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**Quantifying Ethnic Cleansing:
An Application to Darfur**

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Quantifying Ethnic Cleansing:
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Abstract

This paper has two objectives: First, to develop and critically examine various measures of ethnic cleansing on the basis of a review of the existing literature. Second, to apply the suggested measures to a unique sample of 530 villages in Southwestern Darfur. Our data shows that 57 percent of the population from the targeted groups have fled the area and that their share of the total population has fallen from 70 to 46 percent. The degree of ethnic diversity at the regional level is very high but due to the high level of segregation, ethnic diversity at the village level is extremely low. Our results suggest that administrative units with a more pronounced pattern of segregation also experienced a greater degree of ethnic cleansing.

Key words: Ethnic cleansing, genocide, Darfur
JEL Classification codes: P16, O41

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1 Introduction

The international community has been indecisive about the proper labelling of the massive violence that has been going in Darfur since 2003. Whereas US State Secretary Colin Powell referred to the conflict as a genocide, perpetrated by the Janjaweed militia and the Government of Sudan, already in September 2004 (America.Gov, 2004), the UN investigation from 2005 refrained from such terminology and instead referred to "serious violations of international human rights and humanitarian law" and crimes against humanity marked by "...the intent to drive the victims from their homes, primarily for purposes of counter-insurgency warfare." (United Nations, 2005, p 3-4). In July 2010, the prosecutor of the International Criminal Court in the Hague chose to extend his previous warrant of arrest on Sudan's incumbent president Omar al-Bashir to also include charges of genocide in Darfur (ICC, 2009, 2010).

In this paper, we focus on a related phenomenon, *ethnic cleansing*, which has so far been not been the object of extensive analysis in the social science literature. Whereas genocide is concerned with the destruction or extermination of a population group, "in part or in whole", our crude working definition of ethnic cleansing is *the forced removal of an ethnically defined population from a given territory*. In the extensive framework developed by Mann (2005), genocide is the most extreme manifestation of ethnic cleansing on a scale of intensity that starts from harassments and discrimination against certain ethnic groups, proceeds with forced migration and deportations, and eventually reaches murderous ethnic cleansing, i.e. genocide. What we refer to as "forced removal" might thus include genocide but does not necessarily do so.

The current paper has two broad objectives. First, on the basis of a discussion of how the term has been defined in the literature, we develop and critically examine various quantitative measures of ethnic cleansing. Ethnic cleansing is inherently multi-dimensional and there is no single index which can capture the phenomenon as a whole. Second, we apply the suggested measures to a previously unexploited data set on the ethnic composition of the population before and after conflict in 530 villages in Southwestern Darfur. We find that ethnic cleansing during the period 2003-2008 has been both very extensive and intensive. 57 percent of the targeted populations have been cleansed from the area and 85 percent of these lived in villages that were subsequently destroyed. We also find that regional ethnic diversity was very high before the conflict and that it increased even further after that. However, this pattern is not reflected in the average village composition, where diversity was low and remained low because of persistent high segregation. We study the pattern of segregation in connection with cleansing and find a positive correlation between

the two.

This paper is part of a recent literature on the dynamics of ethnic diversity. Caselli and Coleman (2006) is one of very few attempts at explaining how ethnic identification evolves over time. In their model, ethnic identification serves the purpose of enforcing political coalitions and might therefore change over time as a response to the prevailing economic conditions. Campos and Kuzenyev (2007) document empirically changes in fractionalization in a sample of East European countries after the collapse of the Soviet Union,[1] but they provide only narrative arguments on the drivers of such change (migration, ethnic conflict). Fletcher and Iyigun (2009) show some evidence that current levels of (religious) fractionalization depend on the type of (religious) conflict in the past 600 years.[2] However, due to limited data on fractionalization, they cannot show the level of religious diversity at the beginning of the period nor how it changes over time. Toft (2007) exploits the variation of ethnic composition over time for a large sample of countries to estimate the impact of population changes on the incidence of civil wars. Since she considers only the two major groups for each country, she does not exploit all the information captured by, for example, the fractionalization and discrete polarization indexes.[3]

All these papers do not take into account any type of spatial information into their indexes, like, for example, a segregation index would do. Two papers doing this are Matuszesky and Schneider (2006) and Alesina and Zhuravskaya (2010). The former compute an index of ethnic composition taking into account the clustering of ethnic groups within a country (ethnic diversity and clustering index) and estimate its impact on the incidence of civil wars. The latter authors compute an index of (ethnic) segregation (based on Reardon and Firebaugh, 2002) and estimate its impact on several measures of quality of government. On the other hand, neither of these papers consider the time-variation of ethnic composition.

Finally, none of these mentioned papers analyze ethnic composition at levels more disaggregated than the country. The only strand of literature considering ethnic composition at levels of disaggregation similar to ours is the literature on ethnic segregation in the US (Cutler et al, 1999, constitutes a seminal paper, while Echenique and Fryer, 2007, are a recent contribution). This literature focuses almost entirely on segregation in urban areas in the US or in other OECD countries, a setting hardly comparable with rural villages in a post-conflict areas.

The data on villages in Darfur used in this study have previously featured in two

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[1] They exploit such changes to improve existing estimates of the impact of fractionalization on growth.

[2] They exploit the time-dimension of their dataset and provide estimates of fractionalization over time.

[3] Montalvo and Reynal-Querol (2002, 2005) show that with two groups only the two indexes are proportional to each other.

companion papers to this one: Olsson and Siba (2010) who analyze the determinants of attacks on villages and Olsson (2010) who study the patterns of squatting and reallocations of land as a consequence of the current crisis.

The paper is structured as follows: In section two, we review definitions of ethnic cleansing in the literature and outline an operational definition. In section three, we develop formal measures of ethnic cleansing and illustrate our methodology with examples. In the main section four, we give a brief background to the situation in Darfur and present the data used. We then apply our developed measures to the data. Section five concludes.

2 Defining ethnic cleansing

The expression is a literal translation from Serbo-Croatian/Croato-Serbian. It became part of common language when journalists and politicians started using it when describing the conflict in former Yugoslavia in 1992. Previously, it had been used for administrative matters in 1981 (Petrovic 1994). Bell-Fialkoff (1993) and Hayden (1996) trace episodes of ethnic cleansing in history.

Since there is no clearly established definition of ethnic cleansing, we review definitions found in UN documents, which mostly refer to the conflict in former Yugoslavia, and in the scholarly literature.

2.1 Existing definitions and common features

The Special Rapporteur of the Commission for Human Rights Mazowiecki defines ethnic cleansing as the "systematic purge of the civilian population based on ethnic criteria, with a view to forcing it to abandon the territories where it lives" (UN Doc. E/CN.4/1994/110, p.44).[4] A similar statement can be found in a letter from the Secretary-General to the President of the Security Council[5]: "...ethnic cleansing is a purposeful policy designed by one ethnic or religious group to remove by violent and terror-inspiring means the civilian population of another ethnic or religious group from certain geographic areas".

Among scholars, Bell-Fialkoff (1993) states: "At the most general level (..) ethnic cleansing can be understood as the expulsion of an 'undesirable' population from a given territory due to religious or ethnic discrimination, strategic or ideological

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[4]The definition is important also because in an earlier report (1992, UN Doc. A/47/666, p.6) Mazowiecky writes: "The term ethnic cleansing refers to the elimination by the ethnic group exercising control over a given territory of members of other ethnic groups." The 1994 definition seems substantially broader, as it includes all acts leading to migration, while the 1992 definition, by referring to 'elimination', may be interpreted in the strict physical sense only.

[5]The letter follows "evidence of grave breaches of the Geneva Conventions and other violations of international humanitarian law committed in the territory of the former Yugoslavia" (S/1994/674, p.1) and the establishment of a Commission of Experts to investigate on the issue.

considerations, or a combination of these" (p.110). Similarly, Petrovic (1994) states: "ethnic cleansing is a well-defined policy of a particular group of persons to systematically eliminate another group from a given territory on the basis of religious, ethnic or national origin" (p.351).

One feature is certainly common to all the definitions we mentioned: the reference to a specific geographical area. Conditional on this reference, differences in terminology ("eliminate", "purge", "remove", "expel") appear minor.

The Commission of Experts which investigated crimes in former Yugoslavia makes the followings list of acts related to ethnic cleansing: mass murder, torture, rape and other forms of sexual assault; severe physical injury to civilians; mistreatment of civilian prisoners and prisoners of war; use of civilians as human shields; destruction of personal, public and cultural property; looting, theft and robbery of personal property; forced expropriation of real property; forceful displacement of civilian population; and attacks on hospitals, medical personnel and locations marked with the Red Cross/Red Crescent emblem (S/1994/674, p.34). Investigation over these acts left them with the belief that the policy of ethnic cleansing aimed at convincing the targeted group: "A) to flee; B) not to return"[6]. The latter purpose is primary in at least some of the above-mentioned acts, like rape/sexual assaults, as well as destruction of property, forced expropriation and looting. Targeted subjects must leave knowing that they will find nothing in case of return.

So we may arguably infer that ethnic cleansing is the "intent to remove a particular ethnic group from a specific geographical area" through acts belonging to the list provided above.

2.2 Operational definition

The definitions provided above constitute a benchmark for the evaluation of ethnic cleansing in practice. They are useful because they provide an encompassing picture of the phenomenon: killing, forced migration, destruction, physical and moral injuries. However, once brought to the data, they are likely to show the following limitations:

1. The intent to remove may remain largely unobserved. Following the constitution of the International Criminal Court (2002), the recognition that most of

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[6]The Commission of Experts in their Hearing Before the Commission on Security and Cooperation in Europe (1995, p.12): "The tactics were really very simple and rather simplistic. The tactics were simply to engage in the type of violence that would cause people to leave, after many had suffered and been killed, with the fear of what happened to them and with the terrorizing effect that it created. In fact, it is very telling that in 80 percent of the rape cases that we investigated, the acts of rape were done with the purpose of enhancing the element of shame and embarrassment of the victim, of her family, and of the community, so as to create a terror inspiring effect that would cause people, (A) to flee, and (B) not to return."

the acts related to ethnic cleansing constitute crimes against humanity[7] and the association of ethnic cleansing with genocide[8], officials tend to be more prudent in stating their objectives and tend to use non-state actors for the implementation of their policies (see Harff, 2003 for a similar approach with respect to the measurement of genocide episodes).

2. Acts related to ethnic cleansing such as rape, physical injuries (not conducive to death), mental injuries, mistreatment, use of civilians as human shields, and similar, may be extremely difficult to detect and so remain largely unobserved to the econometrician.

3. It may be difficult, arbitrary or just impossible to distinguish forced migration, which is related to ethnic cleansing, from voluntary migration, which is not.[9]

Overall, ethnic cleansing is essentially multi-dimensional[10], which means that there can be several equally reasonable ways to aggregate the single dimensions into an index. In the following section we present some measures which may broadly capture the phenomenon of ethnic cleansing.

3   Formal measures

Let us imagine a geographical entity with a total population of P. The total population is distributed over a number of smaller geographical units indexed by $i = 1, 2, ...I$ such that $P = \sum_{i=1}^{I} P_i$. The local units could for instance be villages or districts. The population is further made up of one or more ethnic groups $j = 1, 2, ...J$ so that

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[7]Ibid, p.12: "The final report of the Commission (..) takes a strong position in favor of considering such acts as crimes against humanity, and we have no hesitation about that." See list of Crimes Against Humanity and extensive definitions in article VII, Rome Statute.

[8]Ethnic cleansing and genocide coincide when the "intent to remove" equals the "intent to destroy, in whole or in part, a national, racial or religious groups, as such". Mann (2005) argues that this has to do with escalation: if persecution is not sufficient to convince targeted subjects to leave, the persecutor will presumably pass to forced migration; if forced migration proves difficult, lengthy and costly, then the persecutor will pass to mass murder. Similarly, Hayden (1996) states: "Physical slaughter enters the picture as an element of ethnic cleansing, since, after all, it usually takes a great deal of pressure to persuade people to leave their homes for "homelands" that they might, in fact, never have seen" (p. 736). The connection has been recognized by the European Court of Human Rights (ECHR), citing the case of Prosecutor v. Kupreskic and Others (ICTY, IT-95-16-T, judgment of 14 January 2000, § 751; point 44 in ECHR 2007), declares:"for in genocide, the persecutory intent is pushed to its utmost limits through the pursuit of the physical annihilation of the group or of members of the group". To our knowledge, the only scholar who explicitly opposes such overlapping is Schabas (2000), who argues that, since genocide implies elimination and ethnic cleansing concerns displacement, the two can never overlap.

[9]Bell-Fialkoff (1993) is very precise on this point: "While there are indeed extraordinary numbers of people who have been displaced, not all of them have been technically 'cleansed'. From the very start, fear itself created a large number of refugees." (p.118).

[10]Differently from genocide and civil wars, for example, whose measures are based uniquely on number of killings.

$P = \sum_{j=1}^{J} P^j = \sum_{i=1}^{I} P_i$. The population in a particular local unit i is therefore $P_i = \sum_{J=1}^{J} P_i^j$ and the total population of an ethnic group j is $P^j = \sum_{i=1}^{I} P_i^j$.

Let us further assume that there is one particular subpopulation that is the object of ethnic violence from parts of the rest of the population. We define this subpopulation as consisting of a set of $c \subset \{1, 2, ...J\}$ groups having a total size $P^c = \sum_{i=1}^{I} P_i^c < P$.

3.1   Extent of ethnic cleansing

For some reason, segments of the rest of the population pursue a campaign of ethnic cleansing against the targeted population P^c. In line with the discussion above, we define ethnic cleansing as the more or less violent removal of the targeted ethnic groups from the country or region in question. Each individual can experience either effective removal from village (r) or no removal (r_-). In each local unit, a fraction $\gamma_i \in [0, 1]$ of the targeted population is removed, implying that the total size of ethnic cleansing of subpopulation P^c is:

Size of targeted population cleansed: $Z^c = \sum_{i=1}^{I} \gamma_i P_i^c = \sum_{i=1}^{I} Z_i^c$

This might be considered to be the most basic measure of ethnic cleansing, simply showing the total number of people that have been removed from a geographical entity. Two other natural measures are firstly the percentage of own population removed, which is equivalent to the expected probability of being cleansed for a random individual h from the targeted group:

Share of targeted population cleansed (or probability of being cleansed for a random individual in the targeted population): $\frac{Z^c}{P^c} = \mathrm{Prob}(r | h \in P^c)$

Calculating the percentage of the own population that is victimized is a very common metric for empirical assessments of both ethnic cleansing and genocide.

As discussed above, convincing people not to return is one of the main rationales of destruction, looting and expropriation. It might therefore be interesting to learn how large a fraction of the targeted population that used to live in local units that were subsequently destroyed since such individuals are less likely to return than people coming from non-destroyed local units. Let $d \subset \{1, 2, ...I\}$ be the subset of villages that are destroyed. Then we can define Z^d/P^c as:

Share of targeted population cleansed, whose unit has (also) been destroyed: $\frac{Z^d}{Z^c} = \frac{\sum_{i \in d} Z_i^c}{Z^c}$

The measures above focus on outcomes at the most aggregated level. However, the local variation within the geographical unit might also be of great interest. The fraction γ_i might be thought of as a measure of the "success" or "completeness" of

the cleansing in the local unit i. The expected proportion of ethnic cleansing across the local units is

Expected proportion of cleansing: $E(\gamma_i) = \rho_i \sum_{i=1}^{I} \gamma_i$ where $\rho_i = \{P_i/P \text{ or } 1/I\}$.

ρ_i is the weight attached to γ_i. If the first weight P_i/P is used, the measure is equivalent to the expected proportion of cleansing in the village of a randomly drawn individual. If the second weight is used instead, the metric shows the expected proportion of cleansing in a randomly drawn village. It is further straightforward to derive for instance the standard deviation of the expected value above.

3.2   Impact on society

The immediate consequence of the partial or total forced removal of one (or more) ethnic groups is the decrease in total population and the change in its ethnic composition. The change in absolute population level is simply captured by

Share of total population cleansed: $\frac{Z^c}{P} = \text{Prob}(r \,|\, h \in P)$

which also corresponds to the probability that any randomly picked individual in the whole population is ethnically cleansed. If P^c is a very small part of total population, it is less likely to fundamentally affect the country or region in question than if the targeted population is a very large proportion of P, as were the Armenians in the Ottoman empire in 1916.

The change in ethnic composition can be captured by one of several indexes. The standard measure of ethnic diversity in a geographical unit is the "ethnic Herfindahl-coefficient", calculated as

Ethnic fractionalization index: $H = 1 - \sum_{j=1}^{J} \left(P^j/P\right)^2 = 1 - \sum_{j=1}^{J} \left(\pi^j\right)^2 = \sum_{j=1}^{J} \pi^j \left(1 - \pi^j\right)$,

where $P^j/P = \pi^j$. It shows the probability that two randomly drawn individuals from population P belong to different ethnic groups (Alesina et al., 2003). This coefficient approaches 1 in an environment that is split up into numerous miniscule ethnic units and will score 0 if there exists only one group in the area. High levels of the index are associated with corruption (Mauro 1995), low provision of public goods (Alesina et al. 1999) and low economic performance (Easterly and Levine 1997).[11] The equivalent measure for the local level is $H_i = 1 - \sum_{j=1}^{J} \left(P_i^j/P_i\right)^2 = 1 - \sum_{j=1}^{J} \left(\pi_i^j\right)^2 = \sum_{j=1}^{J} \pi_i^j \left(1 - \pi_i^j\right)$.

A complementary information is provided by the discrete polarization index, which differs from the fractionalization index for a different weighting of population shares:

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[11] Indeed, the index can be modelled as approximating the amount of resources wasted by lobbies competing over a private good (see Esteban and Ray 2009 and Valsecchi 2009).

Polarization index: $Q = 4 \cdot \sum_{j=1}^{J} \left(\pi^j \right)^2 \left(1 - \pi^j \right)$

The interpretation is less straightforward than that for the fractionalization index. The index takes maximum value (unity) in correspondence of two equally sized groups, and lowest value (near zero) in correspondence of many equally sized groups. It is associated with civil conflicts (Montalvo and Reynal-Querol, 2005) and genocides (Montalvo and Reynal-Querol, 2008).[12]

Both indexes mentioned above are based on population shares in the geographical unit as a whole. They do not describe to what extent different groups live together locally. Our measure of segregation comes from Reardon and Firebaugh (2002) and has been recently applied by Alesina and Zhuravskaya (2010):

Segregation index: $S = \frac{1}{J-1} \sum_{j=1}^{J} \sum_{i=1}^{I} \frac{P_i}{P} \frac{\left(\pi_i^j - \pi^j \right)^2}{\pi^j}$

This index essentially compares the proportion of an ethnic group in a specific location π_i^j with the average proportion of the group in the geographical unit as a whole, weighted by the relative size of the local unit P_i/P and then divided by the number of existing groups (minus 1). $S = 0$ if the different ethnic groups live together at each locality with exactly the same proportions as on the aggregate level, whereas $S = 1$ if for instance three different groups live exclusively at three ethnically homogenous locations.

Since ethnic cleansing explicitly refers to a reduction or removal of certain groups, it is informative to learn to what extent an ethnic cleansing campaign has altered levels of ethnic fractionalization, segregation, and polarization. Hence, we can for instance make the comparison of the measures one period after conflict (at time $t+1$) and right before the campaign (at time t):

Change in fractionalization: $\Delta H = H_{t+1} - H_t = \sum_{j=1}^{J_{t+1}} \pi_{t+1}^j \left(1 - \pi_{t+1}^j \right) - \sum_{j=1}^{J_t} \pi_t^j \left(1 - \pi_t^j \right)$

Change in segregation: $\Delta S = S_{t+1} - S_t =$
$= \frac{1}{J_{t+1}-1} \sum_{j=1}^{J_{t+1}} \sum_{i=1}^{I} \frac{P_{i,t+1}}{P_{t+1}} \frac{\left(\pi_{i,t+1}^j - \pi_{t+1}^j \right)^2}{\pi_{t+1}^j} - \frac{1}{J_t-1} \sum_{j=1}^{J_t} \sum_{i=1}^{I} \frac{P_{i,t}}{P_t} \frac{\left(\pi_{i,t}^j - \pi_t^j \right)^2}{\pi_t^j}$

Change in polarization: $\Delta Q = Q_{t+1} - Q_t = \sum_{j=1}^{J_{t+1}} \left(\pi_{t+1}^j \right)^2 \left(1 - \pi_{t+1}^j \right) - \sum_{j=1}^{J_t} \left(\pi_t^j \right)^2 \left(1 - \pi_t^j \right)$

Note that we assume here that J_{t+1} is not necessarily the same as J_t since certain new groups might have arrived. The naive expectation would of course be that $\Delta H < 0$ so that ethnic diversity is reduced in the unit as a whole. Similarly, we would expect $\Delta S > 0$ and $\Delta Q < 0$. However, as we shall see, this will depend to a great extent on the pre-conflict size of the targeted ethnic group.

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[12] There is also a close relationship with the amount of resources wasted by groups lobbying for a club good (Esteban and Ray, 1999).

3.3 An example

In order to illustrate the discussion above concerning the formal measures, let us briefly have a look at a simple example. Let us assume a geographical unit consisting of two villages ($I = 2$) and three ethnic groups ($J = 3$) where group 1 is the targeted group ($d = 1$). The distribution of the population is as in table 1 below. All in all, there are 1200 people in this imagined unit. Village A is solely populated by 400 individuals of the targeted group whereas the larger village B has a more mixed population of all three groups. Before conflict, the ethnic Gini (G_t) is fairly high at 0.61 and so is polarization ($Q_t = 0.89$), whereas segregation S_t is not too bad since the dominant group 1 live in both villages.

As a result of the conflict, we assume that village A is destroyed and all its 400 residents flee elsewhere ($\gamma_A = 1$) whereas only 50 percent of the targeted individuals are removed from village B. In total, 500 people are ethnically cleansed (Z^c), constituting a fraction 0.83 of the total targeted population (Z^c/P^c), and about 42 percent of total population (Z^c/P). A very large fraction of the total targeted population originally lived in villages that were subsequently destroyed ($Z^d/P^c = 0.67$). The expected fraction of people fleeing in the village of a randomly picked individual is about 67 percent whereas the expected fraction being cleansed in a random village is 75 percent.

In this example, ethnic fractionalization is actually reduced by 0.04 units (ΔG) which is due to the fact that one group (3) is now more dominant than the previously dominant group (1) was before conflict. Polarization is also slightly reduced.[13]

4 Ethnic cleansing in Darfur

In this section, we apply the measures developed above on one particular conflict episode, Darfur. More specifically, we study the consequences of the counter-insurgency campaign against civilian villages, carried out by Janjaweed/government forces, that was initiated in summer 2003.

4.1 Background

The population of Darfur is made up of a mosaic of ethnic groups. At the most aggregated level, there are three broad categories: The "old" African tribes, the "new" African tribes, and the Arabs. The old privileged African tribes are the Fur, Masalit and Zaghawa with traditional homelands and a certain authority over local land issues. The Fur and the Masalit are farmers whereas the Zaghawa are

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[13]The fact the level of segregation falls to zero arises because there is only one populated local unit after the conflict.

pastoralists. These tribes make up a majority of the total population in Darfur. The new African tribes are usually farmers and typically have a more recent history in the area. These groups have mainly been neutral in the conflict that started in 2003. The Arabs, lastly, constitute a large number of relatively small tribes or clans that are cattle or camel herders and that share a cultural identification as Arabs with the government in Khartoum. All ethnic groups in Darfur are Muslim.

The recent conflict in Darfur is generally described as having started in early 2003 when two rebel groups announced their opposition to the government in Khartoum and soon started attacking government outposts in the area. The rebels were entirely made up of recruits from the three dominant tribes in the area; Fur, Masalit, and Zaghawa. After some initial success, the government in Khartoum managed to mobilize a militia from loyal Arab tribes that is now known as the Janjaweed. The government military provided intelligence, coordination and aircraft resources, whereas the militia supplied the manpower on the ground.

Starting in summer 2003, the joint government/Janjaweed militia launched a massive counter-insurgency campaign aimed at civilian local villages. The typical pattern for such attacks was that the villages were first bombed by government fighter aircraft, whereafter the Janjaweed would arrive by horse, camel or pickup vehicles and carry out various acts of devastation such as killings, rape, destruction of livelihoods, abductions, and the spread of racist propaganda (Prunier, 2007; Hagan and Rymond-Richmond, 2008; Vanrooyen et al, 2008). In this campaign, which had its most intense phase about a year after its initiation, it is estimated that some 300,000 died and 2.7 million people became refugees out of a total population in Darfur of about 6.5 million. In 2009, the International Criminal Court in the Hague chose to issue an order of arrest on Sudan's president Omar al-Bashir, accusing him of war crimes and crimes against humanity (ICC, 2009). The indictment was extended in July 2010 to also include charges of genocide.

Why did the counter-insurgency campaign take on this massive proportion? This is discussed at some length in a companion paper to this one (Olsson and Siba, 2010). In brief, it is usually argued that there are two main dimensions of the conflict: On the one hand a local struggle over dwindling natural resources between pastoralist and farming tribes, on the other a conflict between marginalized tribes in the periphery and the government in Sudan. Both are likely to have played a certain role. It is well documented that rainfall in this part of the Sahel has been drastically reduced since 1970s (Kevane and Gray, 2008). Small-scale conflicts between sedentary farmers and nomadic herders have been endemic since the 1980s. The deteriorating quality of land, combined with an influx of populations from even drier parts of the Sahel, provided an explosive environment that was eventually ignited by the two rebel groups JEM and SLA in February 2003.

There is however also an even older issue of a marginalization of Darfur within the Sudanese state. For centuries, Darfur was an independent sultanate dominated by the Fur. Sudan became a British colony in 1898 but Darfur was not included until 1916. The British largely neglected the area and so did the post-colonial governments in Khartoum from 1956. The area is one of the least developed in Africa in terms of infrastructure and other public goods. When it was clear that the government in Khartoum was about to sign a peace and power-sharing deal with the SPLA rebels in southern Sudan, there was a general fear that in Darfur that the region would become even more marginalized. The stated political agendas of the rebel groups that appeared in 2003 were not about independence but rather expressed a desire to get a greater share of the accumulated wealth of the country. Even so, it appears that the government in Khartoum regarded the rebellion as a very serious threat and mobilized a large-scale counter-offensive.[14] The outcome of this offensive in terms of population changes is the object of our empirical study.

4.2   Data

The data was collected by some international organization(s) operating in the area.[15] Starting in 2004, these organization(s) undertook a return-oriented profiling exercise in Southwestern Darfur to improve the prevailing understanding of the complex picture of displacement that had been created by the 2003 crisis. A stated objective was to support war affected communities, sustain voluntary return and prepare the ground for an eventual voluntary return of a large number of IDP's and refugees to their villages of origin. A further aim was to provide reliable intelligence to other emergency organizations operating in the area. The profiling was designed to obtain a comprehensive picture of both the current and pre-conflict situations. Pre-conflict situations refer to the situation by early 2003, whereas the latest information about the current situation has November 30, 2005 as the oldest date and June 2008 as the most recent date (the median village had its latest visit in October, 2007).

The data collection covered eight administrative units in Southwestern Darfur with a total area of approximately 25,000 sq km (almost equivalent to the size of Belgium or Vermont and roughly 5 percent of Darfur's total territory). The data collecting staff had an ambition to gather information from all known villages in the area. Some secondary towns like Forobaranga and Habila were also included, whereas major towns like Garsila and Zalingei are not included. Figure 1 gives a

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[14] It has been suggested for instance by Prunier (2007) that the counter-insurgency campaign after a while went out of control and escalated beyond what the government had originally intended.

[15] Given the current security situation in Darfur, we have agreed not to disclose the identity of the organization(s) that have provided the data that our study builds upon. Until the situation in the area improves, more details will only be communicated through personal correspondence with the authors.

general overview of the area. All in all, our base sample consists of 530 settlements[16] with a total population of approximately 792,000 people before the conflict.[17]

The teams in the field collected information on numerous variables, including the typology of settlements (abandoned/destroyed), and, most importantly for our purpose, a retrospective assessment of the size of population and of the composition of ethnicities before and after the crisis. In addition to speaking with sheiks and other traditional and administrative authorities, the teams were instructed to verify the information they gathered with people in the market and other ordinary residents of each village. Where a location had an international presence, the team also crosschecked information with that organization. Upon return from each mission, the team had three-day debriefing sessions with other staff to compile the data and identify the main issues and trends that emerged from the information gathered. This was followed by a one-day debriefing with two staff members from another organization in the area.

The main advantage of our data is the level of detail and the focus on this particular conflict area of Sudan. On the other hand, our data are far form representative of the total Sudanese population, even before the conflict took place. For instance Alesina et al (2003) suggest that the population of Sudan can be characterized by the following ethnic composition (in percent): Arab (49.1), Other Sudan (12.7), Dinka (11.5), Nuba (8.1), Beja (6.4), Nuer (4.9), Azande (2.7), Bari (2.5), and Fur (2.1).[18] The corresponding levels of diversity are 0.71 (fractionalization) and 0.65 (polarization). Other authors provide roughly similar levels of ethnic diversity for the country as a whole with or without detail on group shares.[19] If we were to maintain the list of groups in Alesina et al (2003), our data would provide the following ethnic composition in West Darfur before the conflict: Arab (13.8), Fur (54.1), other African (31.4), other West Darfur (0.7). The corresponding levels of diversity would

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[16]The sample originally contained 562 villages. 20 villages in the original sample had an inconsistent share of inhabitants. Their ethnic compositions fail to add up to one and no logical explanation is provided for why it is so. As ethnic composition is our primary source of information for identifying African and Arab predominated villages, we excluded these villages from our analysis. 12 other villages had no population before the conflict. The final sample size that our study bases on thus contains 530 villages.

[17]We have reached this figure by multiplying the total number of households 143,938 with an assumed average size of 5.5 individuals, which was the average household size in a survey on the region collected by Deporteere et al (2004). The area sampled has roughly 12 percent of the total population in Darfur.

[18]Alesina et al (2003) also report the following data on language and religion composition. Language composition: Arabic (49,37%), Bari (2,45%), Beja (6,39%), Dinka (11,55%), Fur (2,05%), Lotuko (1,48%), Nubian languages (8,10%), Nuer (4,90%), Shilluk (1,71%), Zande (Azande, 2,71%), Sudan Other (9,29%). The corresponding level of fractionalization is 0,7190. Religious composition: Sunni Muslim (73,00%), Sudan Traditional (16,70%), Christian (9,09%), Sudan Other (1,20%). The corresponding level of fractionalization is 0,4307.

[19]Fearon (2003) is an example of the former, Montalvo and Reynal-Querol (2005) and Posner (2004) are examples of the latter.

be 0.59 (fractionalization) and 0.87 (polarization).

Our data allow us investigate the local ethnic composition in much greater detail: We identify 59 distinct tribes (21 African, 31 Arab, 7 other West Darfur).[20] In the next section we will discuss whether and how we should aggregate these tribes into larger groups. We will then apply the specific measures discussed in the previous section.

4.3 Empirical analysis

Before we apply the measures above, we consider the so-called grouping problem (Posner 2004), i.e. whether and how we should group tribes into bigger clusters:

> "There is no single 'correct' accounting of the ethnic groups in a country, and thus no single 'correct' ethnic fractionalization index value. Countries possess multiple dimensions of cultural cleavages and multiple possible accounting of the salient ethnic communities. Researchers must choose the one that provides the appropriate enumeration of ethnic groups for the specific causal mechanism that is being tested" (Posner, 2004, p 850).

The challenge is to choose a grouping which reflects the relevant cleavages in the society (accuracy). In turn, relevance depends on the outcome of interest. For example, we may be interested in the determination of a macroeconomic policy, the allocation of public expenditure, the emergence of civil conflict. Each of these issues may or may be not be determined by bargaining along the same ethnic cleavage. Indeed, this presents a problem: "If there are multiple plausible ways of listing a country's "ethnic groups," we must be careful that we do not, in effect, choose the coding that best supports our theory, after the fact." (Fearon, 2003, p 98). In other words, the risk we run in being as accurate as possible is to end up defining "the independent variable in terms of the dependent variable" (Posner, 2004, p 855).

The literature on ethnic diversity has largely overlooked this issue, perhaps due to data scarcity. Our analysis is not an attempt to identify the impact of ethnic composition on something else. It is a descriptive analysis of ethnic composition of West Darfur before and after the conflict. Still, we may be tempted to cluster African tribes into traditional/rebels and new African after having observed that traditional tribes had been targeted by for ethnic cleansing. However, there are several reasons to identify rebel tribes, other African tribes and Arab tribes as three distinct groups independently from the conflict. A primary cleavage, that separates African tribes from Arab tribes, is the type of economic activity: Members of African tribes are sedentary farmers, while members of Arab tribes are cattle and camel herders.

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[20]See Appendix 1 for a list of all groups and population shares.

A second cleavage that separates rebels tribes from other African tribes is that two of the rebel tribes (Fur and Masalit, that account for the large majority of the rebel population) are traditional tribes whose community leaders retain the power related to customary administration of the land. According to Abdul-Jalil (2006), this led to the allocation of the best and fertile land to their fellow members and relegated new African tribes which migrated throughout the 1970s and 80s from Chad and Northern Sudan to a lower status (see Olsson and Siba, 2010, and references therein for a detailed account). Throughout the rest of the paper we will consider the following partition as our benchmark: Fur-Masalit-Zaghawa (henceforth FMZ); new African tribes; Arab tribes; other tribes. However, in order to control whether the analysis is robust to alternative grouping choices, we will repeat the analysis for two other possible partitions: i) one tribe-one group; ii) African tribes, Arab tribes, other tribes.

A related assumption is that ethnic cleavages are constant through space and time. With respect to space, considering a single region (West Darfur) instead of many countries makes the assumption that cleavages remain constant across space very reasonable. With respect to time, one may worry that the relevant list of groups changed over time because of "a shift in political institutions, leadership, or even the policy issue that happens to be on the table results in a shift in the relevant axis of social division for that mechanism." (Posner 2004:854). However, two points are worth mentioning. First, the conflict has been described as a massive counter-insurgency led by the central government, that is, from outside the region (Prunier 2007). This makes us confident that the conflict did not directly modify the cleavage along which groups interacted. Second, it may well be the case that the conflict will have an impact on the distribution of power across groups, which may lead to new cleavages to take over existing ones. However, what we describe here is the short-run change in ethnic composition and not the long-run consequences of the conflict.

4.4   Extent of ethnic cleansing

In table 2 we provide some simple descriptive statistics. Before the conflict takes place, the population in Southwestern Darfur amounts to 142,906 households in 530 villages. The targeted groups constitute 70 percent of the population, while the "new Africans" and the Arab groups constitute 15 and 14 percent respectively. Targeted groups are also present in 70 percent of the villages.

The conflict takes place and the population decreases to 93,860 households. The targeted groups now constitutes only 47 percent of the population, while "new Africans" and Arab groups constitute 25 percent and 28 percent respectively. Notice that these two groups have increased not only in relative size, but also in absolute

number of households (+10.3 percent and +32.9 percent respectively). This is so because they include migration inflows (see Olsson 2010). On the other hand, the targeted groups experience a massive decrease. The decrease in absolute number of households corresponds to the measure of targeted population cleansed (Z^c), and amounts to 57,263 households.[21] The number is large and frightening, also because we consider only part of Darfur and not the whole region (our sample constitutes 5 percent of the Darfur area and 12 percent of the Darfur population).[22] The share of population cleansed (Z^c/P^c) is 57 percent and indicates that the ethnic cleansing campaign has been rather "successful" in removing the Fur-Masalit-Zaghawa population from Southwestern Darfur.

As discussed in the previous section, cleansing is implemented not just through forced removal, but also through acts (mass rape, destruction of property and, obviously, mass murder) whose aim is to convince the targeted people not to come back. In our sample, 47.9 percent of the villages have been destroyed. The percentage of targeted population cleansed who also had their village destroyed, $\left(Z^d/Z^c\right)$ is 85 percent. We may conclude that cleansing has been very intense and that an eventual repatriation will be extra difficult because of the extensive destruction.[23]

The mean share of targeted population cleansed for a randomly drawn village $E\left(Z_i^c/P_i^c\right)$ is 47 percent. Since it is smaller than the aggregate figure (57 percent), it indicates that bigger villages have been hit harder. More interestingly, the share of targeted population cleansed at the village-level varies substantially. The standard deviation is 0.71 and the median share is 0.74. So variation across villages is substantial. We will explore further this point in the next sub-section.

4.5   Impact on society

As we argued in the previous section, changes in population size and population composition are the most immediate consequences of ethnic cleansing (and may constitute its aims). We find that the share of total population cleansed (Z^c/P) is 40 percent (table 3). In turn, such a decrease in population density cannot but release pressure over land as well as affect the pattern of trade and the entire structure of

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[21]Notice that this constitutes a lower bound of the true value, because it does not count for possible (although unlikely) migration inflows of members of targeted groups previously abroad.

[22]Unfortunately, it is also consistent with other estimates. For example, the absolute number of people murdered, forced to migrate or fled voluntarily is 105,165, which corresponds to 73.6 percent of the population and is consistent with the area being a high-intensity conflict area (it has been estimated that, for the entire Darfur, about 300,000 people died, and 2.7 million people became refugees out of a total population of 6.5 million people, which means that just less than half of the population died or fled).

[23]In order to compute this index we restricted the sample to villages whose targeted population did not increase over the conflict period (482 out of 530). By doing so we ensure that the presence of Internally Displaced People belonging to the targeted groups does not compromise the value of the index.

markets. These are the most immediate and obvious market channels through which the ethnic cleansing will affect non-targeted groups. Obviously, there are even more important non-market channels: Widespread violence and destruction of villages related to acts of ethnic cleansing cause mass voluntary migration even among non-targeted groups. The total number of households who flee from Southwestern Darfur is 105,165, which corresponds to 73.6 percent of the pre-conflict population size. This has provided strong incentives to migrate into these areas either after the end of the conflict (i.e. new African groups and Arab groups), or before the end in case some groups are relatively confident not to be attacked (i.e. Arab groups). Indeed, the post-conflict population size (93,860) implies a strong influx of migrants in the region.[24]

Besides changing the size of the population, ethnic cleansing changes its ethnic composition. Table 3 shows various measures of ethnic composition before and after the conflict. Interestingly, before the conflict takes place ethnic diversity is very high: Fractionalization is 0.46, while (discrete) polarization is 0.73.[25] To the extent that diversity is related to civil wars (Montalvo and Reynal-Querol 2005) and genocides (Montalvo and Reynal-Querol 2008), the ethnic composition in Southwestern Darfur was alarming even before the conflict took place. Most importantly, diversity increases even further with the conflict: Fractionalization becomes 0.64, while (discrete) polarization becomes 0.89. This change may seem at odds with the logic of ethnic cleansing: if one (or more) ethnic groups were removed from the region, then we would expect overall diversity to decrease.[26] However, the targeted groups dominated the others in terms of size and have not been entirely removed. Notwithstanding the massive extent of ethnic cleansing, half the targeted population still inhabits the region. Their population share has decreased substantially in favor of new African tribes and Arab tribes.[27] The population distribution over these groups (and not the population as a whole) is more homogenous, and the population as a whole is therefore more diverse.

Interestingly, the degree of regional diversity masks significant segregation at the village-level. The value of the segregation index is very high both before (0.50) and after the conflict (0.46). Indeed, the mean values of diversity indexes at the village-level are extremely low both before and after the conflict: fractionalization

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[24] See Olsson (2010) for a study on the determinants of immigrants' allocation across villages.

[25] These values are rather consistent with those reported by Alesina et al. (2003), Fearon (2003) and Montalvo and Reynal-Querol (2005) for Sudan. This seems rather casual though, because the dominant group here is FMZ, while at the country level Arab tribes dominate.

[26] At least we would expect this to happen if we relied on the fractionalization index, which decreases as the number of ethnic groups decreases (it is guaranteed if all groups have same size, see Montalvo and Reynal-Querol 2002 and Valsecchi 2010 for more details).

[27] The previously largely dominant group (70 percent to 15 and 14 percent) is now just larger than each of the other two (47 percent to 25 and 28 percent).

passes from 0.07 to 0.06; polarization passes from 0.15 to 0.12. The difference across levels of analysis is explained by the share of villages with completely homogeneous population: 78 percent before the conflict; 80 percent after the conflict. The picture does not change if we consider alternative grouping choices (Appendix 2): Diversity is initially high and increases after the conflict; ii) most of villages are extremely homogeneous, which makes diversity extremely low at the village-level.

In order to gain further insight in the pattern of ethnic composition across different levels of analysis (region, village), we consider each administrative unit separately. Thus we obtain a small sample of eight administrative units, each with its ethnic composition. Table 4 shows substantial variation across these units in terms of ethnic composition. In figure 2 we plot the fractionalization index and the segregation index for this sample before the conflict takes place. The correlation is strong and negative (-0.79). In figure 3 we repeat the same exercise with data after the conflict. The correlation is still strong and negative (-0.58), but smaller. There is no clear reason for this pattern, which goes against what, for example, Alesina and Zhuravskaya (2010) find for their cross-section of countries. Table 4 shows also substantial variation in the share of targeted population cleansed (Z^c/P^c): It ranges from 25 percent (Habila) to 74 percent (Um-Kher). In figure 4 we plot the segregation index (before the conflict takes place) and the share of targeted population cleansed (Z^c/P^c). There is a small positive correlation (+0.26). Although the limited sample size poses obvious problems to this type of analysis, it seems that more segregated administrative units experience more intense ethnic cleansing. In figure 5 we repeat the same exercise with segregation after the conflict. The correlation is still positive and becomes even stronger (+0.40).

5   Conclusions

In this paper, we discuss the formal definitions of ethnic cleansing in the legal literature and how they may be operationalized once applied to the data. We review and discuss some measures which may capture the extent of ethnic cleansing and the impact of cleansing on society. Finally, we apply these measures to a unique dataset on villages in Southwestern Darfur, before and after the recent conflict.

First, we find that ethnic cleansing is essentially multi-dimensional. It concerns not just (and not necessarily) mass murder, but also forced migration and destruction of property and infrastructures. Thus it is conceptually different from related issues like civil conflicts and there are several equally reasonable ways to aggregate its dimensions into an index. We distinguish a measure to capture the extent of ethnic cleansing from a measure capturing its intensity. Given that ethnic cleansing concerns the removal of one (or more) specific ethnic group from a territory, one can-

not avoid to measure the impact of cleansing in terms of population size, population composition (diversity) and population distribution over the territory (segregation).

In our empirical application we find that ethnic cleansing in Southwestern Darfur has been both very extensive and intensive; it has deeply affected the population density in the area and has altered substantially the ethnic composition of the region, but not the one of the average village. Regional ethnic diversity, which was very high already before the conflict, has increased further after the conflict. However, the average village ethnic diversity was low before the conflict took place, and continued to be low even after because of the persistent degree of segregation. Our results show that segregation is positively correlated with the extent of cleansing, which suggests that targeted members in highly segregated areas may have been more vulnerable. Segregation may have made it relatively easy for government-supported Janjaweed militias to target rebel groups. This result calls for further research on, for example, the pattern of cleansing in Rwanda, which was characterized both by very low segregation and cleansing carried out by mass movements rather than by paramilitary groups.

References

[1] Abdul-Jalil, M. A. (2006). "The Dynamics of Customary Land Tenure and Natural Resource Management in Darfur", *Land Reform*, 2: 9-23.

[2] Alesina, A., R. Baqir, and W. Easterly. (1999). "Public Goods and Ethnic Divisions", *Quarterly Journal of Economics,* 114(4): 1243-1284.

[3] Alesina, A., Devleeschauwer, W. Easterly, S. Kurlat and R. Wacziarg (2003) "Fractionalization", *Journal of Economic Growth*, 8:155-94.

[4] Alesina, A. and E. Zhuravskaya (2010) "Segregation and the Quality of Government in a Cross-Section of Countries" forthcoming in *American Economic Review*.

[5] America.Gov (2004) "Powell Reports Sudan Responsible for Genocide in Darfur" <http://www.america.gov/st/washfile-english/2004/September/20040909115958JTgnilwoD0.5094873.html>, 9 September, 2004.

[6] Bell-Fialkoff, A. (1993) "A Brief History of Ethnic Cleansing" *Foreign Affairs*, 72(3), 110-121.

[7] Brosché, J. (2008) "Darfur - Dimensions and Dilemmas of a Complex Situation" UCDP Paper No. 2, Dept of Peace and Conflict Research, Uppsala University.

[8] Campos, N.F., and Kuzeyev, V.S. (2007) "On the dynamics of ethnic fractionalization", *American Journal of Political Science*, 51(3): 620–639.

[9] Caselli, F. and W. J. Coleman II. (2006). "On the Theory of Ethnic Conflict." NBER Working Papers 12125.

[10] Cutler, D. M., E. L. Glaeser and J.L. Vigdor (1999). "The Rise and Decline of the American Ghetto", *The Journal of Political Economy,* 107(3): 455-506.

[11] Depoortere, E., F. Checchi, F. Broillet, S. Gerstl, A. Minetti, O. Gayraud, V. Briet, J. Pahl, I. Defourny, M. Tatay, and V. Brown (2004) "Violence and Mortality in West Darfur, Sudan (2003-2004): Epidemiological Evidence from Four Surveys" *Lancet*, 364, October 9, 1315-1320.

[12] Easterly, W., and Levine, D. (1997) "Africa's growth tragedy: policies and ethnic divisions", *Quarterly Journal of Economics*, 112(4): 1203-50.

[13] Echenique, F. and R. G. Fryer (2007). "A Measure of Segregation Based on Social Interactions", *Quarterly Journal of Economics*, 122(2): 441-485.

[14] Esteban, J., and Ray, D. (1999) "Conflict and distribution", *Journal of Economic Theory*, 87(2): 379-415.

[15] Esteban, J. and Ray, D. (2009) "Linking conflict to inequality and polarization", forthcoming in *American Economic Review*.

[16] European Commission of Juman Rights (2007). "Jorgic vs Germany", Application No. 74613/01.

[17] Fearon, J. D. (2003). "Ethnic and Cultural Diversity by Country", *Journal of Economic Growth*, 8(2): 28.

[18] Fletcher, E., and Iyigun, M. (2009) "Cultures, Clashes and Peace", IZA Working Paper No.4116.

[19] Flint, J. and A. De Waal (2008) *Darfur: A New History of a Long War* (Revised and Updated), New York: Zed Books.

[20] García Montalvo, J. and M. Reynal-Querol (2002). "Why Ethnic Fractionalization? Polarization, Ethnic Conflict and Growth." SSRN eLibrary.

[21] Hagan, J. and W. Rymond-Richmond (2008) "The Collective Dynamics of Racial Dehumanization and Genocidal Victimization in Darfur" *American Sociological Review* 73(Dec), 875-902.

[22] Harrf, B. (2003) "No Lessons Learned from the Holocaust? Assessing Risks of Genocide and Political Mass Murder since 1955", *The American Political Science Review*, 97(1):57-73.

[23] Hayden, R.M. (1996) "Schindler's Fate: Genocide, Ethnic Cleansing, and Population Transfers", *Slavic Review*, 55(4): 727-748.

[24] International Criminal Court (2009). "The Prosecutor v. Omar Hassan Ahmad Al Bashir", ICC-02/05-01/09

[25] International Criminal Court (2010). "The Prosecutor v. Omar Hassan Ahmad Al Bashir", Press Release 12.07.2010, ICC-CPI-20100712-PR557

[26] International Court Tribunal for the Former Yugoslavia (2000). "Prosecutor vs Kupreskic and Others", IT 95 16 T.

[27] Kevane, M. and L. Gray (2008) "Darfur: Rainfall and Conflict" *Environmental Research Letters* 3, 1-10.

[28] Mann, M. (2005) *The Dark Side of Democracy: Explaining Ethnic Cleansing*, Cambridge University Press.

[29] Matuszeski, J. and F. Schneider (2006). "Patterns of Ethnic Group Segregation and Civil Conflict". Mimeo, Harvard University.

[30] Mauro, P. (1995) "Corruption and growth", *Quarterly Journal of Economics*, 110(3): 681-712.

[31] Montalvo, J.G., and Reynal-Querol, R. (2005) "Ethnic polarization, potential conflict, and civil wars", *American Economic Review*, 95(3): 796-816.

[32] Montalvo, J.G., and Reynal-Querol, R. (2008) "Discrete Polarization with an Application to the Determinants of Genocides", *The Economic Journal*, 118(November):1835-1865.

[33] O'Fahey, R.S. and Tubiana (2009) "Darfur: Historical and Contemporary Aspects" <http://www.smi.uib.no/darfur/A%20DARFUR%20WHOS%20WHO3.pdf>

[34] Olsson, O. and E. Siba (2010) "Ethnic Cleansing or Resource Struggle in Darfur? An Empirical Investigation" University of Gothenburg, mimeo.

[35] Olsson, O. (2010) "After Janjaweed? Socioeconomic Implications of the Conflict in Darfur" forthcoming in *World Bank Economic Review*.

[36] Petrovic, D. (1994) "Ethnic Cleansing - An Attempt at Methodology" *European Journal of International Law* 5(1), 342-359.

[37] Posner, D. N. (2004). "Measuring Ethnic Fractionalization in Africa", *American Journal of Political Science,* 48(4): 849-863.

[38] Prunier, G. (2007) *Darfur: The Ambiguous Genocide* (Revised and Updated Edition), New York: Cornell University Press.

[39] Reardon, S. F. and G. Firebaugh (2002). "Measures of Multigroup Segregation", *Sociological Methodology*, 32(1): 33-67.

[40] Sambanis, N. (2004). "What Is Civil War?", *Journal of Conflict Resolution*, 48(6): 814-858.

[41] Schabas, W. (2000) "Genocide in International Law", Cambridge University Press.

[42] Schimmer, R. (2008) "Tracking the Genocide in Darfur: Population Displacement as Recorded by Remote Sensing" *Genocide Studies Working Paper* No. 36, Yale University.

[43] Security Council (2006), "Resolution 1674", S/RES/1674, New York: United Nations.

[44] Toft, M.D. (2007) "Population shifts and Civil War: A Test of Power Transition Theory", *International Interactions*, 33: 243-269.

[45] United Nations (2005) "Report of the International Commission of Inquiry on Darfur to the United Nations Secretary General", United Nations: Geneva.

[46] United Nations. (2002). "Rome Statute of the International Criminal Court." A/CONF.183/9 of 17 July 1998, corrected by Process-verbaux of 10 November 1998, 12 July 1999, 30 November 1999, 8 May 2000, 17 January 2001 and 16 January 2002.

[47] United Nations, Security Council (1994). "Situation of Human Rights in the Territory of the Former Yugoslavia: Sixth Periodic Report on the Situation of Human Rights in the Territory of the Former Yugoslavia submitted by Mr Tadeusz Mazowiecki, Special Rapporteur of the Commission on Human Rights, pursuant to paragraph 32 of Commission resolution 1993/7 of 23 February 1993." E/CN.4/1994/110.

[48] United Nations, Security Council (1992). "Situation of Human Rights in the Territory of the Former Yugoslavia: Note by the Secretary-General." A/47/666.

[49] United Nations, Security Council (1994). "Letter Dated 24 May 1994 from the Secretary-General to the President of the Security Council." S71994/674.

[50] United States Goverment, Commission on Security and Cooperation in Europe (1995). "Genocide in Bosnia-Herzegovina: Hearing before the Commission on Security and Cooperation in Europe." CSCE 104-1-4.

[51] Valsecchi, M. (2010) "Ethnic Diversity, Economic Performance and Civil Wars", Swopec Working Paper No. 433.

[52] Vanhanen, T. (1999) "Domestic Ethnic Conflict and Ethnic Nepotism: A Comparative Analysis", *Journal of Peace Research*, 36(1): 55–73.

[53] Vanrooyen, M., J. Leaning, K. Johnson, K. Hirschfeld, D. Tuller, A. Levine, J. Hefferman (2008) "Employment of a Livelihood Analysis to Define Genocide in the Darfur Region of Sudan" *Journal of Genocide Research* 10(3), 343-358.

Table 1: Example of ethnic composition among three groups in two villages before and after conflict

	Before				After				
	Villages					**Villages**			
Population	*A*	*B*	Sum	π_i	Population	*A*	*B*	Sum	πj
$P^{1=c}$	400	200	600	0,5	$P^{1=c}$	0	100	100	0,143
P^2	0	200	200	0,167	P^2	0	200	200	0,286
P^3	0	400	400	0,333	P^3	0	400	400	0,571
P	400	800	1200		*P*	0	700	700	
					γ_i	1	0,5		
H	0,611				H	0,571		ΔH	-0,040
S	0,25				S	0		ΔS	-0,25
Q	0,889				Q	0,863		ΔQ	-0,026

Formal measures

Z^c	500	E(γ_i) if	0,667
Z^c/P^c	0,833	E(delta2)	0,75
Z^c/P	0,417		
Z^d/P^c	0,667		

Table 2: Extent of ethnic cleansing in Southwestern Darfur

Variable	Description	before		after	
		pop	**share**	**pop**	**share**
FMZ	Fur (F), Masalit (M) and Zaghawa (Z) in terms of number of households.	100541	0,70	44056	0,47
New Africans	All other African tribes (see Appendix 1 for a list) in terms of number of households.	21548	0,15	23767	0,25
Arabs	All Arab tribes (see Appendix 1 for a list) in terms of number of households	19785	0,14	26287	0,28
Other	All non-African and non-Arab tribes (see Appendix 1 for a list) in terms of number of households	1032	0,01	370	0,00
Total population (P)	Total population in terms of number of households	142906	1,00	93860	1,01
Villages with FMZ population		369/530	69,62	153/530	28,86
Size of targeted population cleansed (Z^c)	Total targeted population cleansed in terms of number of households.		57263		
Total targeted population (P^c)	Total targeted population in terms of number of households		100541		
Total population (P)	Total population in terms of number of households		142906		
Share of targeted population cleansed (Z^c/P^c)	Ratio between targeted population cleansed (Z^c) and total targeted population (P^c)		0,57		
Number of destroyed villages			254/530		
Number of destroyed or abandoned villages			327/530		
Share of targeted population cleansed, whose village has been destroyed (Z^d/Z^c)	Ratio between targeted population cleansed whose village has been destroyed (Z^d) and targeted population cleansed (Z^c)		0,85		

Variable	Description	mean		s.d.	median
Expected proportion of cleansing ($E(\gamma)$)	Expected proportion of targeted population cleansed (Z^c/P^c) in a randomly drawn village	0,47		0,71	0,74

Source: authors' calculations based on data collected by international organizations in the area.

Table 3: Impact of ethnic cleansing on society

Variable	Description	obs	before				after			
Share of total population cleansed (Z^c/P)	Ratio between targeted population cleansed (Z^c) and total population (P)	1	0,40							
Fractionalization index H (region)	Fractionalization index H computed over the entire territory and over four groups.	1	0,46				0,64			
Polarization index Q (region)	Discrete polarization index Q computed over the entire territory and over four groups.	1	0,73				0,89			
Segregation index S (region)	Segregation index S computed over the entire territory and over four groups.	1	0,50				0,46			
Percent homogeneous villages	Percentage of village whose population belongs entirely to one of the four groups	1	78,49				80,19			

Variable	Description	obs	mean	s.d.	min	max	mean	s.d.	min	max
Fractionalization (village)	Expected value of the fractionalization index in a randomly drawn village.	530	0,07	0,16	0,00	0,72	0,06	0,15	0,00	0,66
Polarization (village)	Expected value of the discrete polarization index in a randomly drawn village.	530	0,15	0,31	0,00	1,00	0,12	0,27	0,00	1,00

Source: Authors' calculations based on data collected by international organizations in the area.

Table 4: Ethnic cleansing, fractionalization, polarization, and segregation across administrative units

Variable	Period	all	Bindisi	Foro-baranga	Garsila	Habila	Mukjar	Um-Dukhun	Um-Kher	Zalingei
			1	2	3	4	5	6	7	8
Number of villages		530	63	51	107	58	65	103	75	8
Population	before	142906	16094	13679	34474	12615	15587	24869	24102	1486
Share FMZ	before	0,70	0,62	0,36	0,93	0,75	0,85	0,53	0,70	0,56
Population	after	93860	13524	14730	16541	12169	6661	16991	12389	855
Targeted population cleansed (Z^c)		57263	3312	2025	18400	2342	8571	9606	12439	568
Share of targeted population cleansed (Z^c/P^c)		0,57	0,33	0,41	0,57	0,25	0,65	0,73	0,74	0,68
Share of total population cleansed (Z^c/P)		0,40	0,21	0,15	0,53	0,19	0,55	0,39	0,52	0,38
Fractionalization index H (region)	before	0,46	0,52	0,67	0,13	0,39	0,27	0,58	0,47	0,59
Polarization index Q (region)		0,73	0,86	0,83	0,25	0,69	0,49	0,90	0,75	0,85
Percent homogeneous villages		78,49	61,90	64,71	97,20	75,86	87,69	79,61	70,67	50,00
Segregation index S (region)		0,50	0,51	0,26	0,75	0,37	0,49	0,42	0,47	0,45
Expected fractionalization (village)		0,07	0,15	0,11	0,01	0,09	0,05	0,07	0,09	0,15
Expexted polarization (village)		0,15	0,29	0,20	0,02	0,17	0,09	0,13	0,18	0,29
Fractionalization index H (region)	after	0,64	0,61	0,59	0,29	0,56	0,46	0,50	0,67	0,62
Polarization index Q (region)		0,89	0,89	0,82	0,55	0,85	0,77	0,79	0,98	0,81
Percent homogeneous villages		80,19	58,73	74,51	95,33	77,59	92,31	81,55	73,33	50,00
Segregation index S (region)		0,46	0,42	0,17	0,74	0,30	0,50	0,37	0,56	0,34
Expected fractionalization (village)		0,06	0,15	0,05	0,01	0,08	0,03	0,07	0,06	0,15
Expected polarization (village)		0,12	0,27	0,10	0,03	0,15	0,05	0,13	0,12	0,30

Source: Authors' calculations based on data collected by international organizations in the area.

Appendix 1:

List of tribes and population shares

Group	before	after	group	before	after
Asangor	0,12%	0,14%	BaniHussien	0,54%	0,83%
Barnow	0,04%	0,07%	Bediria	0,03%	0,09%
Borgo	1,84%	4,10%	Hiamat	0,69%	1,64%
Dagal	0,01%	0,02%	Hotia	0,08%	0,15%
Dajo	2,73%	4,69%	Irigat	0,05%	0,10%
Eringa	0,51%	1,52%	Juami	0,08%	0,13%
Falatta	0,21%	0,25%	Kuzam	0,56%	1,17%
Fungaro	0,01%	0,00%	Mahadi	0,38%	0,62%
Fur	54,08%	31,75%	Mahamid	0,00%	0,09%
Gimier	1,31%	1,87%	Mahareya	0,93%	1,80%
Hawsa	0,07%	0,14%	Meseriya	2,63%	4,81%
Kajakssa	0,68%	0,73%	Naja	0,31%	0,50%
Mararit	0,46%	0,66%	Nawaiba	0,58%	1,75%
Masalit	16,08%	14,37%	Rezigat	0,91%	1,51%
MeseriyaJabal	0,62%	0,84%	Ruaina	0,03%	0,00%
Mimi	0,16%	0,07%	Saada	0,04%	0,06%
Mubi	0,03%	0,06%	Salamat	2,59%	6,45%
Rongar	0,06%	0,02%	Sharaffa	0,35%	0,59%
Singar	1,46%	3,05%	Taisha	0,35%	0,54%
Tama	4,75%	7,07%	Tallba	0,07%	0,16%
Zagawa	0,20%	0,83%	Targam	0,13%	0,33%
Total African tribes	85,43%	72,26%	OtherArab	0,01%	0,13%
ArabZagawa	0,04%	0,05%	Total Arab tribes	13,85%	28,01%
AuladIdd	0,25%	0,45%	AuladAmier	0,00%	0,00%
AuladGonab	0,04%	0,10%	AuladGinub	0,00%	0,00%
AuladJanoub	0,01%	0,01%	AlHamid	0,69%	0,35%
AuladRashid	0,64%	1,13%	Jalul	0,00%	0,00%
AuladZaid	0,01%	0,01%	Rashida	0,02%	0,03%
Awatifa	0,27%	0,30%	Sefadin	0,00%	0,00%
BaniHallba	0,93%	1,97%	Sura	0,01%	0,02%
BaniHazam	0,02%	0,03%	Total other tribes	0,72%	0,39%

Note: authors' calculations based on data collected by international organizations in
the area.

Impact on society: alternative grouping choices

Group	obs	before				after			
		mean	s.d.	min	max	mean	s.d.	min	max
Method 2: Tribes as groups									
Fractionalization index H (region)	1	0,68				0,87			
Polarization index Q (region)	1	0,65				0,42			
Fractionalization index H_i (village)	530	0,17	0,27	0,00	0,85	0,15	0,26	0,00	0,89
Polarization index Q_i (village)	530	0,24	0,37	0,00	1,00	0,21	0,35	0,00	1,00
Percent homogeneous villages	1	0,68				0,70			
Method 3: African/Arab/other tribes									
Fractionalization index H (region)	1	0,25				0,41			
Polarization index Q (region)	1	0,49				0,81			
Fractionalization index H_i (village)	530	0,02	0,07	0,00	0,51	0,03	0,10	0,00	0,50
Polarization index Q_i (village)	530	0,03	0,14	0,00	1,00	0,06	0,21	0,00	1,00
Percent homogeneous villages	1	0,93				0,88			
Segregation index S	1	0,49				0,42			

Note: authors' calculations based on data collected by international organizations in the area.

Figure 1: Eight administrative units in Southwestern Darfur included in the sample
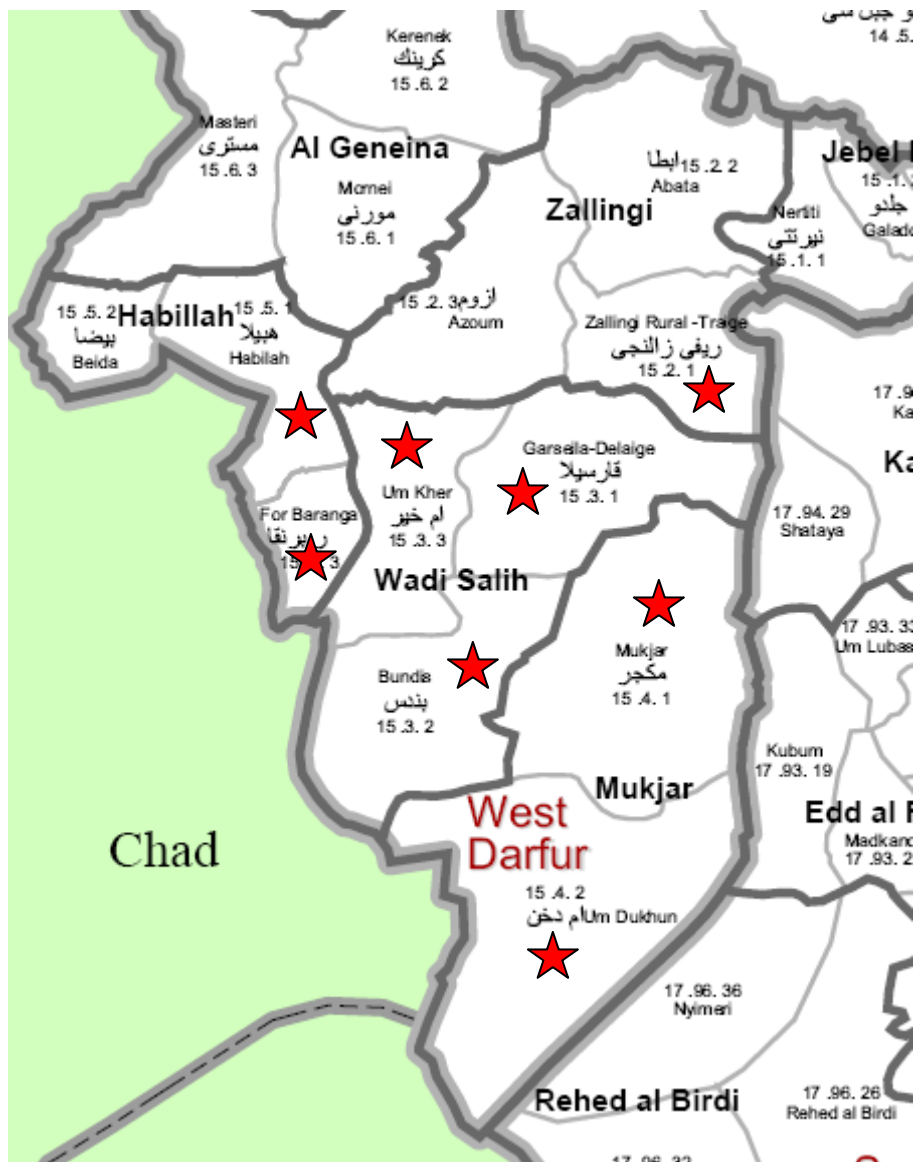
Note: The map shows the eight administrative units (marked by a red star) that are covered in the study. The administrative units are Habila (Habilah on map), Forobaranga (For Baranga), Um-Kher (Um Kher), Garsila (Garseila-Delaige), Bindisi (Bundis), Mukjar (Mukjar), Um-Dukhun (Un Dukhun), and Zalingei (Zallingi Rural-Traige). Source: Relief Web (2009)

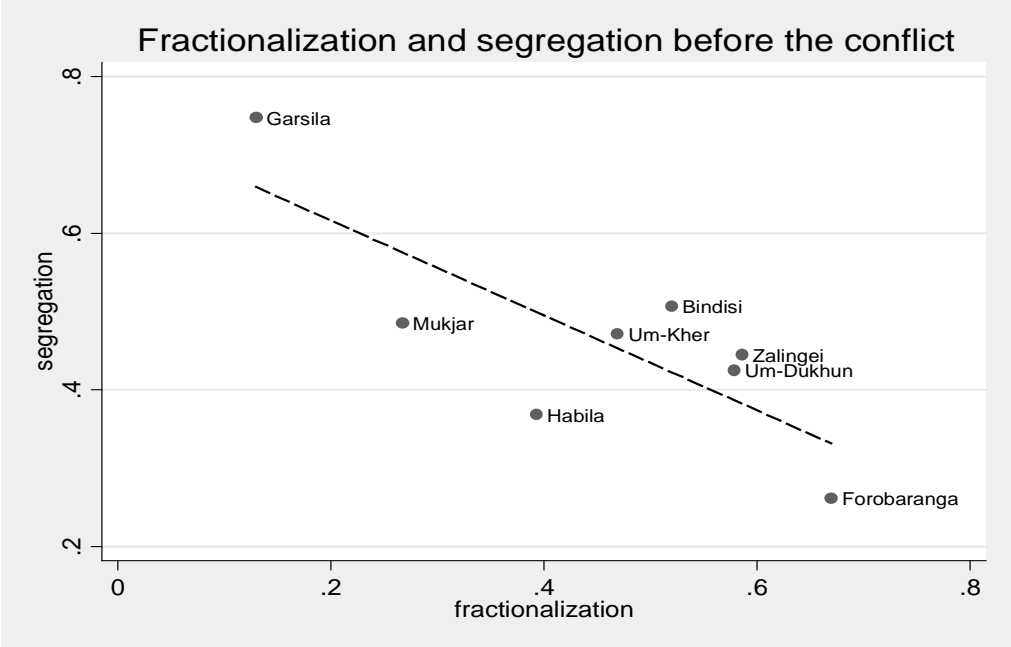**Figure 2:** Levels of fractionalization (*H*) and segregation (*S*) before conflict among eight administrative units

Fractionalization and segregation before the conflict

Figure 3: Levels of fractionalization (*H*) and segregation (*S*) after conflict among eight administrative units
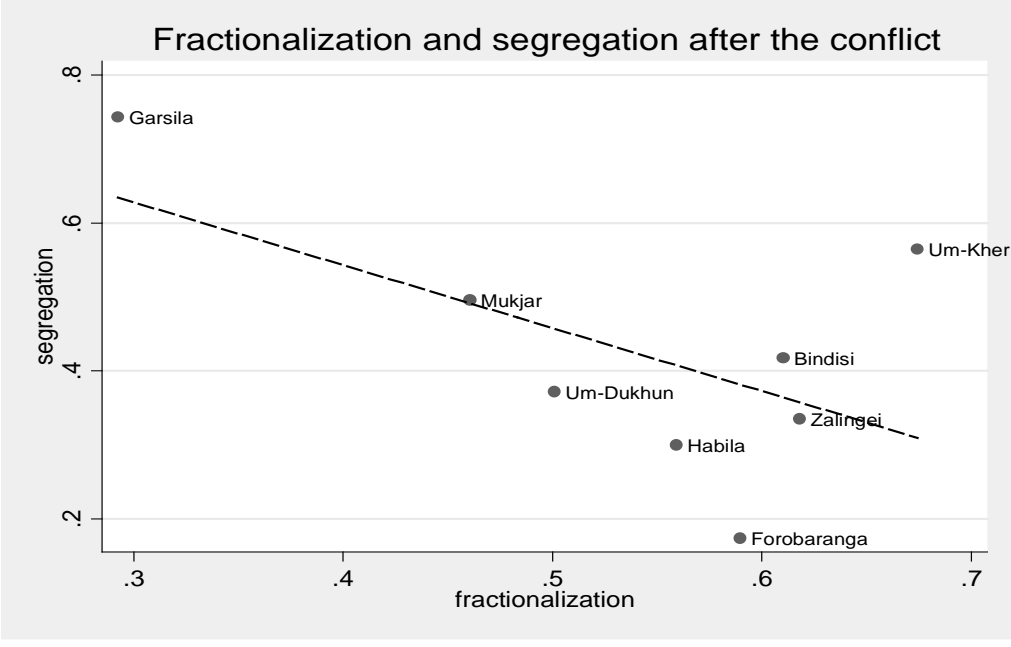

Fractionalization and segregation after the conflict

Figure 4: Levels of ethnic cleansing as a result of conflict (Z^C/P^C) and segregation before conflict (S) among eight administrative units

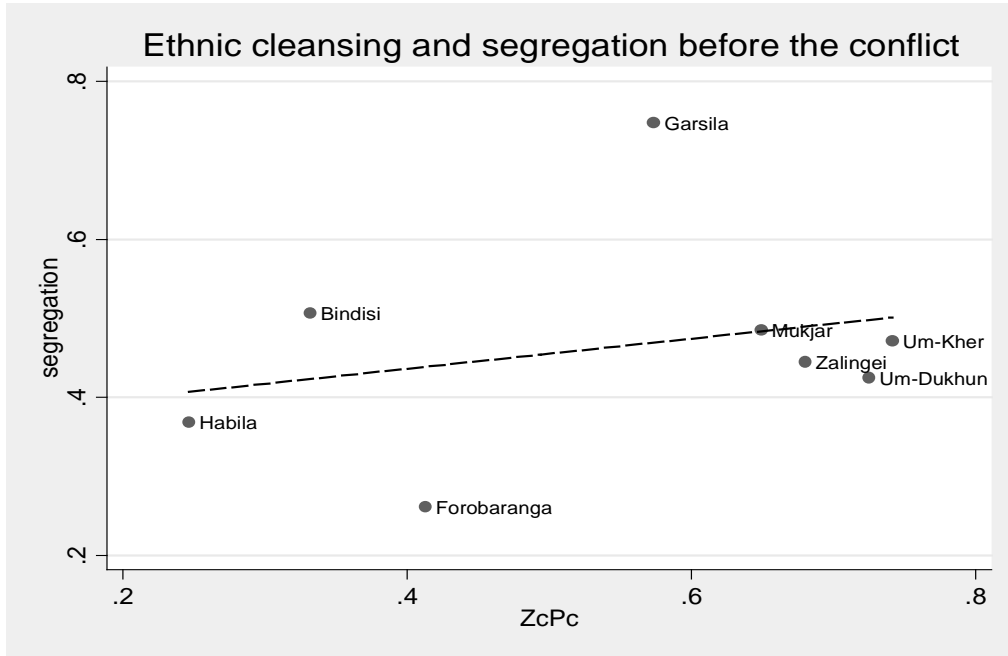Ethnic cleansing and segregation before the conflict

Figure 5: Levels of ethnic cleansing as a result of conflict (Z^C/P^C) and segregation after conflict (S) among eight administrative units

Ethnic cleansing and segregation after the conflict