Measuring the diversity dividend for community-level health and women’s empowerment in Africa

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ABSTRACT

Despite the large body of evidence for a negative association between ethnic diversity and socio-economic development at the national level, there is reason to suppose that community-level diversity may be positively associated with development outcomes. For example, personal interaction with members of an out-group may facilitate the erosion of traditional social norms that inhibit the adoption of innovations that can improve the quality of life. Using household survey data from 20 Sub-Saharan African countries, we measure the overall association of community-level diversity with several measures of women’s empowerment and child health. For most of the measures, we find a positive association, even when we condition on other household characteristics such as education and wealth. Our results suggest that the diversity dividend is not just a characteristic of a few idiosyncratic locations, but part of a broad trend.

1. Introduction

Despite overall progress towards the achievement of Sustainable Development Goal 3 (Good Health and Wellbeing), substantial inequalities persist within and between the countries of Sub-Saharan Africa (Mejía-Guevara, Zuo, Bendavid, Li, & Tuljapurkar, 2019). Household-level health inequalities are known to be strongly associated with inequalities in income and wealth (Nikoloski, Wanni, Menchini, & Chatterjee, 2021; Selebano & Ataguba, 2022). However, community-level characteristics could also explain some of the variation in health outcomes. In this paper, we focus on the association of one specific community-level characteristic – the local level of ethnic diversity – with indicators of fertility and child health, and also with women’s empowerment, which is known to be a correlate of child health (Abreha & Zereyesus, 2021; Pratley, 2016).

Our study connects with the literature on ethnic fractionalization in sociology, economics, and political science. Here, “fractionalization” is understood as the degree of ethnic diversity in a certain location, usually measured as the probability that two randomly selected individuals in a given location will identify with different ethnic groups. The locations are usually nation states and ethnicity is usually defined in terms of native language, giving rise to the term “ethno-linguistic fractionalization” (ELF). A majority of these studies report a negative association between the level of fractionalization and a particular socio-economic outcome; commonly studied outcomes include per capita income, the level of public goods provision, social capital, and the avoidance of violent civil conflict. Some studies try to identify the extent to which this association reflects a causal effect of fractionalization on the outcome.1

Policy recommendations in this literature are seldom very specific, authors suggesting either greater effort to mitigate the negative consequences of fractionalization (for example, more investment in education or healthcare), or policies that might break the link between fractionalization and its consequences (for example, greater effort to improve trust and communication between community leaders). These recommendations reflect the view that ethnic diversity is necessarily an obstacle to development, and an adjective frequently used in this literature is “bleak”. A smaller number of studies have examined the association between ethnic fractionalization and socio-economic outcomes at lower levels of geographical aggregation. Results using province-level data are mixed, but some consistency appears across studies of community-level data from individual countries in the global south: despite a negative

1 See section 3.4 of Ginsburgh and Weber (2020) for a summary of this literature and Dinesen et al. (2020) for a meta-analysis of evidence for the association of ELF with social capital.

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association of community-level ethnic diversity with trust and public good provision, there is a positive association with some community-level measures of health, education, wealth, and women’s empowerment. Using data from 20 countries in Sub-Saharan Africa and analyzing seven different development outcomes, we show that for no outcome is there any substantial negative association across the 20 countries, and for some outcomes, there is a substantial positive association.

2. Literature review

Beginning with Easterly and Levine (1997), a large body of evidence has accumulated on the negative association of national-level ethnic diversity (Ginsburgh has accumulated on the negative association of national-level ethnic diversity (Ginsburgh & Weber, 2020; Dinesen, Schaeffer, & Sonderskov, 2020). Further studies have explored the channels through which there might be a negative causal effect of ELF on different dimensions of development. Common themes in this literature include the association of ELF with the under-provision of public goods (Habyarimana, Humphreys, Posner, & Weinstein, 2007), lower levels of trust, altruism, or social capital (Ziller, 2015), and a higher prevalence of civil conflict (Bhavnani & Miodownik, 2009; Esteban, Mayoral, & Ray, 2012). Although some authors contest the importance of ELF as a causal factor (Arbaili, Ashraf, Galor, & Klemm, 2020; Steele, 2016; Wimmer, 2016), there is a consensus that ceteris paribus, highly fractionalized nation states tend to be less developed.

It is important to stress that national-level ELF is distinct from ELF at other levels of geographical aggregation. Consider two countries, each of which comprises two equally sized ethnic groups and therefore has a conventional ELF measure of 0.5. If all towns and villages in the first country are ethnically homogeneous but all towns and villages in the second are ethnically mixed, then the two countries will have very different sub-national ELF measures. Empirical results using province-level data on ELF and development indicators are mixed, some authors finding a negative association (e.g. Alesina, Gennaioli, & Lovo, 2019; Gershman & Rivera, 2018) while others find a positive one (e.g. Gerring, Thacker, Lu, & Huang, 2015). Results using data at lower levels of geographical aggregation are also mixed, but a pattern emerges. There is a negative association of community-level ELF with trust and public goods provision (Okten & Osili, 2004; Hodler, Srisuma, Vesperoni, & Zurkinden, 2020; Khwaja, 2009; Miguel & Gugerty, 2005), but in the few countries to have been studied, a positive association of community-level ELF with some range of community-level socio-economic outcomes, including immunization rates and child health. There is evidence for a positive association in Senegal (Lepine & Strobl, 2013; Fielding & Lepine, 2017) and Ethiopia (Dinku, Fielding, & Genç, 2019; Dinku & Regasa, 2021). Giselquist, Leiderer, and Nino-Zarazua (2016) present evidence for both a negative association with public goods provision and a positive overall association with socio-economic outcomes in a single dataset from Zambia. Using highly geographically disaggregated data for the whole of Africa, Montalvo and Reynal-Querol (2021) find a positive association between nighttime intensity (a proxy for economic development) and ELF; the differences between this paper and our own are discussed in the next section.

Alternative theories explaining the negative association of ELF with public goods provision and trust are outlined in Habyarimana et al. (2007), who draw on a broad literature in economics and political science. These theories explore the consequences of the greater degree of heterogeneity in preferences and social norms and the higher communication costs that could arise in an ethnically diverse community. But why is there a positive association of ELF with socio-economic outcomes, despite the negative association with public goods provision? Potential explanations for the positive association are to be found in other disciplines, including sociology and human geography.

In sociology, there is substantial evidence for a negative association between population density and social conservatism (e.g. Glenn & Hill, 1977; Tuch, 1987; Wilson, 1985). Although much of the evidence comes from the United States, the association appears to be a worldwide phenomenon that is a feature of many different cultures (Higgins & DeBies-Carl, 2015). Moreover, Scala and Johnson (2017) show that in at least some places, the relationship between population density and social conservatism is approximately continuous, with small towns exhibiting levels of conservatism somewhere between those of the city and the village. The first theory to explain this association appears in Wirth (1938), who argues that cities tend to be more culturally heterogeneous than villages, and so provide more opportunity for interactions between individuals from different cultures that erode attachments to traditional sources of authority. Alternatively, Fischer (1975) argues that the cultural diversity of the city facilitates unconventional behaviour that would be censured in a culturally homogeneous village. These ideas connect with later research on the geography of gender, including Jarvis, Cloke, and Kantor (2009: 113):

“World cities … experience … increased exposure to different cultural and social norms, because of their very openness, and therefore have the capacity to induce gender liquefaction … A … world city, therefore, has to have the capacity to create and maintain different gendered forms that can only thrive in this rich, diversified urban environment.”

Building on Jarvis et al., Evans (2018) presents evidence for an association between population density and social norms in Zambia, where gender ideologies are eroding more rapidly in urban areas, which therefore have a less gendered division of labour. This body of theory and evidence is persuasive, but it overlooks variation in the degree of cultural heterogeneity across cities and across villages. Cities are indeed more culturally heterogeneous than villages, on average, but, as we will see later, a minority of cities are very homogeneous and a minority of villages are very heterogeneous. The arguments summarized above suggest that the erosion of traditional norms will depend not just on local population density (which will affect the total number of interpersonal interactions), but also on the level of cultural diversity of the location (which will affect the proportion of interpersonal interactions that are inter-cultural). Moreover, the erosion of traditional norms could enhance social and economic development. If, for example, the erosion of norms involves greater empowerment for women, this could lead to lower fertility rates and better child health.

Another branch of sociology explores the association between cultural diversity and educational performance. If diversity exposes individuals to a wider range of ideas and patterns of thought, then it can enhance their cognitive skills and capacities. Evidence for such an association appears in a variety of academic contexts. For example, Brauer and Dronkers (2013) show that ethnic diversity in Dutch school classrooms is associated with better student performance, while Alshehli, Babwan, and Woon (2018) show that scientific papers by ethnically diverse groups of co-authors are cited more often. This literature connects with research in industrial economics and management studies that explores the association between firm performance or worker productivity and the ethnic diversity of the workforce or of the firm’s location. There is substantial evidence for a positive association in
industrialized countries (Akay, Constant, Giulietti, & Guzi, 2017; Lee, 2015; Nathan, 2016). Evidence from the global south is more limited, but Bernard, Collion, De Janvry, Rondot, and Sadoulet (2008) show that village-level ethnic diversity is associated with market-oriented economic development in Burkina Faso.

The existing literature suggests that ethnic diversity can have both a negative effect on socio-economic development (through lower levels of trust, under-provision of public goods, and a greater propensity for conflict) and a positive effect (through an erosion of traditional social norms, better education, or higher productivity). The negative effects could operate at different levels of geographical aggregation: for example, trust within a village might be lower if the village is ethnically diverse and trust between mono-ethnic villages might be lower if each village is home to a different ethnic group. However, the positive effects discussed above are more likely to be a function of inter-personal contact and therefore relevant only at lower levels of geographical aggregation: they are a function of diversity within villages. It is therefore possible for village-level diversity to be positively associated with socio-economic outcomes (if the positive channels are stronger than the negative ones) while national-level diversity is negatively associated with socio-economic outcomes.

As noted above, a few country-level studies have produced evidence for a positive overall association of community-level diversity with outcomes such as immunization rates and child health. In these studies, the association between the outcomes and ethnic diversity is sometimes conditioned on household-level schooling and wealth, which rules out the education and productivity channels, but the norm-erosion channel is still a possible explanation. We build on this evidence by using household survey data from 20 Sub-Saharan African countries to estimate the association of community-level ethnic diversity with (i) child health outcomes, (ii) fertility rates, (iii) practices reflecting attitudes to child health, and (iv) attitudes towards women’s empowerment. We measure these associations conditional on other characteristics such as parental education and household wealth. We find evidence for a negative association of diversity with fertility and a positive association of diversity with some other outcomes. We do not try to identify the causal effect of attitudes on child health, but the positive association of diversity with attitudes is consistent with such an effect.

3. The data

The data are taken from the USAID Demographic and Health Surveys (DHS): see https://dhsprogram.com. In each of the 20 countries in our sample, the household survey chosen was, at the time that this study commenced, the most recent one containing data on the respondent’s ethnicity: either the sixth or seventh wave of the DHS, i.e. DHS-VI or DHS-VII; more detail is provided in Table A1 of the Supplementary Material. These are the only 20 Sub-Saharan African countries with a survey containing data on the respondent’s ethnicity. Each survey is based on a stratified sampling design, with households selected at random from representative survey sites in each province of the country. The survey sites – henceforth “clusters” – comprise one or two villages, or a small town, or a suburb of a large town or city. The unit of observation in all of our data analysis will be a DHS cluster. The precise size of our sample varies according to the outcome we are measuring, but the largest sample used in the estimates below comprises 7,895 observations.

Our outcome variables are average characteristics of the women or children in a cluster. The indicator of ethnicity used to construct our cluster-level diversity measure is the self-reported ethnic identity of each woman in the cluster. We do not attempt to aggregate identities according to the linguistic group of which the ethnic group’s language is a member, which means that we are measuring ethnic rather than ethnolinguistic diversity. We take this approach because self-reported ethnicity is likely to be a more salient indicator of local identity than a linguistic aggregate, and we wish to measure diversity at the local level. Our measure of diversity is an estimate of the probability that two women selected at random from the cluster will identify with different ethnic groups, i.e. $1 - \frac{1}{N} \sum_{i} f_i$, where $f_i$ is the fraction of women in cluster $i$ identifying with group $i$; this measure is denoted diversity. The map in Fig. 1 shows the level of diversity. It can be seen that while there is substantial variation in national average diversity levels (compare Côte d’Ivoire or Zambia with the Democratic Republic of Congo or Ethiopia), there is also substantial variation within countries. All countries contain some clusters with a diversity level of zero and other clusters with a level greater than 0.8. Across all countries, the mean level of diversity is higher in urban clusters (0.47) than in rural ones (0.25), but in both groups, there are clusters with a diversity level of zero and other clusters with a level greater than 0.8.

There is some variation in the number of women in each cluster, and diversity may contain a large amount of measurement error in clusters where the number is very small. We will therefore exclude clusters with fewer than 11 women and test whether the estimated associations with diversity vary with the number of women in the cluster (which has a mean of 25). In fact, the exclusion of small clusters makes no substantial difference to our results; further details are available on request.

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5 The association of diversity with education is the focus of another study.
6 The countries are Benin, Burkina Faso, Cameroon, Côte d’Ivoire, the Democratic Republic of Congo, Ethiopia, Gabon, Ghana, Guinea, Kenya, Liberia, Malawi, Mali, Mozambique, Nigeria, Senegal, Sierra Leone, Togo, Uganda, and Zambia.
7 The community-level studies cited in the literature review use either cluster-level DHS data (e.g. Dinku et al., 2019) or other household surveys with a similar level of geographical disaggregation (e.g. Lepine & Strobl, 2013, which uses village-level data).
8 We acknowledge that one limitation of the measure is that the DHS does not allow for the expression of multiple identities: the women have to choose the group with which they identify the most.
9 Some data points in the map overlap, and maps at a larger scale are available on request.
We will measure the conditional association of diversity, with seven different cluster-level outcomes: two measures of child health, two measures of practices reflecting attitudes to health, one measure of fertility, and two measures of attitudes towards women’s empowerment. (As indicated in the Supplementary Material, other outcomes were considered, but none of the alternative outcomes is reported in all 20 countries, so the corresponding sample sizes are smaller.) All confidence intervals reported below employ a Bonferroni correction to allow for the fact that seven different associations have been estimated simultaneously. The seven measures are listed below; more detail about their construction appears in notes 10–13.

a. \([\text{mean } \log(\text{weight/age})]\), The mean of the log of the weight-to-age ratio of each child in the cluster aged under five.

b. \([\text{mean } \log(\text{weight/height})]\), The mean of the log of the weight-to-height ratio of each child in the cluster aged under five.\(^{10}\)

c. \([\text{proportion immunized}]\), The fraction of children aged 1–5 in the cluster who are fully immunized according to World Health Organization guidelines.\(^{11}\)

d. \([\text{proportion sanitary}]\), The fraction of households in the cluster in which the youngest child’s stools are disposed of in a sanitary way.\(^{12}\)

e. \([\text{mean } \log(\text{1-births})]\), The mean of the log of one plus the number of live births reported by each woman in the cluster aged 15–45.

f. \([\text{proportion never-ok}]\), The fraction of women in the cluster aged 15–45 who think there are no circumstances in which it is justified for a woman’s partner to beat her.

g. \([\text{mean decision-score}]\), A mean decision score for across women in the cluster aged 15–45.\(^{13}\)

Note that measures (a-c) are child characteristics, measure (d) is a household characteristic, and measures (e-g) are women’s characteristics. If we calculate unweighted means and proportions, then with the exception of measure (d), these variables do not give equal weight to each household in the cluster, because some households contain more than one child or woman. If we wish to measure the association between the ethnic diversity of a cluster and average household-level outcomes in that cluster, then we should use weighted means, with weights equal to the inverse of the number of children or women in the household. It turns out that the results using weighted means are similar to those using unweighted means, but we will report both sets of results (denoted “with family weights” and “without family weights” respectively). Descriptive statistics for diversity, and the outcome variables appear in Table 1.

The unconditional correlation of diversity with one of the outcomes could be at least partly because both variables are correlated with other cluster-level characteristics. For this reason, we will fit a set of regression equations to measure the association of diversity with the outcomes conditional on a set of control variables, all of which are taken from the DHS. These variables are listed in Table 2: for outcomes (a-d), they include cluster-level means of characteristics of the child, the child’s mother, the mother’s husband, and the household, along with characteristics of the cluster.\(^{14}\) For outcomes (e-g), there is a similar set of controls excluding the child characteristics. Note that the number of households in the sample varies across the different outcomes, so the mean values of the control variables are specific to each outcome. For the family-weighted mean outcomes, the control variable means are weighted in the same way. Finally, the level of diversity is correlated with the proportion of women in the cluster from specific ethnic groups, and the culture of certain groups might be associated with better or worse outcomes, so we also control for the share of each ethnic group in the cluster. Nevertheless, there may remain some cluster-level unobserved heterogeneity that is correlated with both diversity and the outcomes; the next section includes a discussion of the way in which we deal with this possibility.

| Table 1 | Descriptive statistics for the variables in levels. |
|---------|--------------------------------------------------|
| variable | measure               | mean   | std. dev. | minimum | maximum |
| diversity  | all clusters   | 0.323  | 0.298   | 0.000   | 1.000  |
|           | urban clusters  | 0.471  | 0.299   | 0.000   | 1.000  |
|           | rural clusters  | 0.252  | 0.270   | 0.000   | 1.000  |
| mean log(weight/age) | with family weights without family weights | 1.606  | 0.194   | 0.943   | 2.864  |
|           | with family weights without family weights | –2.055 | 0.074  | –2.604  | –1.669 |
| proportion immunized | with family weights without family weights | 0.548  | 0.286   | 0.000   | 1.000  |
| proportion sanitary | with family weights without family weights | 0.646  | 0.341   | 0.000   | 1.000  |
| mean log(1-births) | with family weights without family weights | 1.126  | 0.248   | 0.000   | 2.013  |
|           | with family weights without family weights | 1.183  | 0.240   | 0.000   | 2.086  |
| proportion never-ok | with family weights without family weights | 0.520  | 0.278   | 0.000   | 1.000  |
| mean decision-score | with family weights without family weights | 0.496  | 0.251   | 0.000   | 1.000  |

\(^{10}\) The prevalence of obesity among children in Sub-Saharan Africa is close to zero but the prevalence of malnourishment is high, so higher weights represent a better outcome. Weight is measured in kilograms, age in months, and height in centimetres. For individual children, values of weight/age are trimmed at 1.5 and 60; values of weight/height are trimmed at 0.05 and 0.25. The observations in the right-hand tail are for very young babies; trimming individual values at the fifth and 95\(^{th}\) percentiles of the distribution does not substantially alter the results.

\(^{11}\) Full immunization comprises one dose of the measles vaccine, one dose of the vaccine for tuberculosis, four doses of the polio vaccine, and three doses of the DPT vaccine. The variable measures the fraction of children who have been fully immunized by the age of five years, not the fraction who were already fully immunized at 12 months, but the two measures are highly correlated.

\(^{12}\) The sanitary methods are burial or rinsing into a toilet, latrine, drain or ditch. Arguably, rinsing into a drain or ditch is unsanitary, but this category comprises only 6\(^{th}\) of the total sample, and its recategorization makes no substantial difference to the results. The unsanitary methods include throwing the stools into the garbage or not disposing of them at all.

\(^{13}\) For each woman, the score is the fraction of the following decisions over which the woman has full or partial control: whether to seek healthcare for herself, whether to make a large household purchase, whether to visit friends or family, and what to spend the partner’s earnings on.

\(^{14}\) The controls measure the following characteristics that might be correlated with ethnicity (and therefore diversity) but might also influence empowerment or child health: parental age (a proxy for age at marriage), parental education, husband’s occupation, household wealth, the number of adults in the household, and the mother’s relationship to the household head (since family structure could vary across ethnic groups). The controls also include measures of population density and local climate. The pattern of settlement by one ethnic group, and therefore local diversity, might be associated with agro-climatic conditions suitable for the traditional economic activities of that group, but climate can also influence child health.
empowerment outcomes with ethnic diversity conditional on the economic development of the cluster. In other words, we measure a diversity dividend that is quite distinct from theirs. Second, the ethnically diverse locations in their dataset are defined as polygons lying on the border of two ethnic homelands, with each point in space allocated to a diverse location common to a band:

$$\Delta y_i = \beta_0 + \beta_1 \Delta \text{diversity}_{it} + \sum_{j=1}^{M} \beta_j \Delta x_{ij} + \Delta \varepsilon_{it}$$

(3)

This method will be robust to any unobserved heterogeneity that is common to locations br and br-1. Note that $\Delta y_{br}$ measures a difference between two neighboring locations in the same country, so it is independent of any country-level characteristics, for example, country-level ELF. Note also that the differentiating introduces autocorrelation in the error term, and computation of the standard errors of the $\beta$ parameters should allow for this, as well as for the possibility of clustering at the

Table 2

| Definitions of the control variables* | 
|--------------------------------------|
| proportion children female          | proportion of children who are girls |
| mean child age (months)             | mean age of children in months |
| mean child age (months)             | squared mean child age |
| mean woman’s age                    | mean age of women (or mothers) in years |
| mean woman’s age                    | squared mean woman’s age |
| proportion heads                    | proportion of women (or mothers) who are household heads |
| proportion heads                    | proportion of women (or mothers) who are heads of households |
| proportion cohabiting               | proportion of women (or mothers) cohabiting with a partner |
| proportion women primary            | proportion of women (or mothers) with primary education |
| proportion women secondary          | proportion of women (or mothers) with secondary education |
| proportion women tertiary           | proportion of women (or mothers) with tertiary education |
| mean husband age                    | mean age of women’s (or mothers’) cohabiting husbands in years |
| mean husband age                    | squared mean husband age |
| proportion husbands primary         | proportion of cohabiting husbands with primary education |
| proportion husbands secondary       | proportion of cohabiting husbands with secondary education |
| proportion husbands tertiary        | proportion of cohabiting husbands with tertiary education |
| mean log(wealth)                   | mean of the log of the DHS household wealth index |
| mean adults in household            | mean number of adults in the household |
| proportion husbands unemployed      | proportion of cohabiting husbands who are unemployed |
| proportion husbands farmer          | proportion of cohabiting husbands who work in agriculture |
| precipitation                       | mean annual precipitation in the cluster in millimetres |
| temperature                        | mean annual temperature in the cluster in degrees centigrade |
| distance                           | distance in km from the cluster to the nearest urban centre |
| log(density)                       | the log of the number of people per square km in the cluster |
| I(urban cluster)                   | an indicator variable for a cluster in the DHS urban sample |

* Data for mothers are used in the models of child outcomes; data for women are used in other models.

4. Methods

We aim to estimate the association of diversity with each of the outcomes (a-g) conditional on the characteristics in Table 2. However, there remains a possibility that our results will be confounded by unobserved community-level heterogeneity that is correlated with both diversity and the outcomes. We do not have longitudinal data, so we cannot condition on community-level fixed effects in the conventional way, but we can mitigate the effects of unobserved heterogeneity by employing the method of Druckmiller and Hsiang (2018). We begin with an equation for the underlying model that we wish to fit:

$$y_i = \beta_0 + \beta_1 \text{diversity}_i + \sum_{j=1}^{M} \beta_j x_{ij} + \varepsilon_i$$

(1)

Here, $y_i$ stands for the value of one of the dependent variables (a-g) in cluster $i$, $x_{ij}$ stands for the value of the $j$th control variable in Table 2 using the cluster mean appropriate for measure $y_i$ and $\varepsilon_i$ is an error term; the $\beta$ terms are parameters to be estimated. By assumption, $\varepsilon_i$ is uncorrelated with diversity, but if there are unobserved community-level characteristics correlated with both $\text{diversity}_i$ and diversity, this assumption will be violated and standard estimates of the $\beta$ parameters (for example, OLS estimates) will be biased. If this heterogeneity is spatially correlated, then one way of mitigating the bias, following Druckmiller and Hsiang (2018), is to sort clusters by latitude, as illustrated in Fig. 2. Each band of latitude in each country is treated as one element in a panel: within each country-specific band $b$, we denote each observation of the dependent variable as $y_{ib}$ ($t = 1, 2, \ldots, T^b$), with lower values of $t$ corresponding to locations further to the east. There does not yet exist any theory on which to base the width of the band, but we will work with bands $50$ km wide. Of all the bandwidths we considered ($30$ km through to $70$ km), this is the one that minimizes the mean distance between $y_{ib}$ and $y_{ib-1}$, i.e. the mean length of the thin lines in Fig. 2.15

The following equation expresses our model using the new notation:

$$y_{ib} = \beta_0 + \beta_1 \text{diversity}_{ib} + \sum_{j=1}^{M} \beta_j \Delta x_{ij} + \Delta \varepsilon_{ib}$$

(2)

We then take differences of the dependent variable ($\Delta y_{ib} = y_{ib} - y_{ib-1}$) and of each explanatory variable, so that we can fit a random-effects regression equation using variables that have been purged of all variation common to a band:

$$\Delta y_{ib} = \beta_0 + \beta_1 \Delta \text{diversity}_{ib} + \sum_{j=1}^{M} \beta_j \Delta x_{ij} + \Delta \varepsilon_{ib}$$

(3)

Fig. 2. Linking clusters in the spatial difference model. Each green dot represents a cluster. In each country, within each band of latitude, each cluster is linked to the cluster immediately to the east. Each thin line linking two dots corresponds to one observation in the sample. The bandwidth is selected to minimize the mean distance between linked clusters. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

15 This minimum mean distance turns out to be $25.0$ km. Larger bandwidths reduce the mean difference in longitude between $ht$ and $ht-1$ but also increase the mean difference in latitude. With these two opposing effects, mean distance is approximately a quadratic function of the bandwidth, and $25.0$ km is the minimum point on this function. The minimum is preferred because we suspect the existence of local unobserved heterogeneity that is common to an area, but we do not know the precise size of this area. Minimizing the distance maximizes the probability of removing the unobserved heterogeneity.
band level. Figs. 3–9 are histograms of the spatial differences of the seven different outcome variables (using means without family weights). It can be seen that the spatially differenced variables are approximately normally distributed, although for the outcomes that are measured as proportions, there is a large number of observations at zero: these are cases in which two adjacent clusters have proportions exactly equal to zero or one. Descriptive statistics for $\Delta$diversitybt, the spatially differenced outcome variables, and the spatially differenced control variables appear in Table A2 of the Supplementary Material.

The use of lines of latitude to define the bands is somewhat arbitrary, but this provides us with a robustness test. We can change the co-ordinate system that defines the lines of latitude and fit the model again. If our method is generally robust to unobserved heterogeneity, then the parameter estimates should be approximately invariant to the co-ordinate system that we use. The tables below include results using two alternative co-ordinate systems: the normal one centred on the North Pole, and an alternative system in which the globe is rotated 45$^\circ$ along the 90$^\circ$ line of longitude, so that the new “north pole” is the point 45$^\circ$N 90$^\circ$W (in Marathon County, Wisconsin), and new lines of latitude and longitude are centred on this point.

The DHS stratified sampling design means that communities in different parts of the country have different probabilities of being selected into the sample. The DHS therefore includes sampling weights for each cluster. We cannot use these weights directly, because each of our observations is for a pair of clusters that may not have the same sampling weight. We take two alternative approaches to this problem. (i) We weight each observation by the inverse of the number of clusters in the country, so that each country has equal weight in the estimates, but no use is made of sampling weights: results using this method are denoted “without cluster weights”. (ii) We weight each observation by the average of the two clusters’ DHS sampling weights, scaling them so that the mean weight in each country equals the inverse of the number of clusters in that country: results using this method are denoted “with cluster weights”. With two types of cluster weight, two co-ordinate systems, and two types of family weight for six of our seven variables, we have $2 \times 2 \times (1 + 6 \times 2) = 52$ estimates in total.

The distributions of the proportion variables are bounded within the interval $[-1, 1]$, and in the case of [proportion immunized] and [proportion sanitary], there are some observations at the boundaries. However, these observations represent less than one percent of the total sample, so we do not consider a non-linear model.

One further way to mitigate endogeneity bias is to use diversitybt-2 and diversitybt+1 as instrumental variables for $\Delta$diversitybt. The Instrumental Variables estimates are qualitatively similar to those below but with somewhat larger coefficient estimates.

5. Results

The estimates of the diversity coefficients appear in Figs. 10–11, along
with corresponding 95% confidence intervals constructed with standard errors using the method of Driscoll and Kraay (1998) and applying a Bonferroni correction for multiple hypothesis testing. In no case is there any significant difference in coefficient estimates between rural and urban clusters. There is also no significant association of the coefficient with the number of women in the cluster, except in the case of mean log(1 + births) when using the 45° rotation. Excluding clusters with fewer than 15 women solves this problem without any substantial change in the estimated coefficient or standard error, so there is no evidence that our results are affected by measurement error in clusters with few women. Table A3-A4 in the Supplementary Material include estimates of the other coefficients and the corresponding standard errors; the restriction that all coefficients are equal to zero can be rejected at the one percent level. The estimated associations of the seven outcome variables with regressors other than diversity are not of direct interest, but they are discussed in the Supplementary Material.

Fig. 10 shows that both weight-for-age and weight-for-height are positively associated with cluster-level ethnic diversity. The size of the association does not vary much across the eight alternative estimates, and all are significantly greater than zero. However, the association is quite small: ceteris paribus, a cluster with maximal diversity ($\text{diversity} = 1$) is estimated to have a mean weight-for-age that is about 2.5% higher than that of a cluster with minimal diversity ($\text{diversity} = 0$); the corresponding figure for weight-for-height is about 2%. These are precise estimates: the 95% confidence intervals lie above zero and below 5%. In other words, we have evidence that there is neither a large positive association nor a negative association of the child health outcomes with diversity. Fig. 11 shows a similar result for the proportion of women who think that domestic violence is never justified: this proportion is estimated to be about 3% higher in maximally diverse clusters than it is in minimally diverse clusters. The corresponding upper 95% confidence interval is below 7% and the lower 95% confidence interval is equal to (or, for some estimates, very slightly below) zero.

For two of the outcomes – the immunization rate and the decision score – the estimated associations with diversity are very close to zero. These are quite precisely estimated zeroes: the 95% confidence intervals are between about +6% and −6%. In other words, we have evidence that any association of diversity with these outcomes is likely to be quite small, on average.\footnote{That is, on average across our 20 countries. If we restrict our sample to those countries (e.g. Ethiopia) where a significant association of immunization rates with diversity has previously been found, our method also produces a significant association, but we cannot say that this is a general pattern across Sub-Saharan Africa.}

There are much larger estimated associations for the fertility rate and the sanitary disposal of stools. A maximally diverse cluster is estimated to have a mean value of 1 + births that is 10–12% lower than that of a minimally diverse cluster; the 95% confidence interval lies between about 5% and 15%. In other words, diverse clusters probably have a substantially lower fertility rates. There is a very similar (absolute-value) point estimate for the proportion of households disposing of stools in a sanitary way, although the 95% confidence interval is very slightly larger.

6. Conclusion

Several recent studies of individual African countries have shown that, conditional on other household and community characteristics, community-level ethnic diversity is positively associated with a range of child health outcomes and with attitudes towards modern healthcare and women’s empowerment. These results stand in contrast to the negative associations with development outcomes that appear in national-level data. In this paper, we show that the positive community-level association is not an anomalous result specific to a few countries; on the contrary, for some outcomes, a positive association is the norm in Sub-Saharan Africa, and for no outcome is there a significantly negative association. Nevertheless, the association is much stronger for some...
outcomes (fertility and the sanitary disposal of stools) than it is for others (child anthropometrics, immunization rates, and measures of women’s empowerment).

While the specific causal channels behind these associations are yet to be identified, we can say that they are unlikely to be a consequence of an association of diversity with variation in wealth or education levels, because our statistical model controls for such variation. One possible explanation is that community-level diversity facilitates personal interaction between individuals from different cultures, and this erodes the influence of socially conservative norms associated with, for example, high fertility and poor sanitary practices. Cosmopolitan attitudes normally associated with large cities may also be a feature of culturally diverse villages.

Why do we find a large association of diversity with two of our outcomes and a small association of diversity with the others? In the absence of more data, answers to this question are necessarily speculative. However, if there are positive effects of diversity on development through the erosion of conservative social norms, then perhaps some norms are more susceptible to erosion than are others. Views about the way that a husband can treat his wife may be very entrenched, on average, while views about the ideal number of children are not. Opposition to vaccines, the benefits of which are sometimes difficult to convey, may be more entrenched than opposition to basic sanitary practices, the benefits of which are more straightforward. In this case, it is unsurprising if the association of diversity with child health, which is likely to depend on all of these attitudes, is positive but relatively small.
on average. The potential benefits of diversity that we have uncovered relate to a level of geographical aggregation at which there is seldom extensive local government, and we do not make specific policy recommendations. Nevertheless, our evidence suggests that provincial and national policymakers should not regard community-level diversity as a problem. No development outcome that we have considered is significantly worse in diverse communities than it is in homogenous ones, and some outcomes are substantially better. Further research on the mechanisms explaining this difference may lead to policies that enhance community-level development.

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**Author statement**

This is a single-author paper; the author is responsible for all of the work.

**Declaration of competing interest**

None.

**Data availability**

The data are published online by USAID: the relevant website is given at the beginning of section 3 of the paper. It is necessary to register before downloading the data.

**Appendix A. Supplementary data**

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2022.101294.

**References**

Abreu, S. K., & Zereyesus, Y. A. (2021). Women’s empowerment and infant and child health status in sub-saharan Africa: A systematic review. Maternal and Child Health Journal, 25(1), 95–106.

Akay, A., Constant, A., Giullietti, C., & Guizzi, M. (2017). Ethnic diversity and well-being. *Journal of Population Economics*, 30(1), 265–306.

Al-Shibli, B. K., Rahman, T., & Woon, W. L. (2016). The pre-eminence of ethnic diversity in scientific collaboration. *Nature Communications*, 9(1), 1–10.

Aleina, A., Gennaioli, C., & Lovo, S. (2019). Public goods and ethnic diversity: Evidence from deforestation in Indonesia. *Econometrica*, 88(2), 727–797.

Bernard, T., Collion, M. H., De Janvry, A., Rondot, P., & Sadoulet, E. (2008). Do village-level public goods provision in Zambia: Evidence of a subnational ‘diversity dividend’. *World Development*, 36, 166–188.

Bhavnani, R., & Miodownik, D. (2009). Ethnic polarization, ethnic salience, and civil war. *American Journal of Sociology*, 115(2), 465–504.

Butta, M., Bhise, M., Prashad, L., Chaurasia, H., & Debnath, P. (2020). Prevalence and risk factors of anemia among children 6-59 months in India: A multilevel analysis. *Clinical Epidemiology & Global Health*, 8(3), 686–697.

Easterly, W., & Levine, R. (1997). Africa’s growth tragedy: Policies and ethnic divisions. *Quarterly Journal of Economics*, 112(4), 1203–1250.

Esteban, J., Mayoral, L., & Ray, D. (2012). Ethnicity and conflict: Theory and facts. *Journal of Development Economics*, 98(S3), 858–865.

Evans, A. (2018). Cities as catalysts of gendered social change? Reflections from Zambia. *Annals of the Association of American Geographers*, 108(4), 1096–1114.

Fielding, D., & Lepine, A. (2017). Women’s empowerment and wellbeing: Evidence from Africa. *Journal of Development Studies*, 53(6), 826–840.

Fischer, C. S. (1975). Toward a subcultural theory of urbanism. *American Journal of Sociology*, 80(6), 1319–1341.

Gerring, J., Thacker, S. C., Ly, V., & Huang, W. (2015). Does diversity impair human development? A multi-level test of the diversity debit hypothesis. *World Development*, 66, 166–188.

Gershmam, B., & Rivera, D. (2018). Subnational diversity in sub-saharan Africa: Insights from a new dataset. *Journal of Development Economics*, 133, 231–263.

Ginsburgh, V., & Weber, S. (2020). The economics of language. *Journal of Economic Literature*, 58(2), 348–404.

Gislonquint, R. M., Leiderer, S., & Nino-Zarazua, M. (2016). Ethnic heterogeneity and public goods provision in Zambia: Evidence of a subnational ‘diversity dividend’. *World Development*, 78, 308–323.

Glenn, N. D., & Hill, L., Jr. (1977). Rural-urban differences in attitudes and behavior in the United States. *The Annals of the American Academy of Political and Social Science*, 429(1), 36–50.

Habyarimana, J., Humphreys, M., Ponser, D. N., & Weinstein, J. M. (2007). Why does ethnic diversity undermine public goods provision? *American Political Science Review*, 101(4), 793–725.

Hodler, B., Sisuma, S., Vesperoni, A., & Zurinlden, N. (2020). Measuring ethnic stratification and its effect on trust in Africa. *Journal of Development Economics*, 146, Article 102475.

Hoehle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *STATA Journal*, 7(1), 281–312.

Higgins, C. M., & Debbils-Carl, J. S. (2015). Tolerance in the city: The multilevel effects of urban environments on permissive attitudes. *Journal of Urban Affairs*, 37(3), 255–269.

Jarvis, H., Croke, J., & Kantor, P. (2009). Cities and gender. *Routledge*.

Khwaja, A. I. (2009). Can good projects succeed in bad communities? *Journal of Public Economics*, 93(7), 899–916.

Lee, N. (2015). Migrant and ethnic diversity, cities and innovation: Firm effects or city effects? *Journal of Economic Geography*, 15(4), 769–796.

Lepine, A., & Strobl, E. (2013). The effect of women’s bargaining power on child nutrition in rural Kenya. *World Development*, 45(1), 17–30.

Meija-Guevara, I., Zuo, W., Bendavid, E., Li, N., & Tulajaparmar, S. (2019). Age distribution, trends, and forecasts of under-5 mortality in 31 sub-saharan African countries: A modeling study. *PLoS Medicine*, 16(3), e1002757.

Miguel, E., & Gugerty, M. K. (2005). Ethnic diversity, social sanctions and public goods in Kenya. *Journal of Public Economics*, 89(31), 2325–2368.

Montalvo, J. G., & Reynal-Querol, M. (2021). Ethnic diversity and growth: Revisiting the evidence. *The Review of Economics and Statistics*, 103(3), 521–532.

Nathan, M. (2016). Ethnic diversity and business performance: Which firms? Which diversity? *Journal of Environment & Planning A: Economy & Space*, 48(4), 2462–2483.

Nikoloski, Z., Wannis, H., Mchence, L., & Chatterjee, A. (2021). Primary healthcare and maternal and child maternal in the Middle East and north Africa (MENA): A retrospective analysis of 29 national survey data from 13 countries. *SSM Population Health*, 13, Article 100727.

Okten, C., & Oszl, U. O. (2004). Contributions in heterogeneous communities: Evidence from Indonesia. *Journal of Population Economics*, 17(4), 603–626.

Pratley, P. (2016). Associations between quantitative measures of women’s empowerment and access to care and health status for mothers and their children: A systematic review of evidence from the developing world. *Social Science & Medicine*, 169, 119–131.

Robinson, A. L. (2020). Ethnic diversity, segregation and ethnonocratic trust in Africa. *British Journal of Political Science*, 50(2), 217–239.

Scalzo, D. J., & Johnson, K. M. (2017). Political polarization along the rural-urban continuum? The geography of the presidential vote, 2000-2016. *The Annals of the American Academy of Political and Social Science*, 672(1), 162–184.

Selebano, K. M., & Ataguba, J. E. (2022). Decomposing socio-economic inequalities in antenatal care utilisation in 12 Southern African Development Community countries. *SSM Population Health*, 17, Article 101004.

Steele, L. G. (2016). Ethnic diversity and support for redistributive social policies. *Social Science & Medicine*, 146, 139–149.

Tuch, S. A. (1987). Urbanism, region, & social trust: A narrative and meta-analytical review. *Annual Review of Political Science*, 21(1), 441–465.

Dinku, Y., Fielding, D., & Genç, M. (2019). Neighbourhood ethnic diversity, child health outcomes and women’s empowerment. *Journal of Development Studies*, 55(9), 1909–1927.

Dinku, Y., & Regana, R. (2021). Ethnic diversity and local economies. *South African Journal of Economics*, 89, 348–367.

Driecoll, J. C., & Klary, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *The Review of Economics and Statistics*, 80(4), 549–560.

Druckermiller, H., & Heisang, S. (2018). Accounting for unobservable heterogeneity in cross section using spatial first differences. *NBER Working Paper* 25177.