	4
<b>Standard sample</b>					
ANM	130	20.557	2	94	12
MRQ	137	10.41	2	44	8
ADEKW	137	5.594	1	20	5
FEA	119	7.492	0	22	5

ANM: Atlas Nadorov Mira; MRQ: Montalvo and Reynal-Querol (2005); ADEKW: Alesina, Devleeschauwer, Easterly, Kurlat and Wacziarg (2003). FEA: Fearon (2003)

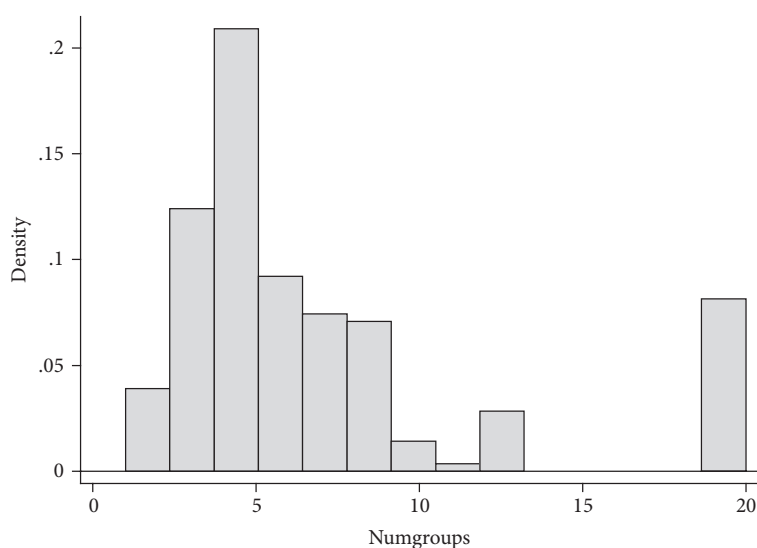
**Figure 8.1** Histogram of ethnic groups by country in Alesina et al. (2003). Full sample.

Table 8.2 describes the main characteristics of fractionalization and polarization calculated from the four datasets.<sup>11</sup> The highest level of average polarization is observed in the FEA dataset (0.58), while the lowest average is associated with the ANM dataset (0.45). The difference is substantial (more than 25%). This is also the case for the index of fractionalization: the FEA data show the highest level (0.50), while the ANM is the lowest (0.40). ADEKW and MRQ present intermediate values (0.44).

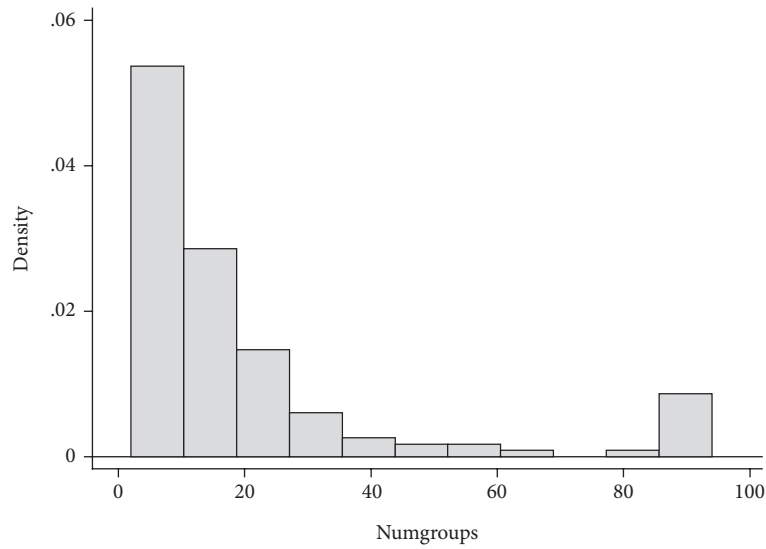


Figure 8.2 Histogram of ethnic groups by country in Atlas Nadorov Mira. Full sample.

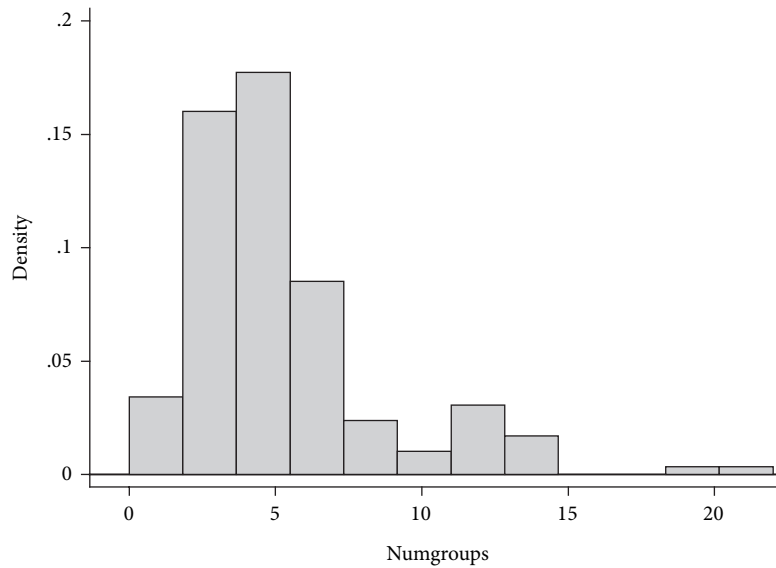


Figure 8.3 Histogram of ethnic groups by country in Fearon (2003). Full sample.

How are fractionalization and polarization related in each of these datasets? Table 8.3 contains the correlation between the measures of fractionalization and polarization in each data source for both samples. The highest correlation in the largest sample happens in the ADEKW dataset (0.73) and the lowest in the MRQ (0.6). This result could be expected from the average number of groups by country of each of the datasets. However, if we restrict the sample to the standard one, the highest correlation is observed in the ANM data, which also have the largest average

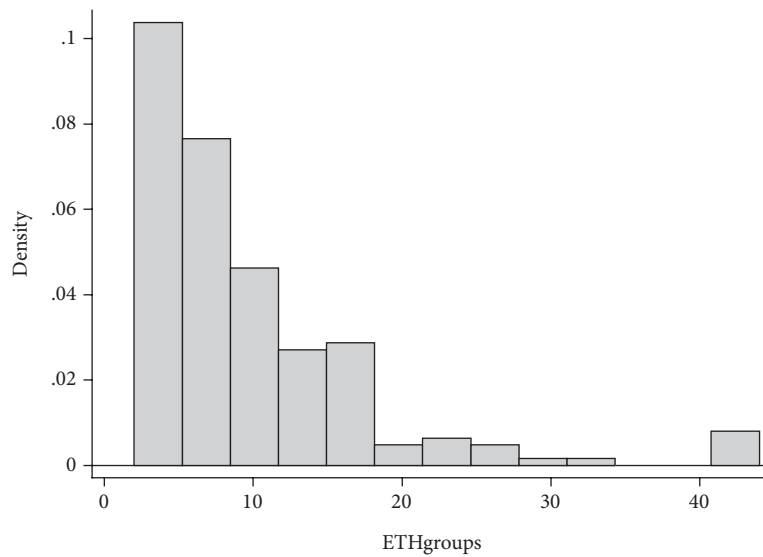


Figure 8.4 Histogram of ethnic groups by country in Montalvo and Reynal-Querol (2005a,b). Full sample.

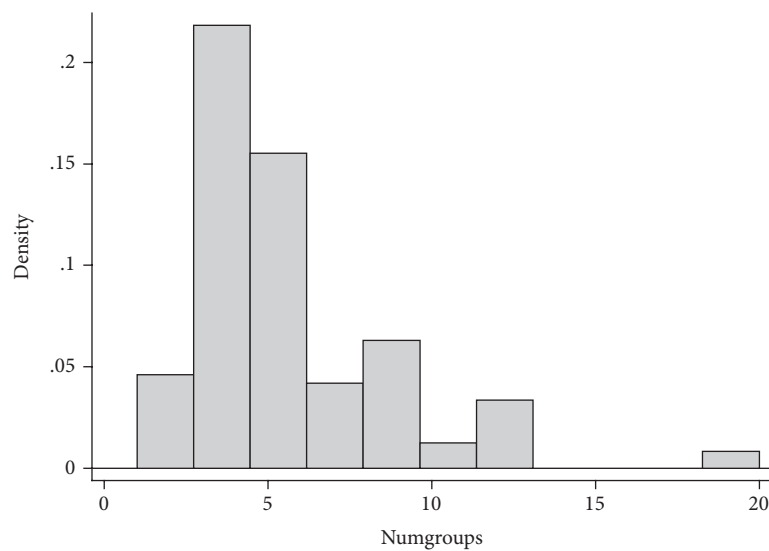


Figure 8.5 Histogram of ethnic groups by country in Alesina et al. (2003). Standard sample.

number of ethnic groups by country. The data of MRQ show a correlation in the standard sample (0.61) that is quite similar to the correlation calculated for the largest available sample. The data in FEA show a very large difference between the correlation between fractionalization and polarization in the standard sample and the correlation in the largest sample.



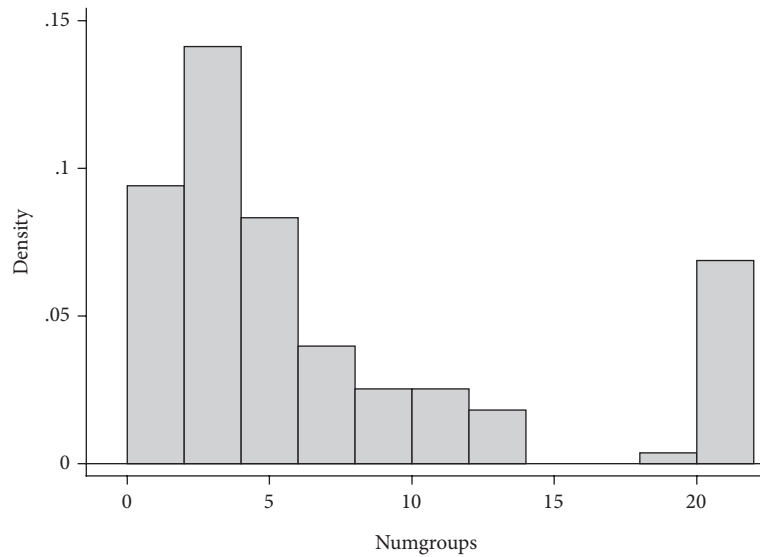


Figure 8.6 Histogram of ethnic groups by country in Fearon (2003). Standard sample.

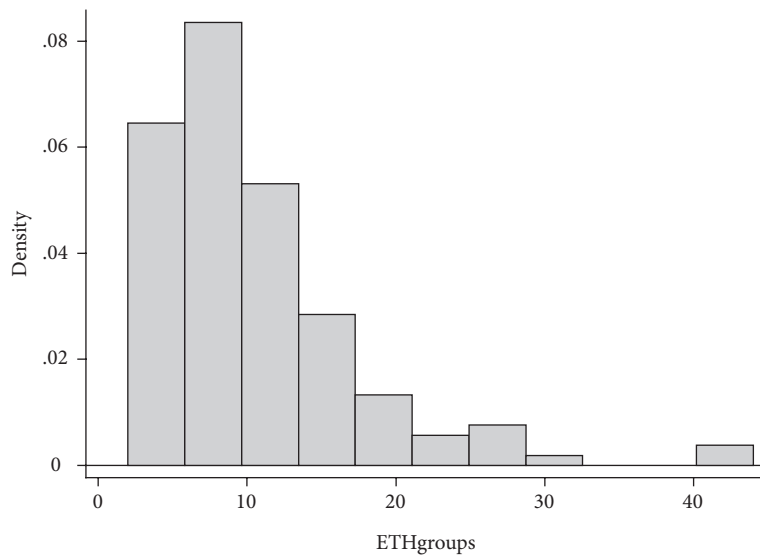


Figure 8.7 Histogram of ethnic groups by country in Montalvo and Reynal-Querol (2005a,b). Standard sample.

Finally, we analyze the relationship between the calculation of fractionalization and polarization among the four basic datasets. Table 8.4 contains the regressions of fractionalization on one dataset against the same concept in another dataset. In column 1 we see that the coefficient of the regression of the fractionalization index in MRQ on the index in FEA is 0.79 and very significantly different from zero. This is the case in all the exercises, which implies that the different measures are highly

**Table 8.2** Descriptive statistics of polarization and fractionalization by source Standard sample

	Average of the index	min	Max
<b>Polarization</b>			
FEA	0.5788	0	0.9856
ADEKW	0.5355	0	0.9676
ANM	0.4545	0.008	0.964
MRQ	0.5157	0.016	0.982
<b>Fractionalization</b>			
FEA	0.500	0.004	1
ADEKW	0.4407	0	0.9302
ANM	0.4046	0.004	0.9250
MRQ	0.4418	0.009	0.958

**Table 8.3** Correlation between fractionalization and polarization by source

Source\sample	Largest sample	Standard sample
FEA	0.6457	0.5381
ADEKW	0.7314	0.7093
ANM		0.7477
MRQ	0.5987	0.6127

**Table 8.4** Regressions for fractionalization. Standard sample.

	MRQ	MRQ	MRQ	FEA	FEA	ADEKW
FEA	0.79 (13.67)					
ADEKW		0.83 (16.60)		0.89 (20.90)		
ANM			0.82 (18.62)		0.70 (12.68)	0.70 (13.31)
Constant	0.07 (2.26)	0.08 (3.14)	0.12 (5.50)	0.08 (3.34)	0.20 (6.90)	0.16 (6.01)
N	118	136	129	118	116	129
R-squared	0.6171	0.6728	0.7319	0.7901	0.5853	0.5825

related despite the fact of using different datasets in their construction. In general we can say that there are two groups: the measures of fractionalization of MRQ and ANM are highly correlated. The measures of ADEKW and FEA have a lower level of correlation with MRQ and ANM, which are quite correlated. However, in the case of the indices of polarization, the relationship is different, since all the measures but the ANM are closely related. As before, the highest correlation is calculated between FEA and ADEKW.

#### 4. THE EMPIRICS OF INEQUALITY, POLARIZATION, AND CONFLICT

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This section describes the empirical literature on the relationship between inequality, ethnicity, and conflict. Sen (1973), among others, claims that there is a very close relationship between inequality and conflict. However, this connection has been very elusive to empirical researchers.<sup>12</sup> Collier and Hoeffler (1998) provide one of the first empirical analyses of the relationship between inequality and conflict. They find that income inequality is statistically insignificant in the explanation of the onset of a civil war. Collier and Hoeffler (1998) also find that ELF is not statistically significant for the probability of civil war, but it is weakly significant in the case of the duration of a civil war. Nevertheless, even in this case the effect is nonlinear, since the authors find that the square of the index of fractionalization is also statistically significant. Collier and Hoeffler (2004) confirm the empirical irrelevance of income inequality (measured as the Gini index or the ratio of the top-to-bottom quintiles of income using the data of Deininger and Squire [1996]). Fearon and Laitin (2003) also find that inequality (measure as a Gini index) is not statistically significant.

Cramer (2003) discussed why the literature has paid little attention to inequality, in light of the fact that it could be an important determinant of conflict. The first problem he identified was that the empirical foundations of this relationship were weak, and second, that there were “common problems in the way in which we define and analyze inequality as well as shortcomings in our ability to measure it.” There are two type of problems in the measurement of diversity. First, there is the issue of the quality of cross-country data. Second, there is the question on the appropriate index to measure diversity. We discuss these issues in the following two subsections.

##### 4.1 The quality of data and the measurement of inequality

The studies referred to in the previous paragraph use cross-country data. The failure of income inequality as an explanatory variable of conflict may be related with

the irregular, scarce, and low quality of the data on income distribution at the country level. However, research on the relationship between conflict and ethnic diversity has recently provided more detailed data. Sambanis (2005) describes some case studies in which inequality seems to be an important factor in the explanation of civil wars. Barron, Kaiser, and Pradhan (2004) studied village-level conflict in Indonesia and found that poverty has very little correlation with conflict, but changes in economic conditions and the level of unemployment are important. They also found that there were “positive associations between local conflict and unemployment, inequality, natural disasters, change in source of incomes, and clustering of ethnic groups within villages.” Murshed, Mansoob, and Gates (2005) conclude that spatial horizontal inequality, or inequality among groups geographically concentrated, was an important explanatory variable for the intensity of conflict in Nepal (measured by the number of deaths) using district-wide data. Similar results on the effect of increasing inequality in Nepal can be found in Macours (2008).

## 4.2 Fractionalization versus polarization

There is a long list of research papers that have found the ELF to be important in the explanation of economic phenomena. Easterly and Levine (1997), using the ELF index, were the first to showing evidence of a negative correlation between ethnic diversity and economic growth. Later, Alesina et al. (2003) provided evidence of the negative impact of ethnic fractionalization on institutions and growth using an updated dataset on ethnic fractionalization. At the macro level (using cross-country data), economists have shown evidence of a negative correlation between ethnic diversity and economic growth (Montalvo and Reynal-Querol 2005a), social capital (Collier and Gunning 2000), literacy and school attainment (Alesina et al. 2003), and the quality of government (La Porta et al. 1999) or the size of government social expenditure and transfers relative to GDP (Alesina, Glaeser, and Sacerdote 2001). At the micro level, there are many results that link high degrees of ethnic diversity to economic phenomena. Glaeser, Scheinkman, and Shleifer (1995) find no relationship between ethnic fractionalization and population growth using U.S. counties. Alesina, Baqir, and Easterly (1999) show that greater ethnic diversity implies less public goods provision using a sample of cities. Finally, Alesina and La Ferrara (2005) find that more ethnic fragmentation implies less redistributive policies in favor of racial minorities and lower levels of social capital, measured as trust. In contrast, Ottaviano and Peri (2005) find a positive correlation between the size of the immigrant population and positive externalities in production and consumption.

However, many empirical studies find no relationship between ethnic fractionalization measured by the ELF index using the data of the ANM and conflict. Collier and Hoeffler (2004) find that ethnic fractionalization (ELF) and religious fractionalization (calculated using the data of Barrett [1982]) are statistically insignificant in

the econometric explanation of the onset of civil wars. Fearon and Laitin (2003) also find that ethnic fractionalization, measured by the ELF, does not have explanatory power for the onset of civil wars.

There are at least two alternative explanations for this lack of explanatory power. First, it could be the case that the classification of ethnic groups in the ANM, the source of the traditional ELF index, is not appropriate. But, as we discussed in section 3, the correlation between the indices of fractionalization obtained using these alternative data sources is very high (greater than 0.8). Therefore it is unlikely that this first explanation is the reason for the lack of explanatory power of the fractionalization index. The second reason is the calculation of the heterogeneity that matters for conflict as an index of fractionalization. In principle, claiming a positive relationship between an index of fractionalization and conflicts implies that the more ethnic groups there are, the higher the probability of a conflict. Many authors would dispute such an argument. As already mentioned, Horowitz (1985) argues that the relationship between ethnic diversity and civil wars is not monotonic: there is less violence in highly homogeneous and highly heterogeneous societies, and more conflicts in societies where a large ethnic minority faces an ethnic majority. If this is so, then an index of polarization should better capture the likelihood of conflicts, or the intensity of potential conflicts, than an index of fractionalization. Montalvo and Reynal-Querol (2005b) find that ethnic polarization, measured by the RQ index, has a statistically significant effect on the incidence of civil wars.<sup>13</sup> Table 8.5 shows that the relationship between polarization and the incidence of civil wars is unrelated with the specific dataset used to calculate the measure of polarization. The logit regressions are classified in two groups: 5-year panel and cross-section. The regressors included in the specifications are the usual suspects in the studies on the incidence of civil wars. All the measures of polarization are statistically significant in the case of 5-year periods. In cross-section, the relationship is weaker than in panel, but still the coefficients estimated are statistically significant at 5% (with one of them significant at 10%). If we included the index of fractionalization it would be statistically insignificant, no matter what dataset was used to construct the index.

Other studies relate the intensity of civil wars (usually measured by the number of casualties) and social diversity. Do and Iyer (2010) conclude, using data on the casualties across space and over time in districts of Nepal, that there is some evidence that greater social polarization (measured by the caste diversity of Nepal) is associated with higher levels of conflict. They also find that linguistic fractionalization and polarization have no significant impact on conflict intensity.

There is less evidence on the effect of ethnic diversity on genocides and mass killings. Harff (2003) constructed a dataset on genocides and politicides and tested a structural model of the antecedents of genocide and politicide. Harff (2003) identifies six causal factors and tests; in particular, the hypothesis that the greater the ethnic and religious diversity, the greater the likelihood that communal identity will lead to mobilization and, if conflict is protracted, prompt elite decisions to eliminate the group basis of actual or potential challenges. However, she finds no empirical evidence to support this hypothesis. The variables used to capture

**Table 8.5** Regressions on the incidence of civil wars. Logit, standard sample, definition of civil war PRIO23

	5-years period				Cross-section			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
C	-6.49 (2.33)	-6.59 (-2.35)	-7.51 (-2.51)	-6.22 (-1.93)	-2.22 (-0.87)	-2.00 (-0.77)	-2.68 (-1.02)	-1.82 (-0.69)
LGDP	-0.47 (2.11)	-0.36 (-1.58)	-0.33 (-1.49)	-0.44 (-1.99)	-0.43 (-1.56)	-0.39 (-1.48)	-0.35 (-1.26)	-0.46 (-1.72)
LPOP	0.41 (2.90)	0.40 (2.81)	0.44 (2.94)	0.41 (2.40)	0.41 (2.13)	0.39 (2.08)	0.43 (2.24)	0.41 (2.14)
PRIMEXP	-1.07 (0.60)	-0.822 (-0.46)	-1.09 (-0.61)	-1.01 (-0.54)	-0.99 (-0.51)	-0.64 (-0.33)	-1.01 (-0.50)	-0.63 (-0.32)
MOUNTAINS	0.00 (0.00)	-0.00 (-0.00)	0.002 (0.24)	-0.002 (-0.25)	0.00 (0.42)	0.00 (0.53)	0.01 (0.86)	-0.004 (0.42)
NONCONT	0.37 (0.58)	0.24 (0.40)	0.13 (0.21)	0.29 (0.49)	-0.32 (-0.43)	-0.35 (-0.47)	-0.43 (-0.58)	-0.313 (-0.42)
DEMOCRACY	0.14 (0.39)	0.05 (0.14)	0.03 (0.07)	0.03 (0.09)	-0.18 (-0.33)	-0.17 (-0.32)	-0.39 (-0.69)	-0.26 (-0.48)
FEA_POL	2.72 (2.87)				2.10 (2.00)			
ADEKW_POL		1.93 (2.32)				1.56 (1.46)		
ANM_POL			2.35 (3.33)				1.99 (2.10)	
MRQ_POL				2.37 (2.97)				2.03 (1.92)
Pseudo R2	0.1245	0.1110	0.1247	0.1218	0.1275	0.1201	111	0.1369
N	838	854	838	846	109	112	0.1412	111

The method of estimation is logit. The absolute z-statistics in parentheses are calculated using standard errors adjusted for clustering

potential conflict were measures of diversity (ethnic fractionalization). For this reason, and in line with most of the literature on the determinants of civil wars, Harff (2003) concludes that the effect of ethnic diversity on genocides is not statistically relevant. Easterly et al. (2006) analyze the determinant of mass killing, which, they clarify, should not be confused with genocides. They find that mass killing is related with the square of ethnic fractionalization. This suggests that polarization of a society into two large groups would be the most dangerous situation, even in the case of mass killing. Finally, Montalvo and Reynal-Querol (2008) find that there is a strong relationship between ethnic polarization and the risk of genocide.

### 4.3 Conflict and other measures of ethnic diversity

There is less evidence of the relationship between these alternative measures and the likelihood of conflict. Collier and Hoeffler (1998) find that ethnic dominance is the only measure of ethnicity that has a statistically significant effect on civil wars. Cederman and Girardin (2007) conclude that the coefficient on the  $N^*$  index<sup>14</sup> is statistically significant in the explanation of the onset of civil wars, in contrast with the traditional index of fractionalization. Lim, Metzler, and Bar-Yam (2007) argue that ethnic and religious fractionalization (and polarization) are measures of diversity that do not consider the spatial structure of ethnic and religious groups. Their model focuses on the geographic distribution of the population as a predictor of conflict. Violence is expected to arise when groups of certain characteristic size are formed and not when groups are much smaller, or larger, than that size. Therefore, highly mixed regions and well-segregated groups are not expected to generate violence.<sup>15</sup> In contrast, partial separation with poorly defined boundaries when groups are sufficiently large in size and are able to impose cultural norms are more prone to conflict. Lim, Metzler, and Bar-Yam (2007) perform simulations based on census data and an agent model for the former Yugoslavia and India. They are able to predict with a high level of accuracy the regions of reported violence using only the pixelated geographic map of the location of ethnic groups.

## 5. CONCLUDING REMARKS

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This chapter summarizes the basic literature on the relationship between inequality, polarization, and conflict. It also presents a novel comparative study of the impact of alternative datasets on the calculation of indices of fractionalization and polarization at the country level that may be of interest for empirical researchers. Inequality of income, wealth, land distribution, etc., have traditionally been associated with the likelihood of social conflicts. However, the empirical literature has found no statistical relationship between the likelihood of civil wars and the level of inequality. Ethnic diversity has also been proposed as a likely motive for grievances, and therefore is possibly connected with the probability of civil wars. But the usual measure of ethnic diversity, the index of fractionalization, has no explanatory power on the probability of conflict once the standard explanatory variables are included in the specification. The index of polarization is an alternative way to summarize ethnolinguistic heterogeneity in a single indicator. The index of polarization reaches the highest level when there are two groups of similar size that cover the whole population. Therefore, when a majority is confronted with a large minority, many social scientists have argued that this is the social configuration that produces the highest likelihood of conflict. The empirical evidence supports this claim.

The literature in this area is quickly changing to more specialized measures of ethnolinguistic diversity that factor in the indices of the spatial distribution of ethnic groups, the sharpness of the frontier across groups, and the degree of overlap between ethnic groups in the same geographical area. Although there are still few results on the relationship between these measures and the likelihood of conflicts, this is a very exciting area of research or the future.

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## NOTES

1. Montalvo and Reynal-Querol (2002, 2005c) insist on this relationship.
2. Usually the data for the construction of the ELF index come from the Atlas Narodov Mira (1964), compiled in the former Soviet Union in 1960. The ELF index was originally calculated by Taylor and Hudson (1972). See section 3 for a complete discussion on datasets available for the construction of indices of fractionalization.
3. Mauro (1995) uses this index as an instrument in his analysis of the effect of corruption on investment.
4. For a discussion on the properties of the index of discrete polarization, see Montalvo and Reynal-Querol (2008).
5. For all the details see Montalvo and Reynal-Querol (2005a, 2005b, 2008).
6. Collier and Hoeffler (2004) define dominance as a situation where the size of the largest group is between 45% and 90%.
7. They provide an empirical illustration of how their index can be operationalized and what difference it makes as compared with the standard ELF index.
8. We will not discuss the measurement of inequality, since this is by now a very well-known topic.
9. In addition, many individuals may have ascriptive attachments to multiple groups.
10. Since these surveys are not available, Fearon (2003) ends up using the standard source of classification of ethnic groups.
11. Notice that the sample used to construct the fractionalization index of the ANM is restricted to the small sample since at the time of collecting the data many current countries did not exist.
12. In this section we use the word inequality to refer to vertical inequality. Some authors, like Stewart (2001), emphasize that we also need to pay attention to the role of horizontal inequalities, a topic that was also explored by Ostby (2005). Vertical



inequality consists of inequality among individuals or households. Horizontal inequality is defined as among groups, typically culturally defined by race, ethnicity, etc.

13. Montalvo and Reynal-Querol (2010) analyze the decomposition of the incidence of civil war as the product of onset by duration. They argue that the effect of ethnic polarization on the incidence of civil wars is mostly related to the duration of wars.
14. The  $N^*$  index is a star-like configuration of ethnic groups centered around the ethnic group in power.
15. Notice that this hypothesis implies that measures of fractionalization, even if they are constructed at detailed geographical levels, will not be highly correlated with conflict, while polarization may have a high correlation.

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