DISCUSSION PAPER SERIES

DP13368

MEASURING ETHNIC STRATIFICATION AND ITS EFFECT ON TRUST IN AFRICA

Roland Hodler, Sorawoot Srisuma, Alberto Vesperoni and Noemie Zurlinden

DEVELOPMENT ECONOMICS AND PUBLIC ECONOMICS

ISSN 0265-8003

MEASURING ETHNIC STRATIFICATION AND ITS EFFECT ON TRUST IN AFRICA

Roland Hodler, Sorawoot Srisuma, Alberto Vesperoni and Noemie Zurlinden

Discussion Paper DP13368
Published 06 December 2018
Submitted 05 December 2018

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

MEASURING ETHNIC STRATIFICATION AND ITS EFFECT ON TRUST IN AFRICA

Abstract

We define and axiomatically characterize an index of ethnic stratification that measures the extent to which the hierarchy in socio-economic positions across the individuals of a society follows ethnolinguistic lines. This index generalizes the idea of between-group inequality to situations where data on economic and ethnolinguistic distances between pairs of individuals is available. We define an estimator of our index that takes the form of a second order U-statistic and has well-behaved statistical properties, and we show that ethnic stratification is empirically related to low levels of trust in other people and institutions at the local level in Africa.

JEL Classification: D31, D63, Z13

Keywords: inequality, ethnic diversity, ethnic fractionalization, Trust

Roland Hodler - roland.hodler@unisg.ch
Universität St Gallen and CEPR

Sorawoot Srisuma - s.srisuma@surrey.ac.uk
University of Surrey

Alberto Vesperoni - alberto.vesperoni@gmail.com
University of Klagenfurt

Noemie Zurlinden - noemie.zurlinden@unisg.ch
Universität St.Gallen

Acknowledgements
We acknowledge helpful comments by Joan-Maria Esteban and Santiago Sanchez-Pages as well as participants at the World Congress of the Econometric Society and the Conference of the Development Economics Network Switzerland 2018.

Measuring Ethnic Stratification and its Effect on Trust in Africa*

Roland Hodler† Sorawoot Srisuma‡
Alberto Vesperoni§ Noémie Zurlinden¶

December 3, 2018

Abstract

We define and axiomatically characterize an index of ethnic stratification that measures the extent to which the hierarchy in socio-economic positions across the individuals of a society follows ethnolinguistic lines. This index generalizes the idea of between-group inequality to situations where data on economic and ethnolinguistic distances between pairs of individuals is available. We define an estimator of our index that takes the form of a second order U-statistic and has well-behaved statistical properties, and we show that ethnic stratification is empirically related to low levels of trust in other people and institutions at the local level in Africa.

JEL classification: D31; D63; Z13.
Keywords: Inequality; ethnic diversity; ethnic fractionalization; trust.

*We acknowledge helpful comments by Joan-Maria Esteban and Santiago Sanchez-Pages as well as participants at the World Congress of the Econometric Society and the Conference of the Development Economics Network Switzerland 2018.

†Department of Economics, University of St.Gallen; CEPR; CESifo; email: roland.hodler@unisg.ch.
‡School of Economics, University of Surrey; email: s.srisuma@surrey.ac.uk.
§Department of Economics, Alpen-Adria University Klagenfurt; email: alberto.vesperoni@gmail.com.
¶Department of Economics, University of St.Gallen; email: noemie.zurlinden@unisg.ch.

1 Introduction

A main goal of the social sciences is to understand and predict cooperation and social conflict, whereby the latter is a broad concept spanning from mistrust and low sense of community to outbreaks of organized violence. Economic and ethnic differences within societies are both well-known determinants of social conflicts.[1] Kanbur (2006) points out that since individuals identify and share resources within their social groups while possibly discriminating against outsiders, economic inequality between social groups is of special significance to understand social conflict even if it accounts for only a relatively small share of the economic inequality in a society.[2] This view is consistent with empirical evidence showing that high levels of between-group inequality are related to low public good provision (Baldwin and Huber, 2010), low levels of trust (Tesei, 2015), poor economic performance (Alesina et al., 2016) and even civil war (Østby, 2008; Cederman et al., 2011). In this paper, we focus on the unequal distribution of economic resources across ethnically diverse individuals, but propose and apply an approach that goes beyond between-group inequality.

From a methodological viewpoint, measures of between-group inequality employ social traits exclusively to partition the population into social groups (e.g., ethnicity A versus ethnicity B). Hence, these traits have a purely categorical role. However, in applications richer data may be available that include a measure of social distance between social groups. For instance, in the literature on ethnic diversity, it is common to proxy for the degree of 'alienation' between two members of different ethnolinguistic groups using the dissimilarity of the languages they speak (e.g., Fearon, 2003; Desmet et al., 2009). Consider the three most common languages in Nigeria: Hausa, Igbo and Yoruba. The latter two are closer to one another than to Hausa, as they both belong to the Niger-Congo language family while Hausa is an Afroasiatic language. There may be good reasons for taking this information into account: First, if we want to measure how unequally economic resources are distributed across 'alienated' individuals, then we may want to give more weight to economic differences between a Hausa and an Igbo than to economic differences between an Igbo and a (linguistically fairly similar) Yoruba. Second, when using ethnicity as a categorical variable, the arbitrary decision of whether to treat two closely related ethnicities as a single group or as two distinct groups may have a large effect on between-group inequality. In contrast, social distances allow 'smoothening' this problem by giving a small, but non-zero weight to economic differences between members of closely related ethnicities. More generally, the measurement of social distance is a broad, interdisciplinary subject dealing with understanding how separated a population is in terms of social identities, making it worthwhile to develop a measure in the spirit of between-group inequality that can take social distances into account.

In this paper, we propose a predictor of social conflict that combines both economic and

[1] See, e.g., Horowitz (1985), who notes that the two may sustain each other via self-fulfilling mechanisms.

[2] Reviewing the empirical literature, Kanbur (2006) finds that between-group inequality typically accounts for less than 15% of economic inequality in a population. See Cowell and Jenkins (1995) for a formalization of the explanatory power of the between-group component relative to the within-group component.

ethnolinguistic traits within the same framework and generalizes the idea of between-group inequality by weighting economic inequalities between pairs of individuals by their ethnolinguistic distances. We call the proposed measure an index of *ethnic stratification.* Social stratification refers to the hierarchy in socio-economic positions in a population, and ethnic stratification, therefore, to the extent to which the hierarchy in socio-economic positions follows ethnolinguistic lines.

In our theoretical framework, we consider a distribution of two attributes in a population: economic resources (wealth) and social traits (ethnicities and the corresponding ethnolinguistic differences).[3] We assume that there is some degree of alienation (or mistrust) between each pair of individuals that is determined by the distances between their economic and social attributes, and we restrict our attention to a class of bivariate measures that are expressions of the *expected alienation* between a randomly selected pair. Having introduced this general class of measures, we focus on a particular index from this class where the alienation of each pair is defined by the product of their economic and social distances. We argue that this index satisfies the essential feature of ethnic stratification as a generalization of between-group inequality, i.e., that the economic and social distances between two individuals are counted only if these individuals are both socially and economically diverse. In this sense, our index presents a strong degree of *complementarity* across dimensions.

Ethnic stratification, as we define it, depends on two crucial forces: the overall magnitude of economic and ethnolinguistic distances and their co-directionality, i.e., the extent to which these distances correlate across pairs of individuals. To distinguish between these forces we present a decomposition of our index into four parts: the average wealth in the population, the Gini coefficient of the wealth distribution, the coefficient of ethnic fractionalization, and a residual term capturing the co-directionality of wealth distances and ethnolinguistic distances. To further clarify the properties of ethnic stratification, we present an axiomatic characterization that uniquely identifies our index from the class of measures of expected alienation via a set of axioms that we motivate as desirable properties of a measure that generalizes between-group inequality. We consider three axioms: *co-directionality by wealth creation or transfer*, *bi-polarization by wealth transfer*, and *co-directionality by linguistic change.* While the first two axioms consider shifts in the wealth distribution, the third axiom considers shifts in the distribution of ethnolinguistic distances all else equal. Each of these axioms focuses on a particular trade-off between increasing/decreasing the magnitude of wealth or ethnolinguistic distances and decreasing/increasing their co-directionality to maintain a given level of ethnic stratification.

Our index can be readily applied to data, and there are at least two ways it can be used. First, as a summary statistic for directly comparing ethnic stratifications across populations (e.g., cross-country comparisons). In particular, we show that our index possesses the struc-

[3]Through the paper, we use the terms economic resources/wealth and social traits/ethnolinguistic traits interchangeably, but tend to use the former, more general terms in the theoretical sections and the latter, more specific terms in the empirical sections.

ture of a second order U-statistic (Hoeffding, 1948), which can be used to derive consistency and asymptotic normality under very weak conditions. Second, our index can be used as a key variable to explain and predict social conflict in regression analyses. We illustrate the use of our index in both manners, but focus on the latter (as is commonly done in related empirical literatures).

We use data from geocoded Afrobarometer surveys (BenYishay et al., 2017) for 26 African countries. We match the respondents' ethnic groups and native languages to the languages listed in the Ethnologue (Gordon Jr., 2005), which allows us to use linguistic trees to calculate ethnolinguistic distances between pairs of individuals. We further construct a wealth index, which allows us to calculate economic distances between pairs of individuals. These distances enable us to compute ethnic stratification not only at the country level but also at the town and village level. To investigate whether ethnic stratification is a predictor of social conflict at the local level, we examine its relationship with *trust.* In particular, we focus on questions on trust in relatives, neighbors, other acquaintances and local political institutions asked in Afrobarometer surveys of round 5 (conducted in 2011–2013). In addition, we use questions on trust in people from the respondents' own and other ethnic groups from Afrobarometer surveys of round 3 (conducted in 2005–2006).

We find that local ethnic stratification decreases trust in people an individual knows as well as trust in local political institutions. This effect remains robust when controlling for the Gini coefficient of the wealth distribution and the coefficient of ethnic fractionalization. Moreover, these two coefficients do not have a statistically significant effect on their own. This result suggests that economic and ethnolinguistic distances between individuals matter, but only if they are captured jointly as by our index of ethnic stratification. We also provide some evidence that individuals trust their co-ethnics more than members of other ethnic groups and that this trust differential increases in ethnic stratification.

The paper develops as follows: Section 2 reviews the literature. Section 3 introduces our index and its decomposition, and presents its axiomatic characterization. Statistical inference is discussed in Section 4. Sections 5 and 6 bring the ethnic stratification index to the data and present our estimates of the effect of local ethnic stratification on trust in African towns and villages. Section 7 concludes. All proofs are in the Appendix.

2 Related literature

This paper is related to the theoretical literature on inequality and diversity measurement as well as the empirical literatures on the consequences of between-group inequality and the determinants of trust. Our review is divided into two sections accordingly.

2.1 Theoretical literature on inequality and diversity measurement

The theoretical literature related to our contribution is vast, partly because we stand at the intersection between inequality and diversity measurement. Chakravarty (2015) presents a comprehensive review of both fields. In this section we focus on contributions that are particularly close to our framework and methodology. To start with, we see ethnic stratification as an extension of the concept of between-group inequality and our measure is evidently related to the group decomposition of the Gini coefficient. The axiomatic approach to between-group inequality started with a series of seminal contributions characterizing indices decomposable in between-group and within-group components (e.g., Bourguignon, 1979; Cowell, 1980; Shorrocks, 1980). In particular, Shorrocks (1980) shows that, to be decomposable in such fashion, an index must belong to the class of Generalized Entropy measures. As the Gini coefficient does not belong to this class, its decomposition presents a residual term which has been subject of various studies and interpretations.[4] Roughly speaking, our index of ethnic stratification can be seen as a generalization of the complement of the within-group component of the Gini coefficient, i.e., the sum of the between-group component and the residual.

In a broader perspective, our index can be seen as a special type of multivariate inequality measure with two dimensions: economic and social traits. All multivariate inequality measures present a certain degree of complementarity across dimensions, which is typically moderate. In this work we deliberately focus on a particularly high degree of complementarity to capture the essential feature of ethnic stratification as a generalization of between-group inequality, i.e., that economic and social distances between individuals are counted only if they differ in both dimensions. Within the context of multivariate inequality, our index can be seen as a bivariate extension of the Gini coefficient. Other multivariate Gini indices are defined in Koshevoy and Mosler (1997), Gajdos and Weymark (2005) and Banerjee (2010). In particular, the distance-Gini mean difference of Koshevoy and Mosler (1997) and symmetric indices of the class of measures characterized in Theorem 4 of Gajdos and Weymark (2005) belong to our class of measures of expected alienation for the bivariate case. However, as the economic distances between socially identical individuals are counted in the measurement of inequality in their models, their indices do not satisfy the before-mentioned essential feature of ethnic stratification as a generalization of between-group inequality.[5]

Our index can also be interpreted as a diversity measure in the form of a bivariate exten-

[4]Gini himself denoted it the 'transvariation' coefficient. Within the literature, Ebert (1988) interprets the residual as a measure of the overlap of groups' distributions, while Lambert and Aronson (1993) explore its geometrical properties and link it to the Lorenz curve. There are many ways of decomposing the Gini coefficient, which lead to alternative formulations of the residual. See Deutsch and Silber (1999) for a review.

[5]Other multivariate inequality measures that present high complementarity degree belong to the Generalized Entropy family and are characterized in Tsui (1995, 1999). The Entropy indices are not measures of expected alienation and, more generally, are not based on distances between individuals but on individual traits that should be meaningfully ordered from high to low (e.g., income, years of education). This is a crucial limitation in the context of diversity measurement.

sion of the univariate fractionalization index characterized in Bossert et al. (2011). This index is originally formulated in Greenberg (1956) and it generalizes the well-known ethnic fractionalization (ELF) index by introducing continuous distances between languages.[6] Among other diversity measures, the univariate polarization indices in Esteban and Ray (1994), Duclos et al. (2004), and Reynal-Querol and Montalvo (2005) are related to our model but present a crucial difference: while we assume that the alienation between two individuals is only determined by the distance of their attributes, they additionally consider how many individuals share an attribute with them (i.e., the group effect).[7] To the best of our knowledge there are no multivariate fractionalization measures in the literature,[8] while there are some multivariate polarization indices that use categorical attributes to define groups. Permanyer (2012) and Permanyer and D'Ambrosio (2015) axiomatically characterize bivariate measures where groups are defined via a categorical attribute and the polarization between groups is quantified via a cardinal or ordinal attribute. Other non-axiomatic contributions present similar features (e.g., Gigliarano and Mosler, 2009).

2.2 Empirical literatures on between-group inequality and trust

The empirical part of our paper is linked to the literatures on the politico-economic consequences of between-group inequality and the determinants of trust in Africa and elsewhere.

Cross-country studies document negative effects of between-group inequality. Alesina et al. (2016) measure inequality between ethnic groups using nighttime lights in the groups' homelands and find that between-group inequality is inversely related to real GDP per capita in a large sample of countries. Baldwin and Huber (2010) find that between-group inequality is negatively related to public goods provision, and Kyriacou (2013) show that it reduces the quality of government in developing countries. Relatedly, Houle and co-authors show that high between-group inequality leads to ethnic identification (Higashijima and Houle, 2018), ethnic voting (Houle et al., 2018), and an increase in the risk of coups (Houle and Bodea, 2017).[9] Many others study whether between-group inequality (sometimes called horizontal inequality) fosters civil conflict. Østby (2008) provides evidence that conflicts are more likely if there are inequalities in educational outcomes between ethnic groups. In the same vein,

[6] From a purely mathematical viewpoint, the ELF index is equivalent to the complement of the Herfindahl index, a measure of market concentration that is widely applied in industrial organization.

[7] When comparing the performance of various diversity measures in predicting outcomes related to social conflict, Desmet et al. (2012) rarely find significant differences between polarization and fractionalization measures, indicating that omitting the group effect may be of secondary importance. Indeed, there can be an ambiguity on the degree (and even direction) of the effect of group size on the ability of a group to mobilize for collective action due to the opposing forces of economies of scale and free-riding (e.g., Olson, 1965; Isaac and Walker, 1988; Feddersen and Pesendorfer, 1998; Guarnaschelli et al., 2000; Esteban and Ray, 2001).

[8] Hodler et al. (2017) propose an analogous framework for the measurement of ethnic segregation based on spatial and ethnolinguistic distances. Their axiomatic characterization treats the spatial and ethnolinguistic dimensions symmetrically, while in this paper we consider specific axioms for the economic dimension based on progressive/regressive transfers of wealth in the tradition of inequality measurement.

[9] Similarly, Huber and Suryanarayan (2016) investigate the effect of between-group inequality on party ethnification across Indian states.

Gubler and Selway (2012) show that civil war onset is less likely if ethnicity is cross-cut by socioeconomic class. Cederman et al. (2011) show that relatively rich and poor ethnic groups are more likely to be involved in violent conflicts than groups with a wealth level closer to the country average. Similarly, Guariso and Rogall (2017) find that ethnic groups are more likely to engage in civil conflicts when rainfall is scarcer in their homeland than the homeland of the most powerful group. In contrast, Huber and Mayoral (2014) do not find any relation between between-group inequality and civil conflict. So far, few studies have looked at the politico-economic effects of between-group inequality at the subnational level. A notable exception is Tesei (2015), whose study we discuss below.

Trust is generally seen as an important contributor to economic growth and government quality (e.g., Knack and Keefer, 1997; Zak and Knack, 2001; Knack, 2002; Durlauf and Fafchamps, 2005; Algan and Cahuc, 2010). Therefore, it is not surprising that a large literature has emerged that looks at the determinants of trust. Focusing on the United States, Alesina and La Ferrara (2002) find that individuals living in racially mixed or economically unequal localities have lower trust. The same pattern has been documented for other countries, including Australia (Leigh, 2006) and Sweden (Gustavsson and Jordahl, 2008). Tesei (2015) is the first one to investigate the effect of economic inequality between groups on trust. He finds that higher between-group inequality lowers generalized trust across US municipalities. Moreover, he documents that the negative effects of economic inequality and ethnic fractionalization on generalized trust turn insignificant once he accounts for between-group inequality. His contribution is probably the closest to our empirical part. There are, however, three important differences: First, we focus on towns and villages in Africa, while Tesei (2015) focuses on US municipalities, clearly making these papers complementary. Second, we apply our index of ethnic stratification, which is based on ethnolinguistic distances between pairs of individuals, while he uses a measure of between-group inequality that treats ethnicity as a categorical variable. Third, our dependent variables measure trust in people an individual knows and in local institutions, while he focuses on generalized trust.

At a more general level, our empirical part contributes to the growing literature on the determinants of trust in Africa. One strand of this literature documents the importance of the traditional structure of society and historical experiences. Prominent examples include Nunn and Wantchekon (2011), who focus on the effects of the trans-Atlantic slave trade, Gershman (2016), who looks at witchcraft, and Moscona et al. (2017), who study the importance of whether ethnic groups are organized as segmentary lineage societies. Another strand studies how current events shape trust. For example, Rohner et al. (2013) find that trust deteriorates with conflict intensity in Uganda; and Sangnier and Zylberberg (2017) provide evidence that trust in political institutions decreases after protests. More closely related to our work, Robinson (2017) focuses on the relation between ethnic diversity and trust in African countries. She finds that the gap between trust in co-ethnics and trust in members of other ethnic groups is greater in more ethnically diverse countries, but lower in more diverse regions within countries. Robinson (2016) further documents that this trust gap decreases as

national identification becomes more salient. We contribute to this literature by establishing that ethnic stratification is an important predictor of trust in people an individual knows and trust in local institutions across African towns and villages.

3 Model

In this section, we first introduce our index of ethnic stratification. We then present a decomposition and an axiomatic characterization.

3.1 Definition of ethnic stratification

Consider a population constituted by a large set of individuals $P \subseteq \mathbb{R}_+$. Each individual in this population is associated with an ethnicity and a wealth level. We denote by $f(e, w)$ the density of individuals in the population that are associated with ethnicity $e \in E \subseteq \mathbb{R}_+$ and wealth level $w \in W \subseteq \mathbb{R}_+$, referring to $f : E \times W \to \mathbb{R}_+$ as the density function of the joint distribution of ethnicity and wealth.[10] We measure the distance between each pair of wealth levels $w, w' \in W$ by the absolute value of their difference, $|w - w'|$. Unlike wealth levels, ethnicities are not necessarily ordered in a meaningful way in E. To measure the distance between ethnicities, we assume that each ethnicity is associated with a language and denote by $\lambda(e, e') \in \mathbb{R}_+$ the distance between the languages of each pair of ethnicities $e, e' \in E$. We refer to $\lambda : E^2 \to \mathbb{R}_+$ as the linguistic function. In line with the idea of distance, we assume $\lambda(e, e) = 0$ and $\lambda(e, e') = \lambda(e', e)$ for each $e, e' \in E$.[11] In what follows, we assume that the relevant characteristics of the population are summarized by a pair of density and linguistic functions. Hence, each pair (f, λ) can be interpreted as a different population (or society).

Denoting by $e_i \in E$ and $w_i \in W$ the ethnicity and wealth level of each individual $i \in P$ and by $m > 0$ the size (or mass) of the population, our starting point is the general class of measures

$$\begin{aligned}\mathcal{M}(f, \lambda) :=& \frac{1}{m^2} \int_{i \in P} \int_{j \in P} \pi\left(\lambda(e_i, e_j), |w_i - w_j|\right) dj di \\ =& \int_{e \in E} \int_{e' \in E} \int_{w \in W} \int_{w' \in W} f(e, w) f(e', w') \pi\left(\lambda(e, e'), |w - w'|\right) dw' dw de' de, \end{aligned} \tag{1}$$

where $\pi : \mathbb{R}_+^2 \to \mathbb{R}_+$ can be any function that is continuous and non-decreasing in each dimension satisfying $\pi(0, 0) = 0$ and $\pi(a, b) > 0$ for some $a, b > 0$. We interpret π as a quantification of the degree of alienation (e.g., mistrust or lack of common interest) between two individuals as a function of their distances. Hence, any measure from class (1) can be

[10] For a finite population, $f(e, w)$ represents the fraction of individuals associated with ethnicity $e \in E$ and wealth level $w \in W$.

[11] Another standard property of a distance is the triangle inequality, i.e., $\lambda(e, e') \leq \lambda(e, e'') + \lambda(e'', e')$ for each $e, e', e'' \in E$. We do not impose this property on λ as it is not necessarily satisfied by social distances. However, as the triangle inequality can be desirable in many contexts, our characterization is based on axioms in which the linguistic function satisfies the triangle inequality.

interpreted as the *expected alienation* between a randomly selected pair of individuals. As the function π is generic (additive, multiplicative, linear, exponential, etc.), this class is broad although it significantly narrows down the type of measures under consideration.[12]

We are now ready to define our index of ethnic stratification. For each pair (f, λ), we measure the degree of *ethnic stratification* in the population by the index

$$\begin{aligned} S(f,\lambda) :=& \frac{1}{m^2}\int_{i\in P}\int_{j\in P}\lambda(e_i,e_j)|w_i-w_j|djdi \\ =& \int_{e\in E}\int_{e'\in E}\int_{w\in W}\int_{w'\in W} f(e,w)f(e',w')\lambda(e,e')|w-w'|dw'dwde'de. \end{aligned} \tag{2}$$

This index belongs to class (1) and coincides with the multiplicative form $\pi(a,b) = ab$ for each $a, b \geq 0$. If the wealth and ethnolinguistic distances between any two individuals take value in the unit interval,[13] then they can be interpreted as the probabilities that the poorer individual feels economically deprived vis-a-vis the richer one and that the two individuals do not share a common ethno-cultural background, respectively. Then, the index (2) can be interpreted as the probability that, for a randomly selected pair of individuals, *both* these events occur so that the poorer individual may feel unjustly deprived due to different economic opportunities across ethno-cultural backgrounds.

3.2 Decomposition of ethnic stratification

We next show that our index of ethnic stratification depends on four different components. The first three components are common measures of average wealth, wealth inequality and ethnic diversity. These components capture the overall magnitude (or scale) of the wealth and ethnolinguistic distances across pairs of individuals. A fourth component instead captures the role played by the co-directionality of these distances.

We start by showing that our index of ethnic stratification nests common measures of wealth level, inequality and ethnic diversity. Letting f be any density function, the densities of the marginal distributions of ethnicity and wealth are $\varphi_f(e) := \int_{w\in W} f(e,w)dw$ and $\gamma_f(w) := \int_{e\in E} f(e,w)de$, respectively.[14] We consider three indices that summarize properties of the marginal distributions that are relevant for the decomposition of ethnic stratification: the *average wealth*

$$\mu(\gamma_f) := \frac{1}{m}\int_{i\in P} w_i di = \int_{w\in W}\gamma_f(w)wdw,$$

[12]See Section 2.1 for a discussion of related approaches in the literature on polarization measurement.

[13]This can be readily achieved by dividing these distances by the maximal distances within a superset of the population. For instance, if we are interested in cross-country comparisons, this can be done by dividing all wealth (ethnolinguistic) distances within each country by the maximal wealth (ethnolinguistic) distance between two individuals within the joint set of all the countries' populations.

[14]For a finite population, $\varphi_f(e)$ represents the fraction of individuals associated with ethnicity $e \in E$ independently of their wealth level, while $\gamma_f(w)$ represents the fraction of individuals associated with wealth level $w \in W$ independently of their ethnicity.

the *Gini coefficient* of inequality (in relative form) of the marginal distribution of wealth

$$G(\gamma_f) := \frac{1}{2\mu(\gamma_f)m^2}\int_{i\in P}\int_{j\in P}|w_i - w_j|djdi = \frac{1}{2\mu(\gamma_f)}\int_{w\in W}\int_{w'\in W}\gamma_f(w)\gamma_f(w')|w-w'|dw'dw,$$

and the coefficient of *fractionalization* of the marginal distribution of ethnicity[15]

$$F(\varphi_f,\lambda) := \frac{1}{m^2}\int_{i\in P}\int_{j\in P}\lambda(e_i,e_j)djdi = \int_{e\in}\int_{e'\in E}\varphi_f(e)\varphi_f(e')\lambda(e,e')de'de.$$

To see that these indices are nested in our model, note that if ethnolinguistic distances 'didn't matter' in the sense that $\lambda(e,e') = 1$ for all $e,e' \in E$ (including $e = e'$), then the ethnic stratification of (f,λ) would be equal to (twice) the Gini coefficient in absolute form, i.e., $S(f,\lambda) = 2\mu(\gamma_f)G(\gamma_f)$. This identifies two scale effects related to the marginal distribution of wealth, as $\mu(\gamma_f)$ measures the average scale of wealth and $G(\gamma_f)$ the average scale of the wealth distances between all pairs of individuals relative to the average scale of wealth. Similarly, if wealth 'didn't matter' in an analogous way, the ethnic stratification of (f,λ) would be equal to $F(\varphi_f,\lambda)$, which represents the average scale of the ethnolinguistic distances between all pairs of individuals, identifying the scale effect related to the marginal distribution of ethnicity.

In what follows, we show that ethnic stratification would be equal to (twice) the product of the three indices above, $2\mu(f)G(f)F(f,\lambda)$, if wealth and ethnicities were independently distributed across all individuals of society (f,λ). We then argue that the deviation of the 'true' ethnic stratification $S(f,\lambda)$ from $2\mu(f)G(f)F(f,\lambda)$ captures the role played by the co-directionality of ethnolinguistic and wealth distances in shaping ethnic stratification in a society. To develop the argument formally, define the *benchmark* of density f as the density function $b_f : E\times W \to \mathbb{R}_+$ such that the marginal densities are identical to the ones of f and that ethnicity and wealth are independently distributed across individuals, i.e., $\varphi_{b_f}(e) = \varphi_f(e)$, $\gamma_{b_f}(w) = \gamma_f(w)$ and $b_f(e,w) = \varphi_{b_f}(e)\gamma_{b_f}(w)$. By extension, the benchmark of a pair (f,λ) is the pair (b_f,λ) constituted by the benchmark density of f and the same linguistic function λ. Figure 1 provides an example: The population (f,λ) is partitioned into three equally sized wealth classes that also correspond to three different ethnicities, while each ethnicity is proportionally represented within each wealth class in the corresponding benchmark (b_f,λ).

Proposition 1. *For each pair (f,λ), the ethnic stratification of the benchmark (b_f,λ) is*

$$S(b_f,\lambda) = 2\mu(\gamma_f)G(\gamma_f)F(\varphi_f,\lambda). \tag{3}$$

Proposition 1 offers various insights for the decomposition of ethnic stratification in terms of scale and co-directionality effects. First, it shows that the ethnic stratification of the bench-

[15]This is the fractionalization index proposed by Greenberg (1956) and axiomatically characterized by Bossert et al. (2011).

Figure 1: Illustration of a pair of density and linguistic functions and the corresponding benchmark. Notes: Each tone of gray indicates a different ethnicity, and ethnolinguistic distances between ethnicities are given by differences in tones of gray. Wealth levels are on the horizontal axis while the vertical axis measures the fraction of the population of each combination of ethnicity and wealth.

mark can be written as a function of the marginal densities γ_f and φ_f instead of f, providing a formal link between ethnic stratification and the three scale effects corresponding to the indices $\mu(\gamma_f)$, $G(\gamma_f)$ and $F(\varphi_f, \lambda)$. Second, in comparison to the ethnic stratification of the benchmark, the 'true' ethnic stratification of (f, λ) additionally depends on a fourth component that captures the co-directionality of ethnolinguistic distances and wealth distances across pairs of individuals. Roughly speaking, we should expect

$$S(f, \lambda) > S(b_f, \lambda),$$

i.e., a positive residual indicating co-directionality, whenever high (low) wealth distances tend to go hand in hand with high (low) ethnolinguistic distances across pairs of individuals, but $S(f, \lambda) < S(b_f, \lambda)$, i.e., a negative residual indicating 'reverse' co-directionality, whenever high (low) wealth distances tended to be associated with low (high) ethnolinguistic distances. To conclude, it follows from Proposition 1 that each of the three components $\mu(\gamma_f)$, $G(\gamma_f)$ and $F(\varphi_f, \lambda)$ captures a different scale effect, while the co-directionality effect is quantified by the deviation of the ethnic stratification of (f, λ) from the ethnic stratification of the benchmark (b_f, λ).[16]

Remark 1. *For each pair (f, λ), the three components of $S(b_f, \lambda) = 2\mu(\gamma_f)G(\gamma_f)F(\varphi_f, \lambda)$ indicate different scale effects, while the comparison $S(f, \lambda) \lesseqgtr S(b_f, \lambda)$ indicates the co-directionality effect.*

3.3 Axiomatic characterization of ethnic stratification

In what follows we show that a measure $M \in \mathcal{M}$ from class (1) satisfies a set of desirable properties (or axioms) if and only if it coincides with our index of ethnic stratification (2) up to positive scalar multiplication, i.e., $M = kS$ for some constant $k > 0$. We motivate our axioms as natural properties of an index of ethnic stratification that generalizes the idea of between-group inequality to situations where additional data on ethnolinguistic differences is available. For simplicity, we state our axioms by means of examples based on degenerate joint

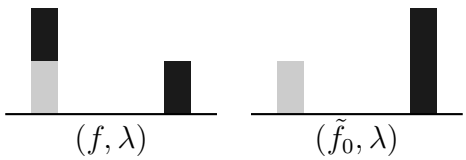
[16] This deviation could be formalized in many alternative ways, e.g., the subtractive form $S(f, \lambda) - S(b_f, \lambda) \lesseqgtr 0$, the ratio form $S(f, \lambda)/S(b_f, \lambda) \lesseqgtr 1$, the logarithmic form $\ln[S(f, \lambda)/S(b_f, \lambda)] \lesseqgtr 0$, or the exponential form $\exp[S(f, \lambda) - S(b_f, \lambda)] \lesseqgtr 1$. Each of these formalizations would lead to a different decomposition of ethnic stratification into the three parts $\mu(\gamma_f)$, $G(\gamma_f)$ and $F(\varphi_f, \lambda)$ plus the corresponding version of co-directionality.

distributions consisting of two or three mass points. These examples consist of comparative static exercises (or shifts) in the functions f and λ, and our axioms impose ethnic stratification to increase (or at least not to decrease) as a consequence of these shifts, all else equal. We consider three axioms in total, two considering shifts in the density function f and one shifts in the linguistic function λ. Each axiom thereby focuses on a different trade-off between increasing/decreasing the overall magnitude of wealth or ethnolinguistic distances and decreasing/increasing their co-directionality.

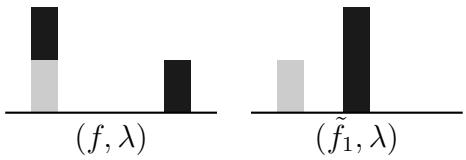
Our first axiom, *co-directionality by wealth creation or transfer (CDbW)*, considers shifts in the density function induced by wealth creation or progressive (i.e., inequality-decreasing) wealth transfers within ethnicities such that the population becomes clustered into two groups whose members are perfectly homogeneous in terms of ethnicity and wealth level, thus strongly enhancing the co-directionality of wealth and ethnolinguistic distances at the cost of (possibly) reducing the magnitude of wealth distances. Let the pair (f, λ) be such that the population is partitioned into three equally sized sets $P_1, P_2, P_3 \subset P$. Suppose that all individuals in P_2 hold wealth level w_1 while all individuals in $P_1 \cup P_3$ hold wealth level w_2, where $w_1 > w_2$ so that $P_1 \cup P_3$ are the poor and P_2 are the rich. Moreover, assume that the population is partitioned into two ethnicities, labelled 1 and 2, speaking different languages, and that all individuals in P_1 belong to ethnicity 1 while all individuals in $P_2 \cup P_3$ belong to ethnicity 2. This description implies the density $f(1, w_2) = f(2, w_1) = f(2, w_2) = 1/3$ and $\lambda(1, 2) > 0$. Axiom CDbW requires that ethnic stratification should not decrease when wealth is created or transferred to the point that all individuals in $P_2 \cup P_3$ come to hold the same wealth level $(1 - \epsilon)w_1 + \epsilon(w_1 + w_2)/2$, where $\epsilon \in [0, 1]$ denotes the fraction of wealth that is transferred from P_2 to P_3 while the remaining fraction is created by P_3. As a result, the population becomes clustered into two groups (P_1 and $P_2 \cup P_3$) whose members are perfectly homogeneous in terms of both ethnicity and wealth level. Figure 2 provides graphical representations of the cases of full wealth creation ($\epsilon = 0$) and full wealth transfer ($\epsilon = 1$).

Co-directionality by wealth creation or transfer (CDbW). Consider any pair (f, λ) that satisfies the aforementioned restrictions. For each $\epsilon \in [0, 1]$, we assume $M(\tilde{f}_\epsilon, \lambda) \geq M(f, \lambda)$ for the density function $\tilde{f}_\epsilon$ that satisfies $\tilde{f}_\epsilon(1, w_2) = 1/3$ and $\tilde{f}_\epsilon(2, (1 - \epsilon)w_1 + \epsilon(w_1 + w_2)/2) = 2/3$.

Our second axiom, *bi-polarization by wealth transfer (BPbW)*, considers shifts in the density function induced by regressive (i.e., inequality-increasing) transfers of wealth across individuals such that the wealth distribution becomes polarized into two opposite classes (thus strongly enhancing the magnitude of wealth distances) while (possibly) altering the co-directionality of wealth and ethnolinguistic distances. Intuitively, while axiom CDbW stresses the importance of co-directionality at the expense of the magnitude of wealth distances, axiom BPbW re-balances the trade-off between these two components of ethnic stratification. Let the pair (f_ϵ, λ) be such that the population is partitioned into three equally sized sets $P_1, P_2, P_3 \subset P$ divided into three ethnicities, labelled 1, 2 and 3, such that all individuals in



(a) Axiom CDbW with $\epsilon = 0$.



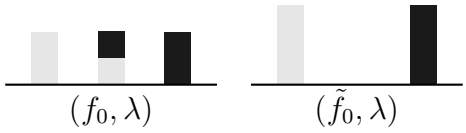
(b) Axiom CDbW with $\epsilon = 1$.

Figure 2: Illustration of Axiom CDbW. Notes: The two graphs of each sub-figure illustrate examples of the two pairs of density and linguistic functions corresponding to this axiom. Each tone of gray indicates a different ethnicity, and ethnolinguistic distances between ethnicities are given by differences in tones of gray. Wealth levels are on the horizontal axis while the vertical axis measures the fraction of the population of each combination of ethnicity and wealth.

P_1 belong to ethnicity 1, all individuals in P_3 belong to ethnicity 3, and a fraction $\epsilon \in [0, 1]$ of the individuals in P_2 belong to ethnicity 2 while the remaining fraction $(1-\epsilon)$ is equally split between ethnicity 1 and ethnicity 3. Assume that the wealth level is homogeneous within each set P_1, P_2, P_3 and denote by $w_1 > w_2 > w_3$ the respective wealth levels. Hence, we can refer to P_1, P_2 and P_3 as the rich, the middle class and the poor. The above description implies the density $f_\epsilon(1, w_1) = f_\epsilon(3, w_3) = 1/3$, $f_\epsilon(2, w_2) = \epsilon/3$ and $f_\epsilon(1, w_2) = f_\epsilon(3, w_2) = (1-\epsilon)/6$ for each $\epsilon \in [0, 1]$. In addition, suppose that the wealth of the middle class is the average of the ones of the rich and the poor and that the language of ethnicity 2 is a balanced mix of the languages of ethnicities 1 and 3, implying $w_2 = (w_1 + w_3)/2$ and $\lambda(1, 2) = \lambda(2, 3) = \lambda(1, 3)/2 > 0$. Axiom BPbW requires that ethnic stratification should not decrease when half of the middle class becomes poor while the other half becomes rich due to regressive transfers of wealth within the middle class. Figure 3 provides graphical representations of the cases of two equally sized ethnicities ($\epsilon = 0$) and three equally sized ethnicities ($\epsilon = 1$).

Bi-polarization by wealth transfer (BPbW). Consider any $\epsilon \in [0, 1]$ and pair (f_ϵ, λ) that satisfies the aforementioned restrictions. We assume $M(\tilde{f}_\epsilon, \lambda) \geq M(f_\epsilon, \lambda)$ for the density function $\tilde{f}_\epsilon$ that satisfies $\tilde{f}_\epsilon(1, w_1) = \tilde{f}_\epsilon(3, w_3) = (3-\epsilon)/6$ and $\tilde{f}_\epsilon(2, w_1) = \tilde{f}_\epsilon(2, w_3) = \epsilon/6$.

Our third axiom, *co-directionality by linguistic change (CDbL)*, considers shifts in the linguistic function that increase the co-directionality of wealth and ethnolinguistic distances by slightly altering the ethnolinguistic distances while leaving their overall magnitude unchanged. While axioms CDbW and BPbW consider shifts in the density function all else equal, axiom CDbL focuses on shifts in the linguistic function while holding the density function fixed. Let the pair (f, λ) be such that the population is partitioned into three equally sized sets $P_1, P_2, P_3 \subset P$ with homogeneous wealth level and ethnicity within each set. De-



(a) Axiom BPbW with $\epsilon = 0$.

(b) Axiom BPbW with $\epsilon = 1$.

Figure 3: Illustration of Axiom BPbW. Notes: The two graphs of each sub-figure illustrate examples of the two pairs of density and linguistic functions corresponding to this axiom. Each tone of gray indicates a different ethnicity, and ethnolinguistic distances between ethnicities are given by differences in tones of gray. Wealth levels are on the horizontal axis while the vertical axis measures the fraction of the population of each combination of ethnicity and wealth.

note by $w_1 > w_2 > w_3$ the respective wealth levels, so that we can again refer to P_1, P_2 and P_3 as the rich, the middle class, and the poor. Then, letting 1, 2 and 3 indicate the ethnicities of the sets P_1, P_2 and P_3, we can write $f(1, w_1) = f(2, w_2) = f(3, w_3) = 1/3$. In addition, suppose that the language of ethnicity 2 is a mix of the languages of ethnicities 1 and 3, implying $\lambda(1, 3) = \lambda(1, 2) + \lambda(2, 3) > 0$. Importantly, let the wealth level of the middle class be closer to the one of the rich than to the one of the poor, so that $w_2 > (w_1 + w_3)/2$. Axiom CDbL requires that any shift in the language of the middle class (ethnicity 2) that brings it closer to the one of the rich (ethnicity 1) and farther from the one of the poor (ethnicity 3), thus enhancing the co-directionality of wealth and ethnolinguistic distances while leaving their overall magnitude unchanged, should not lead to a decrease in ethnic stratification. Figure 4 provides a graphical representation.

Figure 4: Illustration of Axiom CDbL with generic $\epsilon \in (0, \lambda(1, 2)]$. Notes: The two graphs of each sub-figure illustrate examples of the two pairs of density and linguistic functions corresponding to this axiom. Each tone of gray indicates a different ethnicity, and ethnolinguistic distances between ethnicities are given by differences in tones of gray. Wealth levels are on the horizontal axis while the vertical axis measures the fraction of the population of each combination of ethnicity and wealth.

Co-directionality by linguistic change (CDbL). Consider any pair (f, λ) that satisfies the aforementioned restrictions. For each $\epsilon \in (0, \lambda(1, 2)]$, we assume $M(f, \tilde{\lambda}_\epsilon) \geq M(f, \lambda)$ for the linguistic function $\tilde{\lambda}_\epsilon$ which is identical to λ except that $\tilde{\lambda}_\epsilon(1, 2) = \lambda(1, 2) - \epsilon$ and $\tilde{\lambda}_\epsilon(2, 3) = \lambda(2, 3) + \epsilon$.

We are now ready to state our characterization result:

Theorem 1. *A measure $M \in \mathcal{M}$ satisfies axioms CDbW, BPbW, CDbL if and only if it coincides with (2) up to positive scalar multiplication.*

To further clarify the role of each axiom, we now sketch the 'only if' part of the proof of Theorem 1.[17] As our premise is any measure from class $\mathcal{M}$, the proof focuses on showing that the three axioms jointly imply $\pi(a, b) = kab$ for some $k > 0$. To start with, we show that the combination of CDbW and BPbW implies $\pi(a, 0) = \pi(0, b) = 0$ for each $a, b > 0$, meaning that the wealth and ethnolinguistic distances between two individuals are counted only if the individuals differ in both dimensions. As argued earlier on, we believe this high degree of complementarity is a defining feature of ethnic stratification as a generalization of between-group inequality. Given this, we proceed by showing that CDbW additionally requires $\pi(a, b)$ to be weakly concave in b, while BPbW additionally demands it to be weakly convex in b, so that $\pi(a, b)$ must be linear in b by the combination of these two axioms.[18] Together with our finding $\pi(a, 0) = \pi(0, b) = 0$ for each $a, b > 0$, this implies that $\pi(a, b) = \rho(a)b$ for some non-decreasing function $\rho : \mathbb{R}_+ \to \mathbb{R}_+$ that satisfies $\rho(0) = 0$ and $\rho(a) > 0$ for some $a > 0$. Finally, our proof concludes by showing that by CDbL the function ρ is linear, so that $\rho(a) = ka$ for some $k > 0$.

4 Estimating ethnic stratification

This section illustrates how ethnic stratification can be computed and used for inference with a given dataset. When we introduced the general class of measures of expected alienation in equation (1), we mentioned it can be understood as an expectation. We now build on this and view expected alienations, and subsequently ethnic stratifications, as parameters from some population distribution that can be estimated in finite sample.

We assume the setup from Section 3. In what follows, we let (E, W) and (E', W') denote two generic independent pairs of random variables that are drawn from some density f. Let $\mathbb{E}_f[\cdot]$ denote the expectation operator with respect to f. Then for any (f, λ), equation (1) can be equivalently expressed as

$$M(f, \lambda) = \mathbb{E}_f\left[\pi\left(\lambda\left(E, E'\right), |W - W'|\right)\right].$$

Similarly, equation (2) can be re-written as

$$S(f, \lambda) = \mathbb{E}_f\left[\lambda\left(E, E'\right)|W - W'|\right].$$

[17] The 'if' part is trivial as it is straightforward that $M = kS$ satisfies the axioms for each $k > 0$.

[18] These conclusions are drawn by considering the implications of CDbW and BPbW at the extreme cases with $\epsilon = 1$, as depicted in Figure 2(b) and Figure 3(b).

We focus on $S(f,\lambda)$ as our empirical sections are based on it. The analysis for $M(f,\lambda)$ is completely analogous.

Suppose our dataset consists of an i.i.d. sample of size $n \geq 2$, $\{(E_i, W_i)\}_{i=1}^n$, where (E_i, W_i) are ethnicity and wealth levels of individual i that have the same distribution as (E, W). For a given λ, henceforth suppressing the suffix of f on $\mathbb{E}_f[\cdot]$, we can define ethnic stratification as a population parameter:

$$\theta := \mathbb{E}\left[\lambda(E, E')\left|W - W'\right|\right].$$

The most natural way to estimate θ is to use its sample counterpart, where an expectation is replaced by a sample average. In particular, using the Law of Iterated Expectation, we see that $\theta = \mathbb{E}\left[\mathbb{E}\left[\lambda(E, E')\left|W - W'\right|\right| E, W\right]\right]$. We thus propose the following estimator for θ:

$$\theta_n := \frac{1}{n(n-1)} \sum_{i=1}^{n} \sum_{j \neq i}^{n} \lambda(E_i, E_j)\left|W_i - W_j\right| \tag{4}$$

Computationally, a measure of ethnic stratification can therefore be computed in a similar way to other related indices in the literature (e.g. Gini, fractionalization, polarization).[19]

We can use θ_n directly as a covariate in a regression analysis. We can also perform inference on θ. For the latter, very conveniently, θ_n takes the form of a classical *U-statistic* (Hoeffding, 1948) that has well-established statistical properties. We state the following propositions below that summarize the large sample properties of θ_n. We provide details of their proofs in the Appendix.

Proposition 2. *Suppose* $\mathbb{E}[|\lambda(E, E')|W - W'|\,|] < \infty$, *then* $\theta_n \xrightarrow{p} \theta$ *as* $n \to \infty$.

Proposition 3. *Suppose* $\mathbb{E}[|\lambda(E, E')|W - W'||^2] < \infty$, *then* $\sqrt{n}(\theta_n - \theta) \xrightarrow{d} \mathcal{N}(0, \sigma^2)$ *as* $n \to \infty$, *where* $\sigma^2 = 4Var\left(\mathbb{E}\left[\lambda(E, E')\left|W - W'\right|\right| E, W\right]\right)$.

Propositions 2 and 3 assume that the first and second moments of $\lambda(E, E')|W - W'|$ are finite, respectively. These conditions are expected to be satisfied in most applications. For instance, a sufficient condition for $\mathbb{E}[|\lambda(E, E')|W - W'||^k] < \infty$ is when λ is a bounded function and $\mathbb{E}|W|^k < \infty$ for $k = 1, 2$. Then, Proposition 2 says that θ_n is a consistent estimator for θ, and Proposition 3 says that θ_n has a limiting normal distribution. Furthermore, the asymptotic variance of θ_n has a simple form that can be estimated by using its sample counterpart. This can be seen from re-writing σ^2 as

$$\sigma^2 = 4\mathbb{E}[\mathbb{E}\left[\lambda(E, E')\left|W - W'\right|\right| E, W]^2] - 4(\mathbb{E}\left[\lambda(E, E')\left|W - W'\right|\right])^2.$$

One natural candidate for an estimator of σ^2 is σ_n^2, where we again replace expectations in

[19] The form of θ_n in (4) is almost identical to the first line of (2) if we deem the population, P, to consist of m individuals and turn the integrals into summations. Indeed, we can also use $\frac{1}{n^2}$ as the denominator to construct θ_n instead of $\frac{1}{n(n-1)}$. This does not change how one would interpret θ_n or any of the asymptotic results.

the display above by sample averages:

$$\sigma_n^2 := \frac{4}{n}\sum_{i=1}^{n}(\frac{1}{n-1}\sum_{j\neq i}^{n}\lambda\left(E_i, E_j\right)|W_i - W_j|)^2 - 4\theta_n^2 \tag{5}$$

Proposition 4 says that σ_n^2 is a consistent estimator for σ^2.

Proposition 4. *Suppose* $\mathbb{E}[|\lambda\left(E, E'\right)|W - W'||^2] < \infty$, $\sigma_n^2 \xrightarrow{p} \sigma^2$ *as* $n \to \infty$.

Propositions 2 to 4 ensure that we can construct valid confidence intervals and perform hypothesis tests on ethnic stratification based on normal approximation under weak conditions. Alternatively, inference can also be performed using a standard bootstrap (random resampling with replacement), as Arcones and Giné (1992) show that such U-statistics can be consistently bootstrapped. Subsequently, we can perform inference on differences between ethnic stratifications across independent samples. We illustrate this in the next section.

5 Computing ethnic stratification

For the computation of our ethnic stratification index, we rely on data from Afrobarometer surveys, which are representative of all citizens of voting age in a given country and year (Afrobarometer, 2018). The use of Afrobarometer data has several advantages. First, these surveys contain information on the assets of the respondents and the households in which they live. This information, which is considerably richer in more recent survey rounds, allows us to create measures of economic wealth and, consequently, economic distances between pairs of respondents. Second, the Afrobarometer surveys contain information on the respondents' native language and their ethnic affiliation. After matching this language and ethnicity information to the ethnolinguistic groups in the Ethnologue, we can use the Ethnologue's language trees to compute ethnolinguistic distances between pairs of individuals. Third, the Afrobarometer data has recently been geocoded by AidData (BenYishay et al., 2017). Given the economic and ethnolinguistic distances between pairs of individuals, we can estimate country-level indices of ethnic stratification. Additionally, given knowledge about the set of respondents living in the same location, we can also compute ethnic stratification at the local level. Fourth, the Afrobarometer surveys, in particular rounds 3 and 5, include various questions on trust, which can be used to test whether and how ethnic stratification affects trust in Africa.

In this section, we first explain how we compute the economic and ethnolinguistic distances between pairs of individuals on which our index is based. We then provide a brief comparison of ethnic stratification across African countries using equations (4) and (5). In Section 6, we compute ethnic stratification at the level of towns and villages and estimate its effect on trust in people and political institutions at the local level.

5.1 Computing economic and ethnolinguistic distances

To compute economic distances, we first construct a wealth index for each survey, i.e., each country and survey round. To do this, we use the information on the assets that respondents or their households possess and construct an asset-based wealth index similar to the one constructed in the Demographic and Health Surveys (DHS). Filmer and Pritchett (2001) propose such a wealth index consisting of the first principal component of the asset variables. The first principal component is calculated by conducting a Principal Component Analysis. This method is used to reduce the large number of asset variables to linear combinations, which can be interpreted more easily. The first principal component has the largest variance of all linear combinations and thus accounts for the largest part of the variation in the data (Jolliffe, 2002).

We apply the same procedure as the DHS to calculate a wealth index score for each respondent. Afrobarometer surveys of round 5 contain information on the possession of a radio, television, mobile phone, and a motorcycle or car, and about the types of water source, toilet, house and roof.[20] In contrast, survey round 3 only contains information on the possession of a radio, television, bicycle, motorcycle and car. We construct the wealth index for each survey, i.e., each country and survey round, separately. We use the resulting wealth indices as a measure of individual economic wealth and the absolute difference between the index values of a pair of individuals as their economic distance.

In addition, Afrobarometer surveys provide information on the respondents' native language and their ethnic affiliation.[21] To compute the ethnolinguistic distances between respondents, we match the language and ethnicity information from the Afrobarometer to the ethnolinguistic groups in the Ethnologue (Gordon Jr., 2005). The Ethnologue provides the most complete classification of world languages, listing every known living language, namely 7,097, of which 2,143 are in Africa. The Ethnologue's data are modelled as trees that show the historical relation between all languages.

Many languages and ethnic groups used in the Afrobarometer surveys do not match the names of the language groups in the Ethnologue. We match them manually using information from the Ethnologue website,[22] which contains information on alternative names and dialects, and sometimes also on the ethnic groups that speak a certain language. In cases in which a language or ethnic group from Afrobarometer was not found on the Ethnologue website, we use the following sources to match the information from Afrobarometer to the Ethnologue: Eldredge (2015); Falola and Jean-Jacques (2015); Futhwa (2012); Hall (1999); Olson (1996); Otlogetswe (2011); and the Joshua Project.[23]

We successfully match 587 Afrobarometer languages and 525 Afrobarometer ethnicities. However, for some respondents, we cannot match the language or ethnicity information from

[20] Online Appendix A provides further information on the variables used.

[21] The specific questions are: "Which language is your home language?" and "What is your ethnic community, cultural group or tribe?"

[22] https://www.ethnologue.com

[23] https://www.joshuaproject.net

Afrobarometer to the Ethnologue because the corresponding question was not asked or not answered, or because there is no ethnolinguistic group in the Ethnologue that corresponds to the Afrobarometer language or the Afrobarometer ethnicity. In addition, we treat European languages (i.e., English, French, German and Portuguese) as missing. For all these reasons and in order to base our indices on as many respondents as possible, we combine the respondents' information on language and ethnicity, and compute two different measures of ethnolinguistic distances between pairs of individuals: one based primarily on the Afrobarometer language (with the Afrobarometer ethnicity used only if the Afrobarometer language could not be matched to any group in the Ethnologue), and one based primarily on the Afrobarometer ethnicity (with the Afrobarometer language used only if the Afrobarometer ethnicity could not be matched to any group in the Ethnologue). We get 601 distinct ethnolinguistic groups according to the Ethnologue's classification when relying primarily on language, and 568 groups when relying primarily on ethnicity. For our main analysis, we use the coding that relies primarily on the Afrobarometer language, as all surveys ask about the respondents' native language whereas some do not ask about their ethnic affiliation. We present robustness exercises based on the coding that relies primarily on the Afrobarometer ethnicity.

Language trees depict the historical relations between languages, as languages that share more branches have a longer common history. Therefore, many scholars have used language trees to calculate the distance between any two ethnolinguistic groups (e.g., Fearon, 2003; Desmet et al., 2009). Here, we use the formula proposed by Putterman and Weil (2010) to compute ethnolinguistic distances:

$$\lambda(e_i, e_j) = 1 - \sqrt{\frac{2t_{ij}}{T_i + T_j}},$$

where T_i and T_j are the number of nodes in the branch of the languages of the ethnolinguistic groups e_i and e_j, respectively, and t_{ij} the number of common nodes.[24]

5.2 Cross-country comparison

The computed economic and ethnolinguistic distances between pairs of respondents allow estimating ethnic stratification and its variance for any country from our sample using equations (4) and (5). We rely on all respondents from Afrobarometer round 5 who answered the questions used to construct the wealth index and whom we could assign to an Ethnologue language group. We exclude countries where more than 95 percent of the respondents belong to the largest ethnolinguistic group.[25] We are left with 26 ethnolinguistically heterogeneous

[24]Fearon (2003) proposes an alternative formula. We show in robustness tests that the results of our regression analysis are very similar when using his formula instead.

[25]We discuss our sample selection in more detail in Section 6. Note that the respondents that we exclude here are a subset of the respondents that we exclude in Section 6, where we focus on the village level and need the respondents' answers on the trust questions of interest.

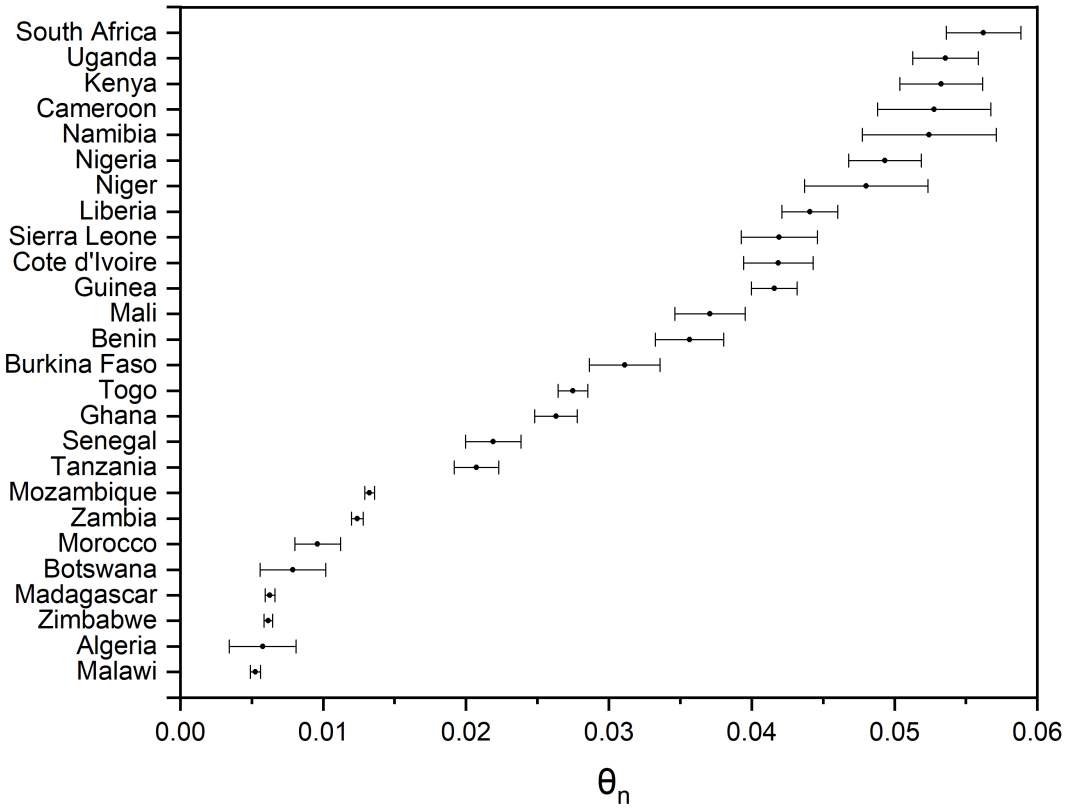


Figure 5: Country-level inference. Notes: Dots indicate point estimates of the countries' ethnic stratification index and lines the 95% confidence intervals based on equations (4) and (5). Data are from Afrobarometer round 5. Economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language, and ethnolinguistic distances are computed using the Putternam and Weil (2010) formula.

countries. We present their estimates of ethnic stratification, arranged from highest to lowest, in Figure 5.

This figure suggests large differences in the point estimates of ethnic stratification across African countries, with the highest levels of ethnic stratification in South Africa and the lowest levels in Algeria and Malawi. We can determine right away that the differences between most country pairs are statistically significant. The reason is that the difference in the point estimates must be statistically significant whenever the confidence intervals between a pair of countries do not overlap. However, Figure 5 is not as informative on the converse situation. An overlapping of confidence intervals has no implication on whether or not we would reject the null hypothesis of no difference in ethnic stratification. Therefore, the exact position in a ranking may have little meaning especially for some countries that are adjacent in the ranking.[26] A formal test for differences in ethnic stratification between any two countries can be conducted using a standard t-ratio, where the variance of the difference between ethnic stratification estimators is simply the sum of the individual variances.

[26] Along similar lines, Høyland et al. (2012) argue that the exact position in country rankings of indicators of economic development or institutional quality have little meaning.

6 Estimating the effect of ethnic stratification on trust

In this section, we use ethnic stratification at the level of towns and villages as an explanatory variable and estimate its effect on trust in people and political institutions at the local level. We first discuss the construction of the dataset and our empirical specification. We then present our findings.

6.1 Our dataset

Given the wealth and ethnolinguistic distances between pairs of individuals (see Section 5.1), we can compute the ethnic stratification index S_{vc} at the level of each town or village v of country c. In addition, we can also compute the average wealth μ_{vc}, the Gini coefficient G_{vc} and the index of ethnic fractionalization F_{vc}. They are all nested in the ethnic stratification index (see Section 3.2), such that their computation requires no additional information.

To construct our dependent variables, we rely on four questions on trust in people the respondent knows and in local political institutions from survey round 5. Three of these questions measure trust in relatives, neighbors and other acquaintances. The specific questions are: "How much do you trust each of the following types of people: Your relatives? Your neighbors? Other people you know?" The fourth question asks about trust in the local assembly: "How much do you trust each of the following, or haven't you heard enough about them to say: Your metropolitan, municipal or district assembly?" Following Rohner et al. (2013), we build indicator variables that equal one if the respondent answers "a lot" or "somewhat," and zero if she answers "just a little" or "not at all."[27] In addition, we use two questions that were only asked in survey round 3. These questions ask how much the respondent trusts people from her "own ethnic group" and people from the same country but "other ethnic groups." We build indicator variables as above to measure the respondent's trust in these two categories of people. Furthermore, we build an indicator variable that equals one if and only if the respondent's answers reveal that she trusts people from her own ethnic group more than people from other ethnic groups.

For our analysis at the local level, we restrict the sample along three dimensions. First, as in Section 5, we exclude countries where more than 95 percent of the respondents belong to the same ethnolinguistic group. For survey round 5, these countries are Burundi, Cape Verde, Egypt, Lesotho, Mauritius, Sudan, Swaziland and Tunisia.[28] For survey round 3, these

[27] Following Nunn and Wantchekon (2011), we also present robustness exercises where we use these four categorical answers to generate a variable that ranges from 0–3.

[28] Respondents in Burundi indicate different ethnicities (Hutu, Tutswi, Twa), which are however not distinct ethnolinguistic groups in the Ethnologue; and more than 99 percent indicate Rundi as their native language. Respondents in Cape Verde indicate ethnicities that cannot be matched to the Ethnologue (as they are related to, e.g., age or class), and 100 percent indicate Kabuverdianu as their native language. Respondents in Egypt, Sudan and Tunisia were not asked about their ethnicity, and more than 99 percent indicate Arabic as their native language. Most respondents in Mauritius indicate ethnicities that cannot be matched to the Ethnologue (e.g., their religion), and more than 96 percent indicate Creole as their native language. More than 97 percent of the respondents in Lesotho indicate Southern Sotho as both their native language and their ethnicity. Respondents in Swaziland were not asked about their ethnicity, and more than 98 percent

countries are Cape Verde and Lesotho (while the other countries excluded for round 5 were not surveyed in round 3). Hence, we are left with 26 (15) ethnolinguistically diverse countries for survey round 5 (3). Second, we restrict our attention to clusters that AidData (BenYishay et al., 2017) classified as "populated places" such as town or villages, as we want to be sure that the various respondents from a cluster lived in close proximity.[29] This restriction reduces the number of clusters in the remaining countries from survey round 5 (3) by 35.0 (34.1) percent. Third, we exclude respondents who did not answer any of the trust questions we are using, respondents who did not answer some of the questions used to construct the wealth index, respondents whom we could not assign an Ethnologue language group, and respondents for whom information on age, education or religion (which we use to construct our control variables) is missing. In addition, we exclude the few clusters where the wealth index and the Ethnologue language group are available for less than three respondents. The reason is that our index of ethnic stratification is not defined in case of a single respondent and would depend on just one pair of individuals in case of two respondents. These restrictions reduce the number of respondents in survey round 5 (3) by another 7.8 (9.2) percent. Our final sample for survey round 5 (3) consists of 21,579 (11,860) respondents from 2,420 (1,300) towns and villages across 340 (167) provinces in 26 (15) ethnolinguistically diverse African countries. Figure 6 depicts the towns and villages in our final sample for survey round 5. In addition, it provides some information on local ethnic stratification, with darker dots indicating higher values.[30]

Table 1 reports summary statistics for these samples. For survey round 5, we see that out of ten respondents, around eight trust their relatives, around six their neighbors and only around four other acquaintances. Half the respondents trust the local assembly. The correlation coefficients between any two of these four trust measures vary between 0.15 and 0.54. Interestingly, the correlation between ethnic fractionalization and wealth inequality is very low (0.05). Unsurprisingly, ethnic stratification is positively correlated with both fractionalization (0.85) and wealth inequality (0.30). The summary statistics for round 3 confirm that respondents tend to trust people from their own ethnic group more than people from other ethnic groups.

indicate Swati as their native language.

[29]There are three other categories: "Administrative regions," "structures" (e.g., schools or health clinics), and "other topographical features" (e.g., mountains, rivers or forests). We exclude clusters coded as "administrative regions" or "other topographical features," because they are less geographically precise, as confirmed by the precision code in the data. We exclude clusters coded as "structures," because schools or health clinics might serve as central meeting points to conduct interviews with people from different villages. Results remain qualitatively unchanged and quantitatively very similar if we include the relatively few respondents from "structures."

[30]Figure B.1 in Online Appendix B provides the same figure for our final sample for survey round 3.

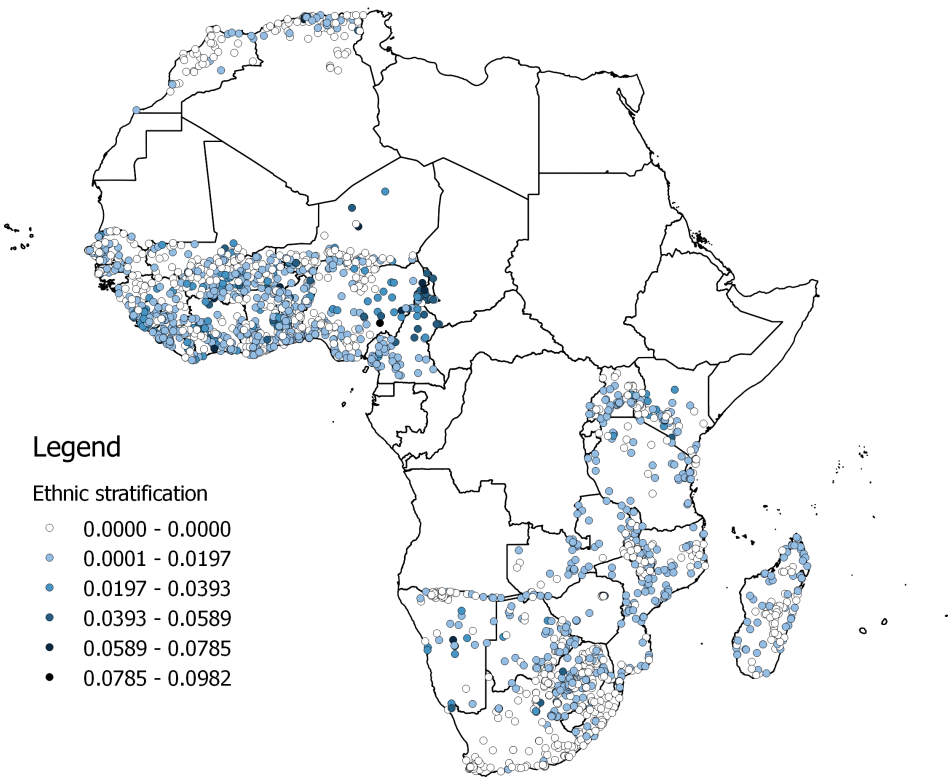


Figure 6: Towns/villages in Afrobarometer round 5. Notes: Dots indicate the town and villages in the final sample from Afrobarometer round 5. Darker shades indicate higher local ethnic stratifications. Economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language, and ethnolinguistic distances are computed using the Putternam and Weil (2010) formula.

6.2 Empirical specification

For each survey round, we start our investigation of the relation between local ethnic stratification and our trust measures with the following specification:

$$Trust_{ivce} = \beta S_{vc} + \theta X_{ivce} + FE_c + \epsilon_{ivce}, \tag{6}$$

where $Trust_{ivce}$ is one of our trust indicators for respondent i living in town or village v of country c and belonging to ethnolinguistic group e. The main coefficient of interest is β, which measures the effect of local ethnic stratification S_{vc} on a respondent's trust in other people or local political institutions. We expect this effect to be negative. The vector of control variables X_{ivce} contains respondent i's economic wealth (measured by our wealth index), her age and age squared as well as indicator variables for her gender, her religion (Christian/Muslim/other), her education (none/primary/secondary/tertiary) and whether she lives in an urban or rural area. These control variables are all based on the Afrobarometer surveys. The country fixed effects FE_c control for all country-specific determinants and experiences that may affect trust.[31]

[31]The country fixed effects are also important because we calculate our wealth index and the economic distances for each country/survey separately.

Table 1: Summary statistics (Afrobarometer rounds 3 and 5)

Variable	Obs.	Mean	Std.Dev.	Min.	Max.
Round 5:					
Trust in relatives	21,544	0.826	0.379	0	1
Trust in neighbors	21,521	0.607	0.488	0	1
Trust in other acquaintances	21,475	0.416	0.493	0	1
Trust in local assembly	19,236	0.493	0.500	0	1
Ethnic stratification (S)	21,579	0.007	0.013	0	0.098
Fractionalization (F)	21,579	0.103	0.147	0	0.696
Wealth inequality (G)	21,579	0.083	0.047	0	0.390
Average wealth (μ)	21,579	0.341	0.069	0.094	0.738
Round 3:					
Trust in own ethnic group	11,833	0.550	0.498	0	1
Trust in other ethnic group	11,710	0.420	0.494	0	1
Higher trust in own group	11,683	0.263	0.440	0	1
Ethnic stratification (S)	11,860	0.013	0.022	0	0.142
Fractionalization (F)	11,860	0.101	0.149	0	0.639
Wealth inequality (G)	11,860	0.252	0.103	0	0.750
Average wealth (μ)	11,860	0.202	0.058	0	0.551

Notes: Trust variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic distances are primarily based on the respondents' language and the Putternam and Weil (2010) formula.

We take additional measures to address potential omitted variable bias. First, we include ethnolinguistic group fixed effects FE_e to control for any group-specific characteristics or experiences that may affect trust. For example, Nunn and Wantchekon (2011) show that respondents from ethnic groups that were raided for the trans-Atlantic slave trade are less trusting today, and Moscona et al. (2017) find that ethnic groups that are organized as segmentary lineage societies have less trust in non-relatives. Second, we control for local ethnic fractionalization F_{vc}, local wealth inequality G_{vc} and local average wealth μ_{vc} within each town or village. As shown in Section 3.2, these measures are nested in our ethnic stratification index. By construction, larger ethnolinguistic and economic distances do not only imply higher ethnic stratification, but also higher ethnic fractionalization and higher wealth inequality, respectively. These controls make sure that coefficient β captures the effect of ethnic stratification on trust in people and local political institutions net of any direct effects of ethnic fractionalization (independent of economic distances) or wealth inequality (independent of ethnolinguistic distances). Jointly, these additional cluster-level control variables and the ethnolinguistic group fixed effects lead to the following, more demanding specification:

$$Trust_{ivce} = \beta S_{vc} + \gamma F_{vc} + \delta G_{vc} + \psi \mu_{vc} + \theta X_{ivce} + FE_c + FE_e + \epsilon_{ivce}. \tag{7}$$

One potential threat to a causal interpretation of β in this specification could be that in towns and villages where trust is generally higher, inhabitants may also be more trusting towards

Table 2: Ethnic stratification and trust at the local level (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-0.89*	-1.30**	-1.67***	-2.19***	-1.89***	-1.73***	-0.59	-1.31**
	(0.50)	(0.52)	(0.49)	(0.44)	(0.47)	(0.34)	(0.51)	(0.55)
R^2	0.12	0.16	0.15	0.18	0.08	0.12	0.09	0.13
S	-1.45	-1.64*	-2.24***	-2.09***	-2.27***	-2.02***	-1.67**	-1.94***
	(0.88)	(0.94)	(0.77)	(0.78)	(0.71)	(0.69)	(0.73)	(0.70)
F	0.08	0.07	0.10	0.03	0.07	0.06	0.12*	0.09
	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)
G	-0.07	-0.09	-0.08	-0.09	-0.06	-0.03	0.10	0.01
	(0.09)	(0.09)	(0.11)	(0.11)	(0.12)	(0.12)	(0.16)	(0.17)
μ	-0.26***	-0.24***	-0.53***	-0.51***	-0.41***	-0.40***	-0.47***	-0.36**
	(0.08)	(0.08)	(0.16)	(0.14)	(0.15)	(0.14)	(0.16)	(0.15)
R^2	0.12	0.16	0.15	0.19	0.08	0.12	0.09	0.13
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,544	21,544	21,521	21,521	21,475	21,475	19,236	19,236

Notes: Linear probability estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

people they know, and ethnic stratification may, for some reason, be lower (conditional on ethnic fractionalization and wealth inequality). Therefore, we control for the local average of generalized trust in some robustness exercises.[32]

We use multi-way clustering and cluster the standard errors ϵ_{ivce} at the level of provinces (ADM1 regions) and ethnolinguistic groups. By doing so, we are more conservative than, e.g., Nunn and Wantchekon (2011) and Rohner et al. (2013), who both cluster standard errors at the level of districts (ADM2 regions) and ethnolinguistic groups.

6.3 Empirical results

Table 2 presents the results of our analysis based on the Afrobarometer's survey round 5. The outcome variables are our binary indicators for trust in relatives in columns (1) and (2), trust in neighbors in columns (3) and (4), trust in other acquaintances in columns (5) and (6), and trust in the local assembly in columns (7) and (8). All columns include the control variables X_{ivce} and country fixed effects, but only even columns include the ethnolinguistic group fixed

[32]Generalized trust is based on the question: "Generally speaking, would you say that most people can be trusted or that you must be very careful in dealing with people?" We code the former as one and the latter as zero.

effects. Each column presents two linear probability estimates, with the difference being that we control for ethnic fractionalization, wealth inequality and average wealth in the lower (but not the upper) panel. The estimated coefficient on ethnic stratification is negative in all 16 regressions presented in Table 2. This negative coefficient is statistically significant in most of these regressions. Hence, the general pattern is clear: local ethnic stratification reduces trust in people an individual knows and in local political institutions. To get an impression of the size of the effect of ethnic stratification, we focus on the lower panels of even columns, which present the results for the demanding specification (7). Our estimates imply that an increase in ethnic stratification by one standard deviation reduces the probability that a respondent trusts her relatives, her neighbors, other acquaintances and the local assembly by 2.1 to 2.6 percent.

There is a more nuanced pattern worth noticing: The effect of ethnic stratification on trust in relatives tends to be smaller than the effects on trust in neighbors or other acquaintances. Possible reasons are that relatives may be more likely than neighbors or other acquaintances to belong to the same ethnolinguistic group as the respondent; and that respondents may have more private information about relatives than about neighbors or other acquaintances, such that trust in relatives depends to a lesser degree on village-level characteristics such as ethnic stratification.

The lower panel of Table (2) further reveals that local ethnic fractionalization and local wealth inequality have no effect on local trust when controlling for ethnic stratification. Hence, it is indeed ethnic stratification rather than ethnolinguistic diversity or economic inequality that undermines trust at the local level. In addition, we see that average economic wealth in a village or town has a robust negative effect on local trust. Given our individual level controls (i.e., education and wealth), this effect suggests that an individual of a given socio-economic status is more trusting in a poorer town or village.

Online Appendix C presents many robustness exercises. In Table C.1, we base our indices primarily on the Afrobarometer's ethnicity information rather than its language information. In Table C.2, we base our indices on ethnolinguistic distances computed by the formula of Fearon (2003) rather than Putterman and Weil (2010). In Table C.3, we base our indices on economic distances measured by absolute differences in the lived poverty index, which is an experiential measure capturing how frequently basic needs are not being satisfied.[33] In Table C.4, we control for the respondent's generalized trust as well as for average generalized trust in her town or village. As discussed before, controlling for average generalized trust could address potential endogeneity concerns. Controlling for the respondent's own generalized trust may moreover allow us to isolate the effect of local ethnic stratification on the truly local component of their trust in people they know and local political institutions. In Table C.5, we control for proxies for the trustworthiness of people and local institutions. The reason

[33]Online Appendix A provides further information on the lived poverty index. In this robustness exercise, we also use the lived poverty index to measure individual and average wealth, but we reverse its scale as higher values of the original index imply that people had to go without basic necessities more often.

is that a decrease in trust could represent a decrease in trustworthiness or a decrease in trust conditional on a given level of trustworthiness. When estimating the effect on trust in the local assembly, we follow Nunn and Wantchekon (2011) in controlling for measures of the perceived trustworthiness of the local assembly and the availability of local public goods (as an objective proxy for the quality of the local government). In the same vein, we control for measures of the trustworthiness of local people when estimating the effect on our other trust measures.[34] In Table C.6, we follow Nunn and Wantchekon (2011) and use the respondents' categorical answers to the trust questions of main interest to build variables that can take the values 0 ("not at all"), 1 ("just a little"), 2 ("somewhat"), or 3 ("a lot"). In Table C.7, we follow Rohner et al. (2013) in estimating Probit maximum likelihood models instead of linear probability models. Finally, in Table C.8, we restrict the sample to the 15 countries that are also covered in round 3. These robustness exercises support the general pattern that local ethnic stratification reduces trust in people the individuals know as well as trust in local political institutions (even when controlling for their trustworthiness). The only exception are the robustness exercises using economic distances based on differences in the lived poverty index. Moreover, Tables C.1–C.6 also support the notion that the effect of ethnic stratification on trust in relatives tends to be smaller than the effects on trust in other people the respondents know.

We now turn to the effect of ethnic stratification on trust in people from the respondents' own and other ethnic groups. The results are presented in Table 3. They are based on Afrobarometer surveys of round 3, as the corresponding trust questions were exclusively asked in this round. There are two reasons for taking them with a grain of salt. First and foremost, Afrobarometer surveys of round 3 contain considerably less information to compute wealth indices and, subsequently, the economic distances between pairs of individuals than surveys of round 5 (see Section 5.1). Second, round 3 includes fewer countries than round 5, such that the countries included in our sample drops from 26 to 15. Columns (1)–(4) show that once we control for ethnic fractionalization and wealth inequality, ethnic stratification tends to increase trust in people from the respondents' own ethnic group but to decrease trust in people from other ethnic groups. While these effects are not statistically significant, columns (5) and (6) suggest that an increase in ethnic stratification makes it more likely that respondents trust people from their own ethnic group more than they trust people from other ethnic groups. Ethnic fractionalization per se tends to have the opposite effect, while wealth inequality and average wealth have no significant effect.[35] We conduct the same battery of robustness exercises as above (see Tables C.9–C.15 in Online Appendix C). Most of these robustness exercises, with the exception of those based on the lived poverty index, reveal a

[34] The notes to Online Appendix Table C.5 provide detailed information on the variables used.

[35] Average wealth μ has robust negative effects in Table 2, but not in Table 3. In Table C.8, we re-estimate the regressions presented in Table 2, but restrict the sample to the countries available for Afrobarometer survey round 3 and used in Table 3. We find negative effects of average wealth μ in Table C.8, suggesting that its non-effects in Table 3 are mainly due to the less informative wealth data rather than the smaller country sample.

Table 3: Ethnic stratification and trust in own/other ethnic groups (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Higher trust in own ethnic group	
S	0.54	0.23	0.22	-0.01	0.15	-0.14
	(0.44)	(0.43)	(0.45)	(0.43)	(0.22)	(0.28)
R^2	0.10	0.14	0.08	0.13	0.04	0.07
S	0.01	0.28	-0.79	-0.16	1.19**	0.99*
	(0.60)	(0.57)	(0.69)	(0.72)	(0.47)	(0.51)
F	0.11	0.00	0.18	0.05	-0.14*	-0.18**
	(0.10)	(0.10)	(0.13)	(0.12)	(0.07)	(0.08)
G	0.03	0.00	0.05	-0.02	-0.11	-0.07
	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)
μ	-0.29*	-0.15	-0.24	-0.19	-0.18	-0.07
	(0.17)	(0.15)	(0.17)	(0.17)	(0.14)	(0.14)
R^2	0.10	0.14	0.08	0.13	0.04	0.07
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,833	11,833	11,710	11,710	11,683	11,683

Notes: Linear probability estimates. Dependent variables in columns (1)–(4) indicate whether respondents trust the respective people "a lot" or "somewhat" as opposed to "not at all" or "just a little". Dependent variable in columns (5) and (6) indicates whether a respondent trusts people from own ethnic group more than people from other ethnic groups. Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 3. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

similar pattern as Table 3.

7 Conclusion

We define an index of ethnic stratification that generalizes the idea of between-group inequality and measures the extent to which the hierarchy in socio-economic positions follows ethnolinguistic lines. Our starting point is a broad family of measures of expected alienation (or mistrust) which can be interpreted as the expected alienation between a randomly selected pair of individuals from the population. To measure ethnic stratification we focus on a particular index from this class where the alienation of each pair is given by the product of their economic and social distances. Hence, a crucial feature of this index is that economic and social distances between two individuals are counted only if they are positive in both dimensions. This complementarity is essential to the notion of ethnic stratification as a generalization of between-group inequality. We provide an axiomatic characterization of our index and a multiplicative decomposition into four components: average wealth, the Gini coefficient

of wealth inequality, the coefficient of ethnic fractionalization, and the co-directionality of wealth distances and ethnolinguistic distances across pairs of individuals. We also define the large sample properties of a natural estimator of our index which is statistically well-behaved. In the empirical part, we calculate the ethnic stratification index at the level of towns and villages of 26 African countries, and we show that local ethnic stratification decreases the degree of trust of an individual in people she knows and in local political institutions. This finding suggests that our proposed index is indeed a predictor of social conflict.

Appendix A Proofs of theorems and propositions

Proof of Proposition 1 Let (f, λ) be any pair of density and linguistic functions. The ethnic stratification of the corresponding benchmark (b_f, λ) is

$$S(b_f, \lambda) = \int_{e \in E} \int_{e' \in E} \int_{w \in W} \int_{w' \in W} b_f(e, w) b_f(e', w') \lambda(e, e') |w - w'| dw' dw de' de,$$

where by definition of the benchmark

$$b_f(e, w) = \gamma_{b_f}(w) \varphi_{b_f}(e) = \gamma_f(w) \varphi_f(e) \text{ for each } e \in E \text{ and } w \in W.$$

Then, combining these equations we obtain

$$S(b_f, \lambda) = \left(\int_{w \in W} \int_{w' \in W} \gamma_f(w) \gamma_f(w') |w - w'| dw' dw \right) \left(\int_{e \in E} \int_{e' \in E} \varphi_f(e) \varphi_f(e') \lambda(e, e') de' de \right),$$

which leads to $S(b_f, \lambda) = 2\mu(\gamma_f) G(\gamma_f) F(\varphi_f, \lambda)$ and concludes our proof. □

Proof of Theorem 1 It is straightforward that any positive scalar multiplication of index (2) fulfills axioms CDbW, BPbW, CDbL. Then, it remains to be shown that an index from class (1) satisfies these axioms only if it takes the form (2) up to positive scalar multiplication, i.e., only if $\pi(a, b) = kab$ for some constant $k > 0$. By axiom CDbW, focusing on the extreme case $\epsilon = 1$,

$$\begin{aligned} M(\tilde{f}_1, \lambda) &= (4/9) \pi \left(\lambda(1, 2), |w_1 - w_2|/2 \right) \\ &\geq M(f, \lambda) = (2/9) \left[\pi \left(\lambda(1, 2), |w_1 - w_2| \right) + \pi(0, |w_1 - w_2|) + \pi(\lambda(1, 2), 0) \right], \end{aligned}$$

which can be rewritten as

$$2\pi \left(\lambda(1, 2), |w_1 - w_2|/2 \right) - \pi \left(\lambda(1, 2), |w_1 - w_2| \right) \geq \pi(0, |w_1 - w_2|) + \pi(\lambda(1, 2), 0). \quad (8)$$

By axiom BPbW, focusing on the extreme case $\epsilon = 1$,

$$\begin{aligned} M(\tilde{f}_1, \lambda) &= (2/9)\left[\pi\left(\lambda(1,3)/2, |w_1 - w_3|\right) + \pi\left(\lambda(1,3)/2, 0\right) + \pi\left(0, |w_1 - w_3|\right)/4 + \pi\left(\lambda(1,3), |w_1 - w_3|\right)\right] \\ &\geq M(f_1, \lambda) = (2/9)\left[2\pi\left(\lambda(1,3)/2, |w_1 - w_3|/2\right) + \pi\left(\lambda(1,3), |w_1 - w_3|\right)\right], \end{aligned}$$

which implies

$$\pi\left(0, |w_1 - w_3|\right)/4 \geq 2\pi\left(\lambda(1,3)/2, |w_1 - w_3|/2\right) - \pi\left(\lambda(1,3)/2, |w_1 - w_3|\right). \tag{9}$$

Combining (9) with (8) and letting $a, b \geq 0$ denote a generic pair of wealth and ethnolinguistic distances, we obtain

$$\pi(0, b)/4 \geq 2\pi(a, b/2) - \pi(a, b) \geq \pi(0, b) + \pi(a, 0).$$

By the non-negativity of π this implies $\pi(0, b) = \pi(a, 0) = 0$ and $2\pi(a, b/2) = \pi(a, b)$, so that there is a non-decreasing function $\rho : \mathbb{R}_+ \to \mathbb{R}_+$ such that $\pi(a, b) = \rho(a)b$ and $\rho(0) = 0$. By axiom CDbL, for each $\epsilon \in (0, \lambda(1, 2)]$,

$$\begin{aligned} M(f, \tilde{\lambda}_\epsilon) &= (2/9)\left[\pi\left(\lambda(1,2) - \epsilon, |w_1 - w_2|\right) + \pi\left(\lambda(2,3) + \epsilon, |w_2 - w_3|\right)\right. \\ &\quad \left. + \pi\left(\lambda(1,2) + \lambda(2,3), |w_1 - w_2| + |w_2 - w_3|\right)\right] \\ &\geq M(f, \lambda) = (2/9)\left[\pi\left(\lambda(1,2), |w_1 - w_2|\right) + \pi\left(\lambda(2,3), |w_2 - w_3|\right)\right. \\ &\quad \left. + \pi\left(\lambda(1,2) + \lambda(2,3), |w_1 - w_2| + |w_2 - w_3|\right)\right], \end{aligned}$$

which by our previous finding $\pi(a, b) = \rho(a)b$ can be rewritten as

$$\rho(\lambda(1,2) - \epsilon)|w_1 - w_2| + \rho(\lambda(2,3) + \epsilon)|w_2 - w_3| \geq \rho(\lambda(1,2))|w_1 - w_2| + \rho(\lambda(2,3))|w_2 - w_3|. \tag{10}$$

Note that the axiom's restrictions $w_1 > w_2 > w_3$ and $w_2 > (w_1 + w_3)/2$ imply $|w_1 - w_2| < |w_2 - w_3|$. Then, by (10) the function ρ is linear and, given our previous findings, we must have $\rho(a) = ka$ for some constant $k \geq 0$. As $\pi(a, b) > 0$ for some $a, b > 0$ by assumption, it follows that $k \neq 0$ which concludes our proof. □

Proof of Propositions 2 and 3 Using the fact that $\lambda(E_i, E_j) = \lambda(E_j, E_i)$ for all i, j, we can re-write θ_n in (4) as follows:

$$\theta_n = \frac{2}{n(n-1)} \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \lambda(E_i, E_j) |W_i - W_j|.$$

The expression above reveals that θ_n is a *second order U-statistic*. We refer the reader to Chapter 5.3 in Serfling (1980) for background materials on this subject. Our proofs below will make use of some standard results of U-statistics. A crucial element in deriving statistical

properties of a U-statistic is its *projection*. For $i \neq j$, let

$$r\left(E_i, W_i\right) = \mathbb{E}\left[\lambda\left(E_i, E_j\right)\left|W_i - W_j\right|\right| E_i, W_i\right],$$

then we denote the projection of θ_n by:

$$\begin{aligned}\widehat{\theta}_n &= \sum_{i=1}^{n} \mathbb{E}\left[\theta_n | E_i, W_i\right] - (n-1)\,\mathbb{E}\left[r\left(E_i, W_i\right)\right] \\ &= \mathbb{E}\left[r\left(E_i, W_i\right)\right] + \frac{2}{n}\sum_{i=1}^{n}\left(r\left(E_i, W_i\right) - \mathbb{E}\left[r\left(E_i, W_i\right)\right]\right).\end{aligned}$$

The projection is well-defined since $\mathbb{E}[|\lambda\left(E, E'\right)|W - W'||] < \infty$. By the Law of Iterated Expectation we have $\theta = \mathbb{E}\left[r\left(E_i, W_i\right)\right]$. Then we can write,

$$\widehat{\theta}_n - \theta = \frac{2}{n}\sum_{i=1}^{n}\left(r\left(E_i, W_i\right) - \mathbb{E}\left[r\left(E_i, W_i\right)\right]\right).$$

Furthermore, it can be shown that $\theta_n - \theta$ and $\widehat{\theta}_n - \theta$ have the same asymptotic distribution when $\mathbb{E}[|\lambda\left(E, E'\right)|W - W'||^2] < \infty$. The square integrability condition holds by assumption. Therefore $\theta_n = \widehat{\theta}_n + o_p\left(n^{-1/2}\right)$ and $\theta_n - \theta$ can thus be approximated by a sum of i.i.d. zero mean variables. Propositions 2 and 3 then follow immediately from a standard Law of Large Numbers and Central Limit Theorem for i.i.d. variables respectively. □

Proof of Proposition 4 Let r_n denote the sample counterpart of r, which is defined in the previous proof, so that

$$r_n\left(E_i, W_i\right) = \frac{1}{n-1}\sum_{j \neq i}^{n} \lambda\left(E_i, E_j\right)\left|W_i - W_j\right|.$$

We can now write (5) as,

$$\sigma_n^2 = \frac{4}{n}\sum_{i=1}^{n} r_n\left(E_i, W_i\right)^2 - 4\theta_n^2,$$

and σ^2, defined in Proposition 3, can be written as

$$\sigma_n^2 = 4\mathbb{E}[r\left(E_i, W_i\right)^2] - 4\theta^2.$$

Since θ_n is consistent, it suffices to show

$$\frac{1}{n}\sum_{i=1}^{n} r_n\left(E_i, W_i\right)^2 = \mathbb{E}[r\left(E_i, W_i\right)^2] + o_p\left(1\right).$$

To this end,

$$\begin{aligned}
\mathbb{E}[|r_n(E_i, W_i) - r(E_i, W_i)|^2] &= \mathbb{E}[Var(r_n(E_i, W_i)|E_i, W_i)] \\
&= \frac{1}{n-1}\mathbb{E}[Var(\lambda(E_i, E_j)|W_i - W_j||X_i)] \\
&\leq \frac{1}{n-1}\mathbb{E}[|\lambda(E_i, E_j)|W_i - W_j||^2] \\
&= O\left(n^{-1}\right).
\end{aligned}$$

Therefore $\mathbb{E}[|r_n(E_i, W_i) - r(E_i, W_i)|^2] = o(1)$, which implies $\mathbb{E}[|r_n(E_i, W_i)^2 - r(E_i, W_i)^2|] = o(1)$, and the required result follows from Markov's inequality. The proof then follows from applications of the Continuous Mapping Theorem. □

References

Afrobarometer (2018). Sampling principles and weighting. Retrieved July 03, 2018, from http://www.afrobarometer.org/surveys-and-methods/sampling-principles.

Alesina, A. and E. La Ferrara (2002). Who trusts others? *Journal of Public Economics 85*(2), 207–234.

Alesina, A., S. Michalopoulos, and E. Papaioannou (2016). Ethnic inequality. *Journal of Political Economy 124*(2), 428–488.

Algan, Y. and P. Cahuc (2010). Inherited trust and growth. *American Economic Review 100*(5), 2060–2092.

Arcones, M. and E. Giné (1992). On the bootstrap of U and V statistics. *Annals of Statistics 20*(2), 655–674.

Baldwin, K. and J. Huber (2010). Economic versus cultural differences: Forms of ethnic diversity and public goods provision. *American Political Science Review 104*(4), 644–662.

Banerjee, A. (2010). A multidimensional Gini index. *Mathematical Social Sciences 60*(2), 87–93.

BenYishay, A., R. Rotberg, J. Wells, Z. Lv, S. Goodman, L. Kovacevic, and D. Runfola (2017). Geocoding Afrobarometer rounds 1 - 6: Methodology & data quality. Williamsburg, VA: AidData at William & Mary. Retrieved November 20, 2018, from https://www.aiddata.org/publications/geocoding-afrobarometer-rounds-1-6-methodology-data-quality.

Bossert, W., C. D'Ambrosio, and E. La Ferrara (2011). A generalized index of fractionalization. *Economica 78*(312), 723–750.

Bourguignon, F. (1979). Decomposable income inequality measures. *Econometrica 47*(4), 901–920.

Cederman, L.-E., N. B. Weidmann, and K. S. Gleditsch (2011). Horizontal inequalities and ethnonationalist civil war: A global comparison. *American Political Science Review 105*(3), 478–495.

Chakravarty, S. (2015). *Inequality, polarization and conflict: An analytical study.* New Delhi: Springer.

Cowell, F. (1980). On the structure of additive inequality measures. *Review of Economic Studies 47*(3), 521–531.

Cowell, F. and S. Jenkins (1995). How much inequality can we explain? A methodology and an application to the United States. *Economic Journal 105*(429), 421–430.

Desmet, K., I. Ortuño-Ortín, and R. Wacziarg (2012). The political economy of linguistic cleavages. *Journal of Development Economics 97*(2), 322–338.

Desmet, K., S. Weber, and I. Ortuño-Ortín (2009). Linguistic diversity and redistribution. *Journal of the European Economic Association 7*(6), 1291–1318.

Deutsch, J. and J. Silber (1999). Inequality decomposition by population subgroups and the analysis of interdistributional inequality. In J. Silber (Ed.), *Handbook of Income Inequality Measurement*, pp. 363–403. New York, NY: Springer.

Duclos, J., J. Esteban, and D. Ray (2004). Polarization: Concepts, measurement, estimation. *Econometrica 72*(6), 1737–1772.

Durlauf, S. N. and M. Fafchamps (2005). Social capital. In P. Aghion and S. N. Durlauf (Eds.), *Handbook of Economic Growth*, Volume 1, Part B. Amsterdam: Elsevier.

Ebert, U. (1988). Measurement of inequality: An attempt at unification and generalization. *Social Choice and Welfare 5*(2), 147–169.

Eldredge, E. A. (2015). *Kingdoms and Chiefdoms of Southeastern Africa: Oral Traditions and History, 1400-1830.* Rochester, NY: University of Rochester Press.

Esteban, J. and D. Ray (1994). On the measurement of polarization. *Econometrica 62*(4), 819–851.

Esteban, J. and D. Ray (2001). Collective action and the group size paradox. *American Political Science Review 95*(3), 663–672.

Falola, T. and D. Jean-Jacques (Eds.) (2015). *Africa: An Encyclopedia of Culture and Society.* Santa Barbara, CA: ABC-CLIO.

Fearon, J. D. (2003). Ethnic and cultural diversity by country. *Journal of Economic Growth 8*(2), 195–222.

Feddersen, T. and W. Pesendorfer (1998). Convicting the innocent: The inferiority of unanimous jury verdicts under strategic voting. *American Political Science Review 92*(1), 23–35.

Filmer, D. and L. H. Pritchett (2001). Estimating wealth effects without expenditure data — or tears: An application to educational enrollments in states of India. *Demography 38*(1), 115–132.

Futhwa, F. (2012). *Setho: Afrikan Thought and Belief System.* Scotts Valley, CA: Createspace Independent Publishing Platform.

Gajdos, T. and J. Weymark (2005). Multidimensional generalized Gini indices. *Economic Theory 26*(3), 471–496.

Gershman, B. (2016). Witchcraft beliefs and the erosion of social capital: Evidence from Sub-Saharan Africa and beyond. *Journal of Development Economics 120*, 182–208.

Gigliarano, C. and K. Mosler (2009). Constructing indices of multivariate polarization. *Journal of Economic Inequality 7*(4), 435–460.

Gordon Jr., R. G. (Ed.) (2005). *Ethnologue: Languages of the World, Fifteenth edition.* Dallas, TX: SIL International.

Greenberg, J. (1956). The measurement of linguistic diversity. *Language 32*(1), 109–115.

Guariso, A. and T. Rogall (2017). Rainfall inequality, political power, and ethnic conflict in Africa. LICOS Discussion Paper Series No. 391/2017.

Guarnaschelli, S., R. McKelvey, and T. Palfrey (2000). An experimental study of jury decision rules. *American Political Science Review 94*(2), 407–423.

Gubler, J. and J. Selway (2012). Horizontal inequality, crosscutting cleavages, and civil war. *Journal of Conflict Resolution 56*(2), 206–232.

Gustavsson, M. and H. Jordahl (2008). Inequality and trust in Sweden: Some inequalities are more harmful than others. *Journal of Public Economics 92*(1), 348–365.

Hall, D. (1999). Cumulative bibliography of African studies: A guide. *Africa Bibliography 1997*, vii–cvii.

Higashijima, M. and C. Houle (2018). Ethnic inequality and the strength of ethnic identities in Sub-Saharan Africa. *Political Behavior 40*(4), 1–24.

Hodler, R., M. Valsecchi, and A. Vesperoni (2017). Ethnic geography: Measurement and evidence. CEPR Discussion Paper No. 12378.

Hoeffding, W. (1948). A class of statistics with asymptotically normal distribution. *Annals of Mathematical Statistics 19*(3), 293–325.

Horowitz, D. (1985). *Ethnic Groups in Conflict.* Berkeley, CA: University of California Press.

Houle, C. and C. Bodea (2017). Ethnic inequality and coups in Sub-Saharan Africa. *Journal of Peace Research 54*(3), 382–396.

Houle, C., C. Park, and P. D. Kenny (2018). The structure of ethnic inequality and ethnic voting. *Journal of Politics*. Forthcoming.

Høyland, B., K. Moene, and F. Willumsen (2012). The tyranny of international index rankings. *Journal of Development Economics 97*(1), 1–14.

Huber, J. D. and L. Mayoral (2014). Inequality, ethnicity and civil conflict. Working paper.

Huber, J. D. and P. Suryanarayan (2016). Ethnic inequality and the ethnification of political parties: Evidence from India. *World Politics 68*(1), 149–188.

Isaac, R. and J. Walker (1988). Group size effects in public goods provision: The voluntary contributions mechanism. *Quarterly Journal of Economics 103*(1), 179–199.

Jolliffe, I. (2002). *Principal Component Analysis.* New York, NY: Springer.

Kanbur, R. (2006). The policy significance of inequality decompositions. *Journal of Economic Inequality 4*(3), 367–374.

Knack, S. (2002). Social capital and the quality of government: Evidence from the States. *American Journal of Political Science 46*(4), 772–785.

Knack, S. and P. Keefer (1997). Does social capital have an economic payoff? A cross-country investigation. *Quarterly Journal of Economics 112*(4), 1251–1288.

Koshevoy, G. and K. Mosler (1997). Multivariate Gini indices. *Journal of Multivariate Analysis 60*(2), 252–276.

Kyriacou, A. P. (2013). Ethnic group inequalities and governance: Evidence from developing countries. *Kyklos 66*(1), 78–101.

Lambert, P. and J. Aronson (1993). Inequality decomposition analysis and the Gini coefficient revisited. *Economic Journal 103*(420), 1221–1227.

Leigh, A. (2006). Trust, inequality and ethnic heterogeneity. *Economic Record 82*(258), 268–280.

Moscona, J., N. Nunn, and J. A. Robinson (2017). Keeping it in the family: Lineage organization and the scope of trust in Sub-Saharan Africa. *American Economic Review 107*(5), 565–571.

Nunn, N. and L. Wantchekon (2011). The slave trade and the origins of mistrust in Africa. *American Economic Review 101*(7), 3221–3252.

Olson, J. S. (1996). *The Peoples of Africa: An Ethnohistorical Dictionary.* Westport, CT: Greenwood Publishing Group.

Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups.* Cambridge, MA: Harvard University Press.

Østby, G. (2008). Polarization, horizontal inequalities and violent civil conflict. *Journal of Peace Research 45*(2), 143–162.

Otlogetswe, T. J. (2011). *Text Variability Measures in Corpus Design for Setswana Lexicography.* Newcastle upon Tyne, UK: Cambridge Scholars Publishing.

Permanyer, I. (2012). The conceptualization and measurement of social polarization. *Journal of Economic Inequality 10*(1), 45–74.

Permanyer, I. and C. D'Ambrosio (2015). Measuring social polarization with ordinal and categorical data. *Journal of Public Economic Theory 17*(3), 311–327.

Putterman, L. and D. N. Weil (2010). Post-1500 population flows and the long-run determinants of economic growth and inequality. *Quarterly Journal of Economics 125*(4), 1627–1682.

Reynal-Querol, M. and J. Montalvo (2005). Ethnic polarization, potential conflict and civil war. *American Economic Review 95*(3), 796–816.

Robinson, A. L. (2016). Nationalism and ethnic-based trust: Evidence from an African border region. *Comparative Political Studies 49*(14), 1819–1854.

Robinson, A. L. (2017). Ethnic diversity, segregation and ethnocentric trust in Africa. *British Journal of Political Science*. Forthcoming.

Rohner, D., M. Thoenig, and F. Zilibotti (2013). Seeds of distrust: Conflict in Uganda. *Journal of Economic Growth 18*(3), 217–252.

Rutstein, S. O. (2015). Steps to constructing the new DHS wealth index. Retrieved June 20, 2017, from http://www.dhsprogram.com/programming/wealth

Sangnier, M. and Y. Zylberberg (2017). Protests and trust in the state: Evidence from African countries. *Journal of Public Economics 152*, 55–67.

Serfling, R. (1980). *Asymptotic Theorems of Mathematical Statistics*. New York, NY: Wiley.

Shorrocks, A. (1980). The class of additively decomposable inequality measures. *Econometrica 48*(3), 613–625.

Tesei, A. (2015). Trust and racial income inequality: Evidence from the US. CEP Discussion Paper 1331.

Tsui, K. (1995). Multidimensional generalizations of the relative and absolute inequality indices: The Atkinson-Kolm-Sen approach. *Journal of Economic Theory 67*(1), 251–265.

Tsui, K. (1999). Multidimensional inequality and multidimensional generalized entropy measures: An axiomatic derivation. *Social Choice and Welfare 16*(1), 145–157.

Zak, P. J. and S. Knack (2001). Trust and growth. *Economic Journal 111*(470), 295–321.

Online Appendix to "Measuring Ethnic Stratification and its Effect on Trust in Africa"

Roland Hodler, Sorawoot Srisuma, Alberto Vesperoni, Noémie Zurlinden[1]

A. Description of economic variables and their sources

Wealth index: For Afrobarometer surveys of round 5, we use the answers to the following questions to construct the wealth index:

(a) We construct three indicator variables from the following three questions: "Which of these things do you personally own?" "Radio", "Television" and "Motor vehicle, car or motorcycle." Answer categories are "No (Don't own)" and "Yes (Do own)."

(b) "How often do you use a computer?" Answer categories are "Every day," "A few times a week," "A few times a month," "Less than once a month," and "Never." We create an indicator variable for whether the household owns a computer, assigning the value one if the answer is "Every day", and the value zero for all other answer categories.

(c) "How many mobile phones are owned in total by members of your household, including yourself?" We construct an indicator variable equal to one if the household owns one or more mobile phones.

(d) "Please tell me whether each of the following are available inside your house, inside your compound, or outside your compound:" "Your main source of water for household use" and "A toilet or latrine." Answer categories are "Inside the house," "Inside the compound," "Outside the compound," and "None, no latrine available" (only for the second question). Following the approach by DHS (Rutstein, 2015), we construct an indicator variable for each answer category. Hence, we construct three indicator variables for the question on the main source of water, and four for the question on whether there is a toilet or latrine.

(e) "In what type of shelter does the respondent live?" Answer categories are "Non-traditional/formal house," "Traditional house/hut," "Temporary structure/shack," "Flat in a block of flats," "Single room in a larger dwelling structure or backyard," "Hostel in an industrial compound or farming compound," and "Other." Analogous to (d), we construct seven indicator variables from the seven answer categories.

[1]Hodler: Department of Economics, University of St.Gallen; email: roland.hodler@unisg.ch. Srisuma: School of Economics, University of Surrey; email: s.srisuma@surrey.ac.uk. Vesperoni: Department of Economics, Alpen-Adria University Klagenfurt; email: alberto.vesperoni@gmail.com. Zurlinden: Department of Economics, University of St.Gallen; email: noemie.zurlinden@unisg.ch.

(f) "What was the roof of the respondent's home or shelter made of?" Answer categories are "Metal, tin or zinc," "Tiles," "Shingles," "Thatch or grass," "Plastic sheets," "Asbestos," "Multiple materials," "Some other material," and "Concrete." Analogous to (d) and (e), we construct nine indicator variables out of the nine answer categories.

For Afrobarometer surveys of round 3, we construct the wealth index based on the five indicator variables constructed from the following five questions only: "Which of these things do you personally own?" "Radio," "Television," "Bicycle," "Motorcycle," and "Motor vehicle/car." Answer categories are again "No (Don't own)" and "Yes (Do own)."

Lived poverty index: Afrobarometer surveys of round 5 provide a variable called the lived poverty index. This index is based on the following questions on basic needs: "Over the past year, how often, if ever, have you or anyone in your family gone without food?", "water?", "medical care?", "cooking fuel?", and "cash income?" Answer categories are "Never," "Just once or twice," "Several times," "Many times," and "Always." Giving these answer categories values ranging from 0 to 4, the lived poverty index is the mean of these variables. We reverse the scale of the index, to get a measure increasing in economic well-being.

Afrobarometer surveys of round 3 include the same questions, but not the lived poverty index itself. We use these questions to construct the lived poverty index for round 3 in the same way as Afrobarometer does it for round 5.

B. Towns and villages in Afrobarometer round 3

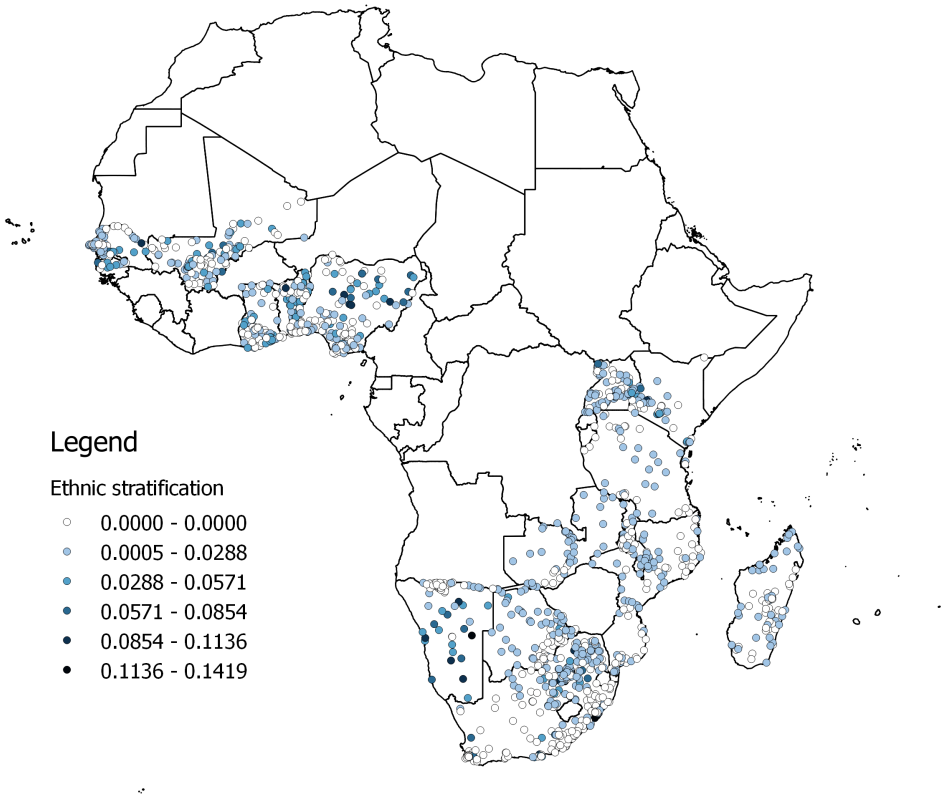


Figure B.1: Towns/villages in Afrobarometer round 3. Notes: Dots indicate the town and villages in the final sample from Afrobarometer round 3. Darker shades indicate higher local ethnic stratifications. Economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language, and ethnolinguistic distances are computed using the Putternam and Weil (2010) formula.

C. Robustness tests

Table C.1: Ethnicities instead of languages (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-0.76	-1.11**	-1.54***	-2.01***	-1.71***	-1.65***	-0.98**	-1.56***
	(0.47)	(0.50)	(0.48)	(0.44)	(0.43)	(0.34)	(0.47)	(0.52)
R^2	0.12	0.16	0.15	0.18	0.08	0.12	0.09	0.13
S	-1.12	-1.20	-2.07***	-2.09***	-1.90***	-1.89***	-1.61**	-1.55**
	(0.79)	(0.84)	(0.62)	(0.65)	(0.69)	(0.70)	(0.63)	(0.63)
F	0.07	0.04	0.10	0.06	0.05	0.06	0.07	0.02
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
G	-0.08	-0.10	-0.07	-0.08	-0.07	-0.03	0.13	0.02
	(0.10)	(0.09)	(0.12)	(0.12)	(0.13)	(0.12)	(0.17)	(0.17)
μ	-0.27***	-0.23***	-0.53***	-0.52***	-0.41***	-0.42***	-0.44***	-0.36**
	(0.08)	(0.07)	(0.16)	(0.14)	(0.15)	(0.14)	(0.17)	(0.15)
R^2	0.12	0.16	0.15	0.18	0.08	0.12	0.09	0.13
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,544	21,544	21,521	21,521	21,475	21,475	19,236	19,236

Notes: Linear probability estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' ethnicities. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.2: Fearon (2003) instead of Putterman and Weil (2010) (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-1.00**	-1.32***	-1.67***	-2.09***	-1.68***	-1.54***	-0.60	-1.23**
	(0.45)	(0.48)	(0.44)	(0.40)	(0.43)	(0.32)	(0.47)	(0.50)
R^2	0.12	0.16	0.15	0.18	0.08	0.12	0.09	0.13
S	-1.36	-1.64*	-1.88***	-1.86***	-1.97***	-1.81***	-1.34*	-1.63**
	(0.84)	(0.88)	(0.69)	(0.71)	(0.62)	(0.60)	(0.69)	(0.66)
F	0.06	0.06	0.05	0.01	0.05	0.06	0.09	0.06
	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)
G	-0.04	-0.05	-0.06	-0.07	-0.04	-0.01	0.11	0.03
	(0.10)	(0.09)	(0.11)	(0.11)	(0.12)	(0.12)	(0.17)	(0.17)
mu	-0.25***	-0.22***	-0.52***	-0.49***	-0.40***	-0.39***	-0.46***	-0.35**
	(0.08)	(0.08)	(0.16)	(0.14)	(0.15)	(0.15)	(0.17)	(0.15)
R^2	0.12	0.16	0.15	0.19	0.08	0.12	0.09	0.13
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,544	21,544	21,521	21,521	21,475	21,475	19,236	19,236

Notes: Linear probability estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Fearon (2003) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.3: Lived poverty index instead of wealth index (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-0.23	-0.38***	-0.45**	-0.65***	-0.53***	-0.43***	-0.26	-0.49***
	(0.16)	(0.13)	(0.19)	(0.16)	(0.18)	(0.14)	(0.17)	(0.17)
R^2	0.12	0.16	0.15	0.18	0.08	0.12	0.09	0.13
S	-0.09	-0.29	0.06	-0.15	-0.57*	-0.43	-0.74*	-0.98***
	(0.29)	(0.26)	(0.35)	(0.32)	(0.34)	(0.31)	(0.40)	(0.35)
F	-0.03	-0.01	-0.12	-0.13*	-0.01	-0.03	0.11	0.11
	(0.07)	(0.06)	(0.09)	(0.08)	(0.07)	(0.07)	(0.09)	(0.09)
G	-0.14	-0.14	-0.14	-0.08	0.28**	0.31***	0.17	0.21*
	(0.09)	(0.09)	(0.13)	(0.13)	(0.12)	(0.11)	(0.12)	(0.12)
μ	-0.08	-0.08	-0.03	-0.06	0.10	0.09	0.04	0.06
	(0.06)	(0.05)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
R^2	0.12	0.16	0.15	0.18	0.08	0.12	0.09	0.13
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,540	21,540	21,517	21,517	21,471	21,471	19,234	19,234

Notes: Linear probability estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the lived poverty index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.4: Controlling for generalized trust (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-0.80	-1.18**	-1.56***	-2.04***	-1.81***	-1.63***	-0.49	-1.17**
	(0.50)	(0.50)	(0.49)	(0.41)	(0.47)	(0.29)	(0.52)	(0.56)
Ind. gen. trust	0.08***	0.08***	0.21***	0.21***	0.25***	0.25***	0.07***	0.07***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Avg. gen. trust	0.08***	0.08***	0.15***	0.13***	0.10**	0.06	0.18***	0.14***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)
R^2	0.13	0.17	0.19	0.22	0.13	0.16	0.10	0.14
S	-1.37	-1.58*	-1.91**	-1.77**	-2.19***	-2.01***	-1.52**	-1.84***
	(0.88)	(0.94)	(0.79)	(0.79)	(0.69)	(0.66)	(0.72)	(0.70)
F	0.08	0.07	0.08	0.01	0.07	0.07	0.12*	0.10
	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.06)	(0.06)
G	-0.09	-0.11	-0.14	-0.13	-0.12	-0.06	0.06	-0.02
	(0.09)	(0.08)	(0.11)	(0.10)	(0.11)	(0.11)	(0.16)	(0.16)
μ	-0.18**	-0.16**	-0.39***	-0.40***	-0.26*	-0.29**	-0.37**	-0.30**
	(0.08)	(0.07)	(0.15)	(0.13)	(0.15)	(0.14)	(0.15)	(0.13)
Ind. gen. trust	0.08***	0.08***	0.21***	0.21***	0.25***	0.25***	0.07***	0.07***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Avg. gen. trust	0.07**	0.08***	0.15***	0.12***	0.09**	0.05	0.17***	0.14***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)
R^2	0.13	0.17	0.19	0.22	0.13	0.16	0.10	0.14
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,143	21,143	21,125	21,125	21,083	21,083	18,874	18,874

Notes: Linear probability estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age, age squared and generalized trust (Ind. gen. trust), indicator variables for gender, religion, education, and urban, and the cluster-level average of generalized trust (Avg. gen. trust). All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.5: Controlling for trustworthiness of other people and local institutions (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-0.87*	-1.25**	-1.61***	-2.09***	-1.90***	-1.71***	-0.52	-0.99**
	(0.50)	(0.53)	(0.50)	(0.44)	(0.49)	(0.33)	(0.45)	(0.49)
R^2	0.12	0.16	0.15	0.19	0.08	0.12	0.19	0.22
S	-1.47*	-1.58*	-2.26***	-2.03**	-2.30***	-2.04***	-1.38**	-1.55**
	(0.89)	(0.95)	(0.79)	(0.79)	(0.73)	(0.70)	(0.69)	(0.67)
F	0.09	0.07	0.10	0.04	0.07	0.07	0.09	0.08
	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)
G	-0.07	-0.10	-0.07	-0.09	-0.05	-0.02	0.05	-0.05
	(0.09)	(0.09)	(0.11)	(0.10)	(0.12)	(0.12)	(0.16)	(0.16)
μ	-0.27***	-0.24***	-0.54***	-0.52***	-0.43***	-0.42***	-0.25*	-0.20
	(0.08)	(0.07)	(0.16)	(0.14)	(0.15)	(0.14)	(0.15)	(0.14)
R^2	0.12	0.16	0.15	0.19	0.08	0.12	0.19	0.22
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trustworthiness FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Public goods FE	No	No	No	No	No	No	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,013	21,013	20,990	20,990	20,945	20,945	16,449	16,449

Notes: Linear probability estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' ethnicities. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. In columns (1)–(6), trustworthiness fixed effects are based on how often during the past year the respondent or anyone from the family felt unsafe walking in his neighborhood (never, just once or twice, several times, many times, or always), feared crime in his own home (never, just once or twice, several times, many times, or always), had something stolen from the house (never, once, twice, or three or more times), and was physically attacked (never, once, twice, or three or more times). In columns (7)–(8), trustworthiness fixed effects are based on whether the respondent approves of the way the elected assembly man/woman performed his/her job in the past twelve months (strongly disapprove, disapprove, approve, or strongly approve), how many of the local councilors he thinks are corrupt (none, some of them, most of them, or all of them), and whether the local councilors try their best to listen to people's concerns (never, only sometimes, often, or always). Public good fixed effects are based on whether there is electricity, piped water, a sewage system, a cell phone system, a post office, a clinic, a school, and a police station in the town/village. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. Sample: Round 5 restricted to countries that are also included in round 3. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.6: Continuous instead of binary outcomes (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-2.05*	-3.28***	-4.03***	-5.10***	-4.09***	-3.71***	-1.35	-2.80**
	(1.14)	(1.11)	(1.03)	(0.80)	(1.12)	(0.69)	(1.12)	(1.24)
R^2	0.17	0.22	0.21	0.25	0.10	0.15	0.12	0.16
S	-2.54	-3.17*	-5.15***	-4.94***	-4.62***	-3.60***	-3.36*	-4.11**
	(1.87)	(1.82)	(1.46)	(1.23)	(1.66)	(1.36)	(1.76)	(1.64)
F	0.13	0.08	0.20	0.07	0.11	0.05	0.23	0.18
	(0.17)	(0.15)	(0.13)	(0.11)	(0.14)	(0.13)	(0.15)	(0.14)
G	-0.26	-0.31	-0.10	-0.08	-0.03	0.03	0.25	0.13
	(0.23)	(0.21)	(0.23)	(0.22)	(0.28)	(0.27)	(0.34)	(0.34)
μ	-0.79***	-0.73***	-1.48***	-1.36***	-1.11***	-1.10***	-1.07***	-0.84***
	(0.25)	(0.22)	(0.33)	(0.29)	(0.32)	(0.29)	(0.34)	(0.30)
R^2	0.18	0.22	0.21	0.25	0.10	0.15	0.12	0.16
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,544	21,544	21,521	21,521	21,475	21,475	19,236	19,236

Notes: OLS estimates. Dependent variables can take the values 0 ("not at all"), 1 ("just a little"), 2 ("somewhat"), or 3 ("a lot"). Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.7: Probit maximum likelihood (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-4.01**	-5.92***	-4.89***	-6.46***	-5.29***	-4.96***	-1.61	-3.60**
	(1.84)	(1.96)	(1.37)	(1.23)	(1.41)	(0.98)	(1.44)	(1.61)
Pseudo R^2	0.14	0.15	0.12	0.14	0.06	0.09	0.07	0.09
S	-5.61*	-6.55**	-6.30***	-5.88***	-6.54***	-6.16***	-4.67**	-5.41***
	(3.10)	(3.26)	(2.13)	(2.13)	(2.06)	(1.95)	(2.11)	(2.07)
F	0.29	0.23	0.26	0.06	0.20	0.20	0.34*	0.27
	(0.27)	(0.29)	(0.20)	(0.20)	(0.17)	(0.19)	(0.19)	(0.20)
G	-0.40	-0.50	-0.22	-0.25	-0.11	-0.01	0.27	0.02
	(0.37)	(0.38)	(0.31)	(0.33)	(0.32)	(0.34)	(0.46)	(0.50)
μ	-1.25***	-1.21***	-1.60***	-1.60***	-1.08***	-1.11***	-1.24***	-0.99**
	(0.37)	(0.38)	(0.47)	(0.44)	(0.40)	(0.41)	(0.46)	(0.44)
Pseudo R^2	0.14	0.15	0.12	0.15	0.06	0.09	0.07	0.09
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	21,544	21,544	21,521	21,521	21,475	21,475	19,236	19,236

Notes: Probit maximum likelihood estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.8: Sample restricted to countries also covered in round 3 (Afrobarometer round 5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:	Trust in relatives		Trust in neighbors		Trust in other acquaintances		Trust in local assembly	
S	-1.22**	-1.33***	-1.50**	-1.93***	-1.30***	-1.52***	-0.08	-0.48
	(0.51)	(0.51)	(0.65)	(0.52)	(0.37)	(0.27)	(0.42)	(0.45)
R^2	0.11	0.15	0.15	0.19	0.09	0.12	0.07	0.11
S	-1.64*	-1.46*	-1.42*	-1.36	-1.59**	-1.70*	-1.25	-1.28*
	(0.92)	(0.87)	(0.84)	(0.83)	(0.78)	(0.87)	(0.79)	(0.73)
F	0.05	0.02	0.01	-0.05	0.05	0.02	0.11	0.08
	(0.09)	(0.08)	(0.08)	(0.07)	(0.08)	(0.09)	(0.09)	(0.09)
G	-0.02	-0.01	0.01	0.03	-0.05	0.05	0.18	0.12
	(0.12)	(0.12)	(0.13)	(0.12)	(0.14)	(0.14)	(0.13)	(0.12)
μ	-0.24**	-0.20**	-0.47**	-0.49***	-0.36**	-0.28**	-0.33*	-0.25
	(0.10)	(0.09)	(0.21)	(0.18)	(0.15)	(0.14)	(0.19)	(0.16)
R^2	0.11	0.15	0.16	0.19	0.09	0.12	0.08	0.11
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	14,220	14,220	14,195	14,195	14,172	14,172	12,317	12,317

Notes: Linear probability estimates. Dependent variables indicate whether respondents trust the respective group/institution "a lot" or "somewhat" as opposed to "not at all" or "just a little". Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' ethnicities. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5, but the sample is restricted to the countries included in round 3 and used in Table 3. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.9: Ethnicities instead of languages (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Higher trust in own ethnic group	
S	0.51	0.20	0.23	0.02	0.20	-0.07
	(0.38)	(0.37)	(0.39)	(0.37)	(0.18)	(0.23)
R^2	0.10	0.14	0.08	0.13	0.04	0.07
S	0.22	0.54	-0.55	0.02	1.24***	1.01**
	(0.53)	(0.50)	(0.61)	(0.62)	(0.45)	(0.47)
F	0.07	-0.05	0.14	0.02	-0.14*	-0.17**
	(0.08)	(0.08)	(0.12)	(0.10)	(0.07)	(0.08)
G	0.02	-0.01	0.04	-0.03	-0.12*	-0.08
	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)
mu	-0.30*	-0.16	-0.25	-0.20	-0.19	-0.08
	(0.18)	(0.16)	(0.17)	(0.17)	(0.15)	(0.14)
R^2	0.10	0.14	0.08	0.13	0.04	0.07
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,833	11,833	11,710	11,710	11,683	11,683

Notes: Linear probability estimates. Dependent variables in columns (1)–(4) indicate whether respondents trust the respective people "a lot" or "somewhat" as opposed to "not at all" or "just a little". Dependent variable in columns (5) and (6) indicates whether a respondent trusts people from own ethnic group more than people from other ethnic groups. Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' ethnicity. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 3. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.10: Fearon (2003) instead of Putterman and Weil (2010) (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Higher trust in own ethnic group	
S	0.46	0.22	0.24	0.03	0.03	-0.14
	(0.39)	(0.39)	(0.40)	(0.39)	(0.23)	(0.26)
R^2	0.10	0.14	0.08	0.13	0.04	0.07
S	0.24	0.40	-0.45	0.11	0.95**	0.68
	(0.61)	(0.53)	(0.59)	(0.60)	(0.44)	(0.47)
F	0.06	-0.02	0.13	0.01	-0.12*	-0.13
	(0.09)	(0.09)	(0.10)	(0.10)	(0.07)	(0.08)
G	0.02	-0.01	0.04	-0.03	-0.12	-0.06
	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)
μ	-0.30*	-0.17	-0.25	-0.21	-0.18	-0.06
	(0.17)	(0.15)	(0.17)	(0.17)	(0.15)	(0.14)
R^2	0.10	0.14	0.08	0.13	0.04	0.07
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,833	11,833	11,710	11,710	11,683	11,683

Notes: Linear probability estimates. Dependent variables in columns (1)–(4) indicate whether respondents trust the respective people "a lot" or "somewhat" as opposed to "not at all" or "just a little". Dependent variable in columns (5) and (6) indicates whether a respondent trusts people from own ethnic group more than people from other ethnic groups. Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Fearon (2003) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 3. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.11: Lived poverty index instead of wealth index (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Higher trust in own ethnic group	
S	0.29	0.07	0.13	-0.07	0.07	-0.13
	(0.26)	(0.23)	(0.31)	(0.27)	(0.15)	(0.17)
R^2	0.09	0.14	0.08	0.13	0.04	0.07
S	-0.46	-0.38	-0.42	-0.41	0.02	0.05
	(0.30)	(0.24)	(0.35)	(0.34)	(0.30)	(0.36)
F	0.19**	0.11	0.15	0.09	0.01	-0.05
	(0.09)	(0.08)	(0.10)	(0.10)	(0.08)	(0.10)
G	0.15	0.21**	0.01	0.04	0.02	0.02
	(0.12)	(0.09)	(0.15)	(0.14)	(0.13)	(0.12)
μ	-0.04	0.05	-0.05	0.01	-0.09	-0.06
	(0.11)	(0.09)	(0.10)	(0.08)	(0.07)	(0.07)
R^2	0.10	0.14	0.08	0.13	0.04	0.07
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,829	11,829	11,705	11,705	11,679	11,679

Notes: Linear probability estimates. Dependent variables in columns (1)–(4) indicate whether respondents trust the respective people "a lot" or "somewhat" as opposed to "not at all" or "just a little". Dependent variable in columns (5) and (6) indicates whether a respondent trusts people from own ethnic group more than people from other ethnic groups. Economic wealth and economic distances are based on the lived poverty index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 3. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.12: Controlling for generalized trust (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Higher trust in own ethnic group	
S	0.79**	0.37	0.45	0.13	0.17	-0.12
	(0.37)	(0.38)	(0.34)	(0.34)	(0.23)	(0.29)
Ind. gen. trust	0.24***	0.24***	0.25***	0.24***	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Avg. gen. trust	0.20***	0.11**	0.19***	0.12**	0.02	-0.00
	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)
R^2	0.14	0.18	0.13	0.17	0.04	0.07
S	-0.23	0.04	-0.99	-0.38	1.23**	1.07*
	(0.62)	(0.59)	(0.75)	(0.76)	(0.49)	(0.55)
F	0.18*	0.06	0.24*	0.10	-0.14**	-0.19**
	(0.09)	(0.09)	(0.13)	(0.12)	(0.07)	(0.08)
G	0.05	0.02	0.06	-0.02	-0.11	-0.07
	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)
μ	-0.21	-0.11	-0.17	-0.16	-0.18	-0.06
	(0.14)	(0.13)	(0.15)	(0.15)	(0.15)	(0.14)
Ind. gen. trust	0.24***	0.24***	0.25***	0.24***	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Avg. gen. trust	0.20***	0.11**	0.19***	0.12**	0.01	-0.01
	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)
R^2	0.14	0.18	0.13	0.17	0.04	0.07
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,551	11,551	11,446	11,446	11,421	11,421

Notes: Linear probability estimates. Dependent variables in columns (1)–(4) indicate whether respondents trust the respective people "a lot" or "somewhat" as opposed to "not at all" or "just a little". Dependent variable in columns (5) and (6) indicates whether a respondent trusts people from own ethnic group more than people from other ethnic groups. Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age, age squared and generalized trust (Ind. gen. trust), indicator variables for gender, religion, education, and urban, and the cluster-level average of generalized trust (Avg. gen. trust). All data are based on Afrobarometer round 3. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.13: Controlling for trustworthiness of other people (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Higher trust in own ethnic group	
S	0.55	0.25	0.23	0.01	0.18	-0.12
	(0.42)	(0.41)	(0.43)	(0.42)	(0.23)	(0.28)
R^2	0.10	0.15	0.09	0.13	0.04	0.07
S	-0.01	0.28	-0.87	-0.22	1.26***	1.06**
	(0.58)	(0.55)	(0.68)	(0.71)	(0.48)	(0.52)
F	0.11	0.01	0.19	0.06	-0.15**	-0.19**
	(0.09)	(0.10)	(0.13)	(0.12)	(0.07)	(0.08)
G	0.03	0.00	0.06	-0.02	-0.12*	-0.07
	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)
μ	-0.29*	-0.14	-0.23	-0.18	-0.19	-0.06
	(0.17)	(0.15)	(0.17)	(0.17)	(0.14)	(0.14)
R^2	0.10	0.15	0.09	0.13	0.04	0.07
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Trustworthiness FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,779	11,779	11,655	11,655	11,629	11,629

Notes: Linear probability estimates. Dependent variables in columns (1)–(4) indicate whether respondents trust the respective people "a lot" or "somewhat" as opposed to "not at all" or "just a little". Dependent variable in columns (5) and (6) indicates whether a respondent trusts people from own ethnic group more than people from other ethnic groups. Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. Trustworthiness fixed effects are based on how often during the past year the respondent or anyone from the family feared crime in his own home (never, just once or twice, several times, many times, or always), had something stolen from the house (never, once, twice, or three or more times), and was physically attacked (never, once, twice, or three or more times). All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.14: Continuous instead of binary outcomes (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Trust in own - other ethnic group	
S	1.20	0.52	0.76	0.43	0.44	0.04
	(0.83)	(0.76)	(0.87)	(0.84)	(0.34)	(0.44)
R^2	0.13	0.18	0.10	0.15	0.03	0.05
S	-0.53	0.02	-1.67	-0.64	1.10	0.61
	(1.32)	(1.32)	(1.40)	(1.45)	(0.86)	(0.85)
F	0.32	0.11	0.41	0.20	-0.07	-0.09
	(0.22)	(0.22)	(0.25)	(0.24)	(0.14)	(0.15)
G	0.10	0.05	0.20	0.06	-0.11	-0.02
	(0.14)	(0.13)	(0.17)	(0.16)	(0.13)	(0.12)
μ	-0.65*	-0.36	-0.40	-0.32	-0.26	-0.06
	(0.36)	(0.30)	(0.38)	(0.34)	(0.20)	(0.18)
R^2	0.13	0.18	0.10	0.15	0.03	0.05
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,833	11,833	11,710	11,710	11,683	11,683

Notes: OLS estimates. Dependent variables in columns (1)–(4) can take the values 0 ("not at all"), 1 ("just a little"), 2 ("somewhat"), or 3 ("a lot"). Dependent variable in columns (5) and (6) is the difference between trust in own and trust in other ethnic groups. Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 3. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.

Table C.15: Probit maximum likelihood (Afrobarometer round 3)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	Trust in own ethnic group		Trust in other ethnic group		Higher trust in own ethnic group	
S	1.50	0.68	0.67	0.03	0.50	-0.39
	(1.15)	(1.17)	(1.21)	(1.23)	(0.68)	(0.88)
Pseudo R^2	0.07	0.11	0.06	0.10	0.03	0.06
S	0.04	0.91	-2.10	-0.39	3.50**	3.01*
	(1.64)	(1.66)	(1.88)	(2.09)	(1.41)	(1.58)
F	0.29	-0.01	0.49	0.12	-0.41*	-0.54*
	(0.26)	(0.30)	(0.35)	(0.36)	(0.23)	(0.28)
G	0.07	-0.00	0.14	-0.06	-0.34	-0.21
	(0.19)	(0.21)	(0.21)	(0.20)	(0.21)	(0.22)
μ	-0.75*	-0.39	-0.65	-0.50	-0.49	-0.18
	(0.44)	(0.42)	(0.47)	(0.48)	(0.44)	(0.45)
Pseudo R^2	0.07	0.11	0.06	0.10	0.03	0.06
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	No	Yes	No	Yes	No	Yes
Observations	11,833	11,833	11,710	11,710	11,683	11,683

Notes: Probit maximum likelihood estimates. Dependent variables in columns (1)–(4) indicate whether respondents trust the respective people "a lot" or "somewhat" as opposed to "not at all" or "just a little". Dependent variable in columns (5) and (6) indicates whether a respondent trusts people from own ethnic group more than people from other ethnic groups. Economic wealth and economic distances are based on the wealth index. Ethnolinguistic groups are primarily based on the respondents' language. Ethnolinguistic distances are computed using the Putternam and Weil (2010) formula. Control variables are the respondents' economic wealth, age and age squared, and indicator variables for gender, religion, education and urban. All data are based on Afrobarometer round 5. Standard errors are adjusted for two-way clustering at the level of provinces and ethnolinguistic groups. ***, **, * indicate significance at the 1, 5 and 10%-level, respectively.