Do Cultural Roots Matter for Citizen Engagement in Government Programs? Evidence from Childhood Vaccination in Sub-Saharan Africa

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Abstract

We study how past exposure to the transatlantic and Indian ocean slave trade has an impact on present attitude towards public health interventions such as vaccination programs in Sub-Saharan Africa. We elaborate on avenues for investigating causal relationship between cultural norms of mistrust inherited by mothers from different ethnic group and their children vaccination decision. Especially, we provide evidence through a rich sample of Demographic Health Survey (DHS) individual level data that ethnicity through its relationship with cultural trust is a salient causal channel. We find a negative and significant effect of slave trade on parent's likelihood to immunize their children against measles. We show that this negative effect goes both through direct vertical transmission of norms by parents and horizontal transmission from negative spillovers of living in low trustworthy environment. There is evidence that both effects are relatively important. We show that the results are not potentially driven by the size effect of the group or discrimination towards smaller ethnic minorities. As for the magnitude of the effect, we find that past exposure to slave trade has a negative impact nearly offsetting the benefit from membership in the highest 20% income quantile. In addition, the associated estimates are higher than the negative effect of distance to health facility on the likelihood of immunization against measles or the positive impact of being born to an employed mother. Our calibration predicts an important decrease in measles incidence in the Hausa ethnic group form Northern Nigeria had they been a slave free group and thus inherited cooperative norms. Using different strategies, we argue that the observed linked is not picking-up the effect of pre-colonial ethnic group characteristics such as centralization or rigidity of social norms. Moreover, a falsification test with less trust sensitive disease such as malaria supports the argument that slave trade is impacting the vaccination decision through its effect on mistrust.

Keywords: Culture, Ethnicity, Trust, Vaccination, Sub-Saharan Africa

1 Introduction

Low-income countries face 56% of the global disease burden but account for only 2% of global health spending (World Bank 2005; Mathers, Lopez and Murray). This situation

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made research on the delivery of health services in developing countries essentially oriented on the supply side impediment to access to health. For Sub-Saharan Africa, the traditional emphasis is on financial constraint such as shortage of government funds, limited technical capabilities, but also negative social behaviors such as widespread corruption or limited access to information from both services suppliers but also final users of public services such as illiterate population.

However, the evidence calls for careful investigation of the role of the demand side such as health-seeking behavior. In fact, even in the presence of adequate supply for medical treatment such as in internationally funded universal campaigns for vaccination against endemic disease, public resistance and absence of compliance caused a rapid spread of viruses and unpreceded death toll. For instance, populations in Nothern Nigeria from majority Hausa and Kanuri ethnic groups have shown noncompliance and boycotted polio vaccination campaigns leading to epidemic outbreak even in previously polio-free neighboring countries (Jegede 2003, Grossman et al., 2015). Most recently, during the Ebola epidemic outbreak in West Africa, many communities did not comply with health authorities safety and epidemic containment directives in safe-burial of deceased relatives, inter-personal interactions and restricted mobility (Blair and al. 2017). This absence of compliance in Liberia, Sierra Leone and Guinea implied quick spread of the disease and to more than 11,300 deaths toll during the last outbreak. Not only was there a high level of resistance regarding safety measures, but even vaccines trials faced the same level of mistrust as illustrated by this quotation from the 27 years old Mohamed Soumah who was the first person to receive the Ebola vaccine: " It wasn't easy. People in the village said that the injection was to kill me. I was afraid. I was the first one to be injected, the very first, here in my village on 23 March 2015." (WHO, July 2015). These cases of rejection of readily available preventive by specific communities are not specific to African geographic locations, making it salient for public health policy makers even in developed countries. For example, African migrants in Nothern England have been shown to refuse Human Papillomavirus Vaccine (HPV) preventing cervical cancer for their adolescent young girls regarding their cultural norms of sexual behavior (Mupandawa and Cross, 2016).

This paper investigates how culture, understood as beliefs, values and social norms people hold, influences public health outcomes. It focuses on one particularly encompassing cultural value which is generalized trust. It builds on the now established literature on trust and its relationship with economic, political, and social outcomes at different levels and its link to basic behavioral attitudes. It aims to contribute to this literature by uncovering the relevance of the demand side, in particular the role of culture and its behavioral implications in terms of cooperative and compliance attitudes of final public service consumers. The idea that cultural attitude is important is not new, especially for societies which have remained relatively traditional as it is the case for African societies. In the academic debate, or in public policy international organization white papers and reports, there is a permanent call for considering contextual environments in which policy and program interventions take place. Addressing the question of culture of cooperation is important since many services delivered by the government need active collaboration of both the supply and demand side: child immunization, schooling of young girls etc. Fostering cooperative behavior is life-saving for immunized children and prevents costly public funds spending from epidemic outbreak. Immunization is one of the most cost-effective public health intervention (United States CDC; Copenhagen Consensus Center,2008 ; WHO,2009) with 2.5 million children lives saved per year but millions born in developing countries do not complete immunization schedule for their first year of life (WHO, 2016).

Moreover, building compliance attitudes implies saving in monitoring and regulation or costly incentives such as conditional cash-transfer.

The novelty of this work is that it systematically attempts to provide empirical evidence on the role of culture, particularly inherited norms of cooperative behavior across groups through prevailing level of trust, on health outcomes relative to other traditional socio-demographic, economic and technical factors in developing country context. In order to find exogenous variations in parents potential level of trust, we build on the work by Nunn and Wantchekon (2011) and focus on past exposure to slave trade and current trusting behavior. In their pioneer work, the authors uncover a causal relationship between past ethnic group exposure to slave trade and today's ethnic group members reported level of trust towards family members, co-ethnics, other ethnic groups members and local government officials. They provide historical evidence documenting the method of enslavement of 144 former slaves informants in the inventory by Koelle (1854) where he conceals that more than 40% of respondents reported that they were seized or kidnapped, and where around 20% were tricked and sold by family members, relatives or treacherous friends. Relatively, only 24 % reported to be taken in a war and 16% were condemned to be sold as slave through the judicial process. Nunn and Wantchekon intuitively argue that such an environment might have implied affected ethnic group to develop norms of mistrust as behavioral rule of thumb when facing uncertainty given the likelihood that trust will lead high probability of grievance. They convincingly show through different test strategies that the observed link between past slave trade exposure at the ethnic group level and nowadays's heterogeneity of trust between groups is causal. First, the authors introduce a very rich set of controls going from individuals socio-demographic characteristics, locations controls, ethnic group pre-colonial controls, and colonial controls to take into account other potential determinants of trust. Second, they instrument the number of slave raided groups with the distance of ethnic groups historical location to the transatlantic and Indian ocean coast and show that it is positively correlated to the level of trust. Moreover, as a falsification test they show that this correlation between distance to the coast and trust is observed only in the African continent and not in other social surveys in Europe and Asia. As a consequence, our work builds from these findings to infer the relationship between inherited mistrust by individuals from different ethnic groups and present day trust in medicine through parents' vaccination decision.

In order to do this, we match parents' ethnicities from our 18 baseline country-representative DHS to Nunn's data on slave trade and match locations in the DHS to Murdock's 1959 historical map for African ethnic group's homelands using our restricted access to geolocalization data. The data cover the most recent compatible survey data from 2010 and 2014. Our analysis covers a total sample of 258,964 children born to 49,287 adults female mothers from 117 ethnic groups with a minimal size above 5% each country population. The main challenge of identifying the effect of culture on the demand for vaccine is controlling for the differential access to vaccine and the quality of health supply. In order to overcome this challenge, we focus on the individual level vaccination decision at the village, town or district level allows to control for relevant individual characteristics and locations controls that are likely to affect immunization decision. We exploit variations within localities between individual from different ethnic groups differentially affected by the slave trade. Focusing on past historical shocks avoid the issues of reverse causalities. Exploiting local level variations with a rich control set mitigate many potential issues due to omitted variable bias for which geography and the heterogeneity of the supply side at the country level or any large geographic area are plausible candidate.

We find a negative and significant effect of slave trade on parent's likelihood to immunize their children against measles. Our most conservative estimates with location fixed effect predicts estimation ranging from 4 to 5 percentage points decrease in the likelihood of immunization for children from slave raided group relative to those from relatively slave free group. The effect found is in the range of other traditional economic determinants of health outcomes such as being part of the wealthiest quantile relative to the poorest, relatively higher the positive employment status of the mother or distance to the health facility. The size of the effect found suggests that the cultural dimension involved in immunization decision is relatively high with respect to other traditional socio-demographic variables such as household income, access to health facility, literacy but also religion or control of birth intervals.

We then rule out the possibility the negative effect of past exposure to slave trade on vaccination picks-up other ethnic pre-colonial characteristics that might affect immunization decision such as past political centralization, social rigidity and girl's norms of sexual behaviour that might affect openness to modern medicine. Moreover, we also rule out the effect of colonial political shocks such as split ethnic groups that are not correlated to slave trade. Interesting findings for the literature on the interactions between culture and institutions (Spolaore and Wacziarg, 2013) , this work provides some insight on the previously studied centralization versus egalitarian political organizations (Gennaioli and Rainer, 2007) . It shows that past centralization has negative effect on today's likelihood of immunization at the individual level in contrast to cross-country analysis showing positive effect on public good provision in general. A possible interpretation is that the individual setting allows to capture a cultural dimension that cross-country or regional analysis does not fit. In this interpretative direction, we found positive correlation between past political centralization at the group level and rigidity of sexual norms of behavior of girls or norms on endogamous marriage.

We also perform a falsification test to confirm that slave trade is associated with vaccination through it effect on mistrust. In order to that, we study the link between number of slave exported by the individual's ethnic group of origin and the propensity of using insecticide-treated (ITN) bednet against malaria conditional on having one. We find that there is any relation between past exposure to slavery on the current use. We argue that malaria is a well known disease and use of bednet do not imply a trust dimension as vaccination does implying no effect. Finally, we provide more evidence for our cultural interpretation through norms of distrust is supported by ruling qualitative evidence from respondents stating that cultural motivations prevent them from using many available health services or products.

Conceptually, we propose an interpretation of immunization decision as involving transmission of cultural trait as modeled in Bisin and Verdier (2001). This literature focuses on the dynamics of trust,and stress the role of intergenerational transmission of values through education from a theoretical standpoint. (Bisin and Verdier, 2001). We attempt to uncover the channel through which mistrust is affecting the mother current vaccination decision and find that both internal cultural norms through vertical transmission from parents and horizontal channel through the behavior of the surrounding neighbors in the same environment have a negative effect.

The rest of the paper is organized as follows, section 2 presents the background on ethnicity and culture in sub-Saharan Africa; section 3 presents our main empircal analysis and section 4 discuss the results; section 5 presents theoretical considerations and empirical implications on cultural persistence across tiem and space and we conclude with

section 6.

2 Ethnicity and culture and in Sub-Saharan Africa

Ethnicity is an important dimension of cultural identity in Sub-Saharan Africa. Since pioneering work by (Easterly and Levine, 1997) which shows a negative cross-country correlation between ethnic fragmentation and public good provision, it is now accepted that ethnicity might explain important features of Africa's economic performance. Even outside Africa, ethnic diversity is also associated to lower local public good provision in US counties (Alesina et al., 1999), due to diversity of individual preferences. More recent studies have redefined historical shocks in Sub-Saharan Africa such as slave trade to their intensity at the ethnic level and subsequently to the level of trust among African populations (Nunn and Wantchekon, 2011). In the same vein, Michalopoulos and Papaioannou (2015) have investigated the long-run effect of ethnic partitioning at the onset of the precolonial period in Africa. They show that the homelands of partitioned groups are more conflict prone compared to non-partitioned group, individuals from partitioned group might face discrimination from the central government and are more likely to participate in civil wars. More importantly pre-colonial ethnic institutions such as past political centralization are still currently positively associated with economic development at the ethnic homeland level captured by satellite image of light density at night (Michalopoulos and Papaioannou, 2015). When analyzing the role of national institutions on sub-national African development (Michalopoulos and Papaioannou, 2015), the authors find that differences in countrywide national institutions do not explain difference in economic performance within the same ethnic group partitioned between two countries and subject top different national contemporary (post-colonial) institutions. Overall, this recent literature tends to uncover and emphasize the salience and persistence of deep-rooted ethnic identity and informal institutions in countries where people identify both with their country as often as their ethnic group.

In the African context, ethnicity is a central dimension of identity which is understood as a fundamental feature of people's psychology (Lowes et al. 2015). This identity has a strong influence on people's behavioral attitude, their adherence to social norms and the way they interact with others (Akerlof and Kranton, 2010). In practice, ethnicity in pre-colonial Africa was associated to specific economic activities, agriculture versus husbandry (farmers as opposed to herders), geographic territories (forest versus seaside) and also diversity in political, and social organizations and preferences. On one hand, at the collective level, the different ethnic groups at the country level which are generally subject to an often centralized political power, might oppose or legitimate the government and affect the cooperative or non-cooperative behavior towards public policies. On the other hand, ethnic group social norms and preferences are associated to different values and beliefs which are likely to influence marital norms, gender norms, attitudes towards modern health interventions and as a consequence health policy outcomes.

The figure 1 below shows a map of Africa where the continent 54 present country boundaries inherited from the colonial period in black bold are overlayed on historical pre-colonial ethnic homeland geographical locations in different colors. The map shows that many ethnic group shares modern day national boundaries with sizable mobility especially towards capital cities or urban areas implying a high level of ethnic diversity in many geographic areas. The figure 2 shows the map with picturing the intensity of slave trade across historical ethnic homeland. Geographic areas in red used to be severely

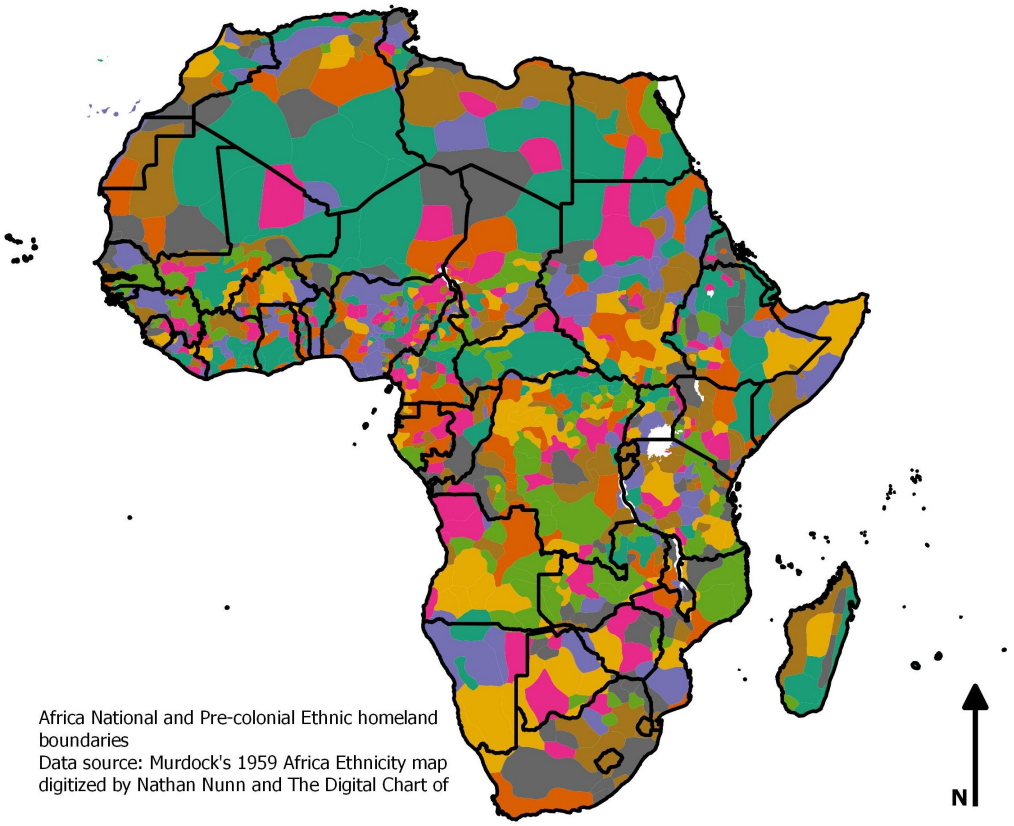

Figure 1: Africa National and Pre-colonial Ethnic homeland boundaries

affected by the transatlantic or Indian ocean slave trade. Overall ethnic groups historically close to the coast were sending more slave during the trade period.

3 Empirical Analysis

3.1 Micro-level data and descriptive analysis

The following section use micro-level data from the Demographic Health Survey to investigate the link between ethnic identity and childhood immunization. The DHS are a nationally representative samples funded primarily by the US Agency for International Development (USAID) with support from other donors and host countries. These surveys use model questionnaires and standardized data formats to ensure uniformity across countries and country specific questionnaires modules. The DHS surveys collect information on both individual and household level through questionnaires addressed to both adult female and male eligible respondents. In this study, we use the female modules questionnaires containing information on their pregnancies, their historical maternal status and parental status, and also the health and immunization status of their children born in the last 5 years. The respondents also reports measurements on household's wealth, education, occupation. We restrict our interest to countries where georeferenced surveys exist and where the respondent's ethnic group identity is reported.

Our final sample covers the most recent compatible survey data (collected between 2010 and 2014, except from Central Africa, Niger and Ethiopia respectively from 1994,

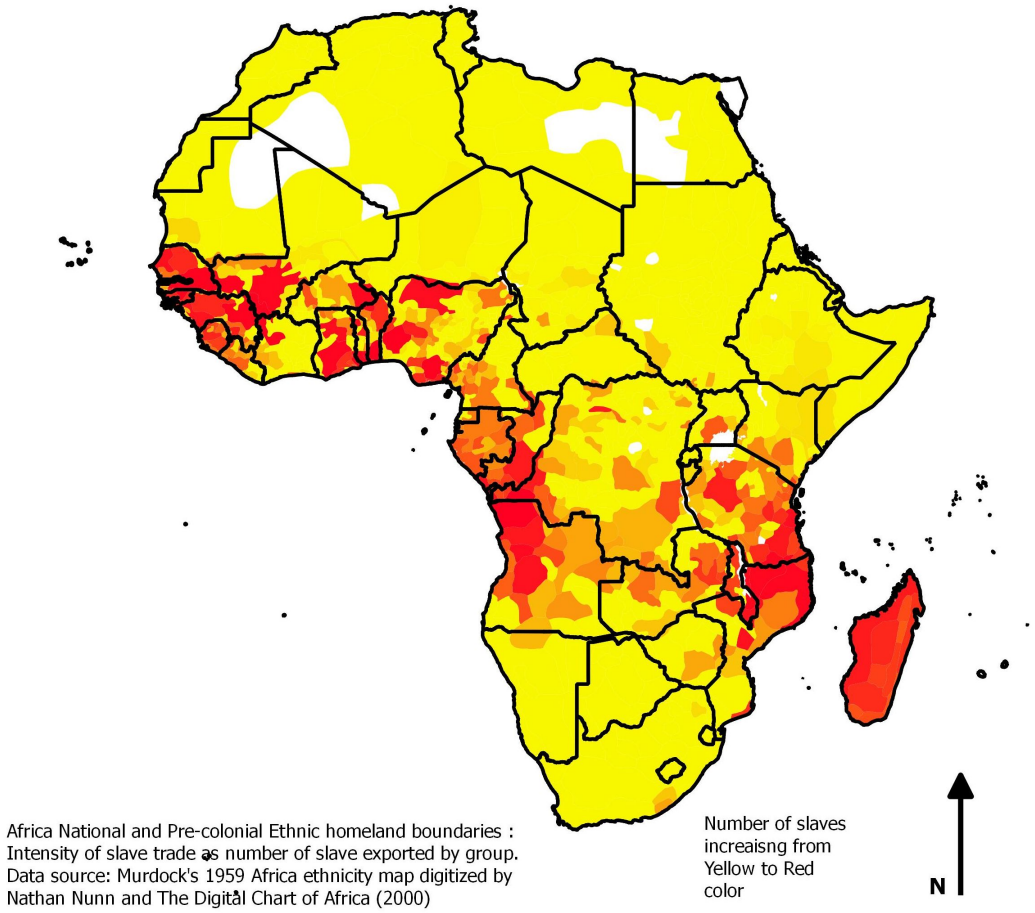

Figure 2: Africa national and Pre-colonial Ethnic homeland boundaries: intensity of slave trade

1998 and 2003) from 22 Sub-Saharan African countries as reported the Table 1 below. The sample includes information from a total of 258,964 infants and children under five years age from 49,287 adults female respondents. The DHS survey methodology use a two-stage stratified sample design where in the first stage the selection of enumeration areas is made based on the country's census. In the second stage, household are randomly selected in the primary enumeration area selected at stage one where the number of households is proportional to population size. The enumeration area corresponds to the cluster level (village, district, municipalities, and small town) which is the lowest locality level of analysis. Our other grouping variable of interest being the ethnic group, the Table 3.1 reports the maximum number of ethnic group identity reported by female respondents in each country. There is a large heterogeneity in the number of ethnic groups found in each country. In a country like Nigeria, the country largest population in Sub-Saharan Africa, more than 269 different ethnic groups are reported by respondents whereas in Guinea individuals identify themselves only in six different groups. However, the number of ethnic group is not necessarily increasing with the population size. For instance, Ivory Coast is a relatively small western African country with around 20 million of inhabitants where a number of 58 of groups are identified whereas respondents in Kenya, an eastern African country more than two times larger (more than 40 million inhabitants) reported 22 different groups. An alternative explanation, might be that individuals use another designation to identify their group when reporting ethnicity. Even in this case,

the absence of conformity in the way people designate the ethnic origin might indicate the level of ethnic fractionalization at the country level. In order to take into account the small number of individuals reporting specific groups and potential duplicates, we gather respondents according to the share their represent in each country. The number of ethnic representing a share equal or above 5 percent (10 percent) of the country's survey respondents are displayed in column five (six respectively) of the descriptive table. The difference between the total number of groups and the share representing above 5% and 10% shows the prevalence of minority groups in a given country or the dominance of majority groups. As for illustration, Guinea is reported as having the lower number of groups (six) where four of them represents more than 5% of the population and 3 of them more than 10% of the population. Conversely a neighboring country which is Ivory Coast has also only 3 groups representing more than 10% of the sample. The size distribution inside the country determines the bargaining power between groups and its effect on ethnic polarization is not clear cut (the discussion on the issue is kept for later). Finally, we end-up with a total of 117 and 68 predominant ethnic groups representing more than 5% and 10% of their country total sample respectively. The focus will on these in the main empirical part of this section.

The following Table 2 presents basic descriptive statistics of childhood immunization outcomes at the cluster level. The sample of interest includes around 11,885 clusters (primary localities) from 22 countries. There an average of more than two different ethnic groups in each cluster, and 50% of the cluster have more than two ethnic groups. This number might be as high as 19 different ethnic groups in some cluster. These figures are interesting for our analysis since it intends to exploit variations in ethnic origins at the more refined level which is the cluster. There is an average of 22 infants or children under 5 in each cluster and an average of four adult female respondents. This approach has the advantage of controlling for access to health facilities at the local level, but also to infrastructures such as roads and other standard public goods likely to affect health (electricity, piped water, sewage system). The other variables displayed are related to immunization and child health outcomes at the cluster level. It appears clearly from the figures that there are large variations in immunization rate across different cluster. For instance the average coverage for the first dose of Diphtheria-Tétanos-Pertusis (DTP1) is 81 % in the overall sample with a standard deviation of 0.23 percentage points. The rate of immunization against measles is overall 66% with a standard deviation 0.21 percentage points. Half of the localities have a rate of immunization below 70%. In the same manner, the prevalence of home birth delivery is 35% implying that more than one third of the children were not born in a health facility. This figure shows that access to health facilities or propensity to demand for birth assistance is heterogeneous across pregnant women in our sample.

The Table 3 below presents child level immunization outcomes and their mothers corresponding individual and demographic characteristics. The data are restricted to 117 ethnic groups and the summary statistics are display variations at the ethnic group level. These figures are illustrative of the previous discussion on ethnic specific traits Sub-Saharan Africa as discussed earlier in this section. On average there are 1696 observations by ethnic group for a minimum of an enough large sample size 155 children. For more 50 % of the groups, we have at least 1255 observations. The large sample size gives confidence for robust statistical inference. When one looks at prevalence of economic activity, it appears that male exerting economic activity is a norm in every group, at least 90 % of adult household (actually husband or male companion of the adult female respondent)

have an economic activity. Oppositely, on 68% of female respondent have an economic activity and there with a standard deviation of 0.19. In some ethnic groups, nearly all females are labor active, it is the case for the Yoruba in Nigeria where 92% of adult female work as shown in subsequent Table 4.

When considering the Peul/Fulani/Pulaar ethnic family present in Central Africa Cameroon and Western Africa Mali and Senegal, less than 40% of adult females are economically active. This finding is interesting and recalls to the relationships between ethnicity and gender norms. These three groups, sharing the same language, are at least subject to different institutional environment but they seem to submit to the same social norms. This suggest evidence of specific effects of cultural traits (Fisman and Miguel, 2007, Miguel et al. 2008) on corruption distinct from national fixed effects (Tabellini, 2008; Algan and Cahuc, 2014). Polygynous marriage has an average prevalence of 25% in our sample. This rate might be as high as 63% for some ethnic group and nearly inexistent for others. One can even identify clear regional pattern, ethnic group such as Pulaar, Wolof from Senegal Peul, Malinke from neighboring Guinea or Bambara from Mali have prevalence rate higher than 30% on average as compared to Kikuyu in Kenya where polygynous marriage is nearly absent (see Table 4 below). Polygynous marriage in western African ethnic groups has been traced back in African historiography to the history of more male slaves in the transatlantic slave trade whereas more female were sold in the Indian Ocean slave trade (Dalton and Leung, 2014).

Other relevant ethnic specific traits are captured by the fertility rate captured by the parity rate (number of living children per adult women), the total history of births and the number of births in the last 5 years. It stands out from the descriptive figures that there is lot of heterogeneity between ethnic groups when it comes to fertility rates of mothers. On average, 46 % of women respondents report that they adult companion wanted more child and an average 29 % of women reported they did not wanted the last child. These findings capture the differences in fertility preferences across ethnic groups. Some adult women reports an ideal number of child of an average of 10 where this average is 3 for the minimum. In some ethnic groups, the sexual activity occurs early in the adolescent female life, it is the case for example for the Haussa from Niger, where sexual activity has on average occurred at the age of 14, for the Igbo in Nigeria it occurs later nearly at the age of 19. In many cases, early sexual activity at the ethnic group level might reveal the prevalence of child marriage and rigid norms on sexual relationship at the group level. Norms of sexual behavior at the ethnic level due to cultural beliefs or Islamic tradition are plausible explanation for the Haussa group, as for the Fulani/ Peul/ Pulaar group for example. This issue is important since in a context where contraception prevalence are low, child marriage are associated to higher childhood mortality or mother mortality at birth and postpartum complications. We also reported the parent's socio-demographic characteristics related to the number of education years of the mother and the husband.

Child immunization outcomes across ethnic group are shown in the middle of Table 3 shown below. The mean column report the average immunization rates across different vaccines at the ethnic group level. On average 62% are immunized against measles at the ethnic level with a standard deviation of 0.14. There is on average lot of variations in immunization coverage rates across different ethnic groups as the detailed figures in Table 5 below confirm. A traditionally investigated case-study is the Nigerian case (discussed previously) where Hausa from the Northern part of the country displays substantially low level of immunization coverage rate across all disease compared to their Ibo and Yoruba counterpart in the South. Noticeably the same Haussa from Niger also have low immu-

nization compared to their Djerma counterpart in the same country. Similarly the Yoruba ethnic group partitioned between Benin and Nigeria have relatively high immunization rate as displayed in the Table 5 (in appendix) , it is remarkable that immunization performance across different vaccines are close figures (63% versus 61% for measles, 85 versus 83 for BCG (Tuberculosis), 51% versus 51 % for Polio3). Even estimates for child mortality at the ethnic level are very close (4% versus 6%). Taking into account the pattern of inside country variations, one can see that for Senegal, Pulaar ethnic group have low immunization rates than any other group which are the Wolof and Serer. The pattern holds for all immunization vaccines. The current findings provide evidence of the relevance of investigating the ethnicity health policy nexus.

Table 1: Basic description of DHS survey samples by country

	Year	N cluster	N Ethnic-group	N Ethnic-group-5	N Ethnic-group-10	Total child	Total mother
Burkina Faso	2010	574	14	4	1	15044	3114
Benin	2011-12	750	8	5	3	13407	2817
Congo RD	20131-14	540	9	7	4	18716	2257
Central Africa	1994	645	9	8	2	2818	914
Ivory Coast	2011-12	352	58	5	3	7776	1710
Cameroon	2011	580	10	6	6	11732	2610
Ethiopia	2003	650	52	5	3	11654	1672
Gabon	2012	336	8	5	4	6071	1450
Ghana	2014	427	8	4	3	5884	1223
Guinea	2012	300	6	4	3	7039	1600
Kenya	2014	1612	22	7	4	20966	4384
Liberia	2013	322	18	8	3	7606	1553
Mali	2012-13	585	12	6	4	10326	1796
Malawi	2010	849	12	6	5	19967	2744
Mozambique	2011	611	20	7	3	11102	2195
Nigeria	2013	904	269	4	3	31482	4283
Niger	1998	268	9	3	2	4798	1380
Sierra Leone	2013	435	10	3	2	11938	2503
Senegal	2010-11	392	7	4	3	12326	3889
Togo	2013-14	330	7	3	3	6979	1461
Uganda	2011	712	19	9	2	7878	1277
Zambia	2013-14	722	56	4	2	13457	2455
total		12,896	643	117	68	258,964	49,287

N Ethnic-group-5 N Ethnic-group-10 stands for the number of ethnic groups accounting for 5 percent and 10 percent or more of the country population

Source: DHS country level survey data

Table 2: Basic description of DHS survey samples at cluster level

	count	mean	sd	p50	min	max
N ethnic grp. cluster	11885	2.55	1.69	2.00	1	19
Cluster size	11885	21.75	11.57	20.00	1	91
N mother cluster	11885	4.14	2.33	4.00	1	25
Dtp1	11883	0.81	0.23	0.89	0	1
Dtp2	11883	0.75	0.25	0.83	0	1
Dtp3	11883	0.66	0.27	0.73	0	1
Polio0	11884	0.68	0.29	0.76	0	1
Polio1	11884	0.86	0.17	0.91	0	1
Polio2	11884	0.78	0.21	0.84	0	1
Polio3	11884	0.61	0.24	0.65	0	1
BCG	11884	0.86	0.21	0.94	0	1
Measles	11882	0.66	0.21	0.70	0	1
Vaccine ever	11406	0.86	0.22	1.00	0	1
Home delivery	11885	0.35	0.33	0.25	0	1

Source: DHS country level survey data

Table 3: Aggregate ethnic level variations in mother and child outcomes

	count	mean	sd	p50	min	max
Ethnic size	117	1696	1512	1255	155	10014
Ethnic pop. share	117	0.15	0.10	0.11	0.05	0.60
Father employed	117	0.99	0.01	1.00	0.90	1.00
Mother employed	117	0.68	0.19	0.73	0.11	0.95
Sexe of child5	117	0.49	0.02	0.50	0.45	0.55
Polygynous	117	0.25	0.13	0.24	0.01	0.63
Has Health card	117	0.79	0.18	0.86	0.19	0.98
Dtp1	117	0.78	0.17	0.82	0.20	0.96
Dtp2	117	0.70	0.18	0.75	0.12	0.94
Dtp3	117	0.60	0.19	0.63	0.07	0.89
Polio0	117	0.63	0.20	0.67	0.08	0.93
Polio1	117	0.83	0.12	0.86	0.39	0.96
Polio2	117	0.74	0.14	0.77	0.26	0.93
Polio3	117	0.57	0.15	0.58	0.11	0.81
BCG	117	0.83	0.15	0.88	0.22	0.98
Measles	117	0.62	0.14	0.64	0.16	0.82
Vaccine ever	117	0.81	0.16	0.87	0.23	0.99
Home delivery	117	0.41	0.22	0.41	0.03	0.98
Husb. educ. yrs	117	5.02	2.87	5.11	0.35	10.79
Mother educ. yrs	117	3.77	0.69	3.70	2.50	5.69
N child living	117	3.53	0.37	3.50	2.03	4.68
Total child	117	4.07	0.46	4.07	2.24	5.14
Birth last 5 yrs	117	1.75	0.14	1.74	1.37	2.18
First sex age	117	16.22	0.80	16.03	14.75	18.57
Ideal N child	117	5.73	1.35	5.53	3.14	10.41
Husb. want more child	117	0.46	0.16	0.45	0.16	0.87
Not wanted last child	117	0.29	0.15	0.28	0.03	0.58
N Ethnic size	117	324	280	240	53	1662
Ethnic child mort. rate	117	0.07	0.02	0.07	0.03	0.13
Urban	117	0.31	0.16	0.28	0.01	0.85

Source: DHS country level survey data

Table 4: Aggregated parents demographic outcomes at the ethnic group level

Ethnicity	Country	Ethnic size	Ethnic share	Father work	Mother work	Husb. educ. yrs	Mother educ. yrs	Polygynous	Homedelivery	Birth L. 5 yrs	Firstsexage	Husbmorechild	Nowantedlchild	urban
Mossi	Burkina Faso	7598.00	0.51	1.00	0.84	1.12	3.85	0.44	0.25	1.63	17.35	0.53	0.10	0.24
Adja	Benin	2000.00	0.15	1.00	0.80	3.74	3.70	0.40	0.07	1.71	17.14	0.42	0.24	0.32
Fon		5683.00	0.42	1.00	0.82	3.66	3.73	0.28	0.03	1.74	17.19	0.49	0.25	0.37
Yoruba		1371.00	0.10	1.00	0.74	3.52	3.76	0.37	0.13	1.62	17.61	0.52	0.17	0.41
Bas-kasaietKwihi	Congo DR	2837.00	0.15	0.97	0.86	9.50	3.77	0.20	0.15	1.88	15.82	0.41	0.32	0.35
UbangietItimbiri		2370.00	0.13	0.99	0.87	7.88	3.46	0.24	0.41	1.97	15.52	0.53	0.37	0.24
Basele-k-man		3183.00	0.17	0.99	0.81	7.13	3.69	0.20	0.10	2.01	16.23	0.52	0.32	0.26
Kasai-Kataga-Ta		5377.00	0.29	0.99	0.82	8.56	3.63	0.24	0.33	2.00	15.98	0.55	0.22	0.34
Gbaya	Central Africa	817.00	0.29	1.00	0.85	4.39	2.75	0.26	0.58	1.76	15.43	0.51	0.19	0.34
Banda		720.00	0.26	1.00	0.87	5.01	2.91	0.29	0.54	1.86	15.54	0.54	0.23	0.35
Baoule	Ivory Coast	1353.00	0.17	1.00	0.73	4.06	4.12	0.22	0.58	1.66	15.74	0.40	0.35	0.25
Senoufo		872.00	0.11	1.00	0.79	1.84	3.94	0.46	0.41	1.65	16.01	0.48	0.17	0.36
Burkina Faso		932.00	0.12	1.00	0.76	1.23	3.89	0.31	0.44	1.67	16.21	0.38	0.21	0.26
Arabchoa-peul/ha	Cameroon	1351.00	0.12	0.99	0.44	2.23	3.63	0.38	0.66	1.90	15.41	0.64	0.21	0.39
Biu-mandara		1666.00	0.14	0.99	0.75	2.76	3.06	0.42	0.72	1.95	16.44	0.69	0.20	0.21
Adamaoua-Oubangu		1539.00	0.13	0.99	0.82	5.24	3.64	0.34	0.63	1.96	16.03	0.64	0.28	0.25
Grassfields		1387.00	0.12	1.00	0.89	7.41	4.86	0.14	0.08	1.65	16.46	0.33	0.27	0.33
Bamilike-Bamoun		2176.00	0.19	1.00	0.71	9.01	3.87	0.19	0.03	1.78	16.81	0.41	0.27	0.69
Beti/Bassa-Mbam		2208.00	0.19	0.99	0.74	9.41	3.78	0.09	0.20	1.72	16.00	0.42	0.40	0.45
Amhara	Ethiopia	1998.00	0.17	0.99	0.57	3.22	3.67	0.02	0.75	1.47	15.87	0.25	0.36	0.27
Oromo		2863.00	0.25	1.00	0.43	3.03	3.40	0.10	0.86	1.86	16.66	0.34	0.37	0.17
Tigrie		1190.00	0.10	1.00	0.78	2.64	3.52	0.01	0.87	1.62	15.69	0.17	0.21	0.15
Fang	Gabon	996.00	0.16	1.00	0.43	10.33	3.18	0.13	0.14	1.74	15.64	0.47	0.52	0.64
Kola-Kele		765.00	0.13	1.00	0.38	7.47	3.50	0.10	0.33	1.86	15.71	0.52	0.54	0.52
Nzabi-Duma		731.00	0.12	1.00	0.52	8.74	3.18	0.10	0.09	1.64	15.74	0.39	0.45	0.57
Shira-puni-Vili		1257.00	0.21	1.00	0.46	8.70	3.43	0.14	0.08	1.70	15.75	0.51	0.43	0.69
Akan	Ghana	2244.00	0.38	1.00	0.82	9.13	3.43	0.06	0.22	1.61	17.64	0.22	0.40	0.47
Ewe		654.00	0.11	1.00	0.79	8.32	3.33	0.14	0.29	1.65	17.62	0.37	0.54	0.42
Mole-Daybani		1557.00	0.26	1.00	0.82	3.94	3.45	0.27	0.31	1.56	17.47	0.39	0.18	0.36
Soussou	Guinea	1029.00	0.15	1.00	0.85	3.97	3.59	0.37	0.45	1.54	15.93	0.69	0.27	0.43
Peul		2675.00	0.38	1.00	0.77	1.97	3.75	0.49	0.67	1.60	15.90	0.74	0.17	0.25
Malinke		2480.00	0.35	1.00	0.86	2.16	3.89	0.49	0.61	1.73	15.06	0.76	0.16	0.29
Kalenjin	Kenya	3205.00	0.15	1.00	0.71	8.41	5.55	0.12	0.49	1.69	16.69	0.28	0.44	0.21
Kikuyu		2366.00	0.11	1.00	0.80	9.86	5.42	0.03	0.14	1.37	18.35	0.24	0.34	0.47
Luhya		2482.00	0.12	0.99	0.73	8.52	5.38	0.11	0.48	1.63	16.65	0.28	0.57	0.36
Luo		2195.00	0.10	0.99	0.70	9.19	5.67	0.15	0.33	1.69	15.52	0.30	0.54	0.41
Bassa	Liberia	1031.00	0.14	1.00	0.58	5.14	2.69	0.10	0.50	1.76	15.37	0.32	0.37	0.23
Grebo		1198.00	0.16	1.00	0.53	6.91	3.06	0.20	0.51	1.75	15.54	0.28	0.45	0.28
Kpelle		1472.00	0.19	1.00	0.68	5.11	2.86	0.10	0.56	1.62	15.52	0.22	0.36	0.31
Bambara	Mali	3384.00	0.33	1.00	0.51	1.65	3.57	0.31	0.37	1.78	16.11	0.59	0.15	0.25
Peul		1462.00	0.14	1.00	0.43	1.33	3.66	0.28	0.41	1.85	16.11	0.59	0.12	0.28
Sarakhole-Sonink		1286.00	0.12	1.00	0.33	1.29	3.70	0.34	0.39	1.81	15.85	0.59	0.09	0.21
Dogon		1199.00	0.12	1.00	0.48	0.71	3.46	0.41	0.71	1.85	16.61	0.63	0.15	0.11
Chewa	Malawi	6097.00	0.31	0.99	0.75	5.73	4.22	0.16	0.29	1.71	16.75	0.18	0.54	0.07
Tumbuka		2050.00	0.10	0.99	0.80	8.34	5.32	0.21	0.15	1.67	16.65	0.27	0.46	0.11
Lomwe		3114.00	0.16	0.99	0.79	6.44	4.29	0.10	0.23	1.65	15.95	0.17	0.54	0.10
Yao		2240.00	0.11	0.99	0.65	5.49	4.23	0.19	0.23	1.72	15.91	0.21	0.52	0.11
Ngoni		2521.00	0.13	0.98	0.79	6.37	4.42	0.09	0.21	1.65	16.66	0.21	0.53	0.12
Emakhuwa	Malawi	1983.00	0.18	0.99	0.56	3.67	3.39	0.14	0.51	1.72	14.80	0.54	0.08	0.28
Xichangawa		1913.00	0.17	0.96	0.38	5.42	3.96	0.19	0.17	1.55	16.00	0.37	0.42	0.53
Cisena		1238.00	0.11	0.94	0.47	4.27	3.34	0.32	0.41	1.86	15.66	0.48	0.11	0.26
Hausa	Nigeria	10014.00	0.32	1.00	0.67	3.51	4.88	0.47	0.88	1.86	15.36	0.74	0.03	0.23
Igbo/Ibo		3414.00	0.11	0.99	0.78	9.37	4.77	0.09	0.20	1.93	18.52	0.28	0.19	0.67
Yoruba		3442.00	0.11	0.98	0.92	10.79	4.91	0.22	0.20	1.65	18.57	0.27	0.14	0.75
Djerma	Niger	1059.00	0.22	0.99	0.63	1.41	4.69	0.26	0.67	1.80	16.16	0.64	0.22	0.33
Haoussa		2876.00	0.60	1.00	0.55	0.81	4.17	0.39	0.80	1.90	14.77	0.64	0.13	0.20
Mande	Sierra Leone	4287.00	0.36	0.98	0.81	3.22	3.48	0.27	0.29	1.68	15.97	0.26	0.16	0.27
Temne		3826.00	0.32	0.98	0.84	3.15	3.55	0.38	0.53	1.61	15.26	0.40	0.14	0.34
Wolof	Senegal	3837.00	0.31	0.98	0.43	1.18	4.20	0.38	0.26	1.79	18.07	0.74	0.33	0.29
Pulaar		4196.00	0.34	0.97	0.39	1.21	3.97	0.35	0.44	1.75	16.20	0.75	0.24	0.26
Serer		1581.00	0.13	0.97	0.46	1.93	3.98	0.25	0.27	1.82	18.11	0.68	0.32	0.24
Adja-Ewe-mina	Togo	1951.00	0.28	1.00	0.84	7.05	3.78	0.25	0.14	1.60	17.47	0.34	0.37	0.48
Kabye-Tem		1918.00	0.27	1.00	0.85	5.79	3.29	0.29	0.31	1.57	16.97	0.35	0.27	0.23
Para-gourma-Akan		2075.00	0.30	1.00	0.89	3.04	3.15	0.43	0.48	1.67	16.98	0.48	0.20	0.12
Baganda	Uganda	1050.00	0.13	1.00	0.72	8.95	4.07	0.20	0.20	1.74	16.18	0.48	0.45	0.52
Other		1176.00	0.15	0.99	0.78	6.41	4.12	0.30	0.47	2.00	16.03	0.52	0.47	0.18
Bemba	Zambia	3296.00	0.24	0.98	0.64	8.22	3.96	0.07	0.28	1.68	16.89	0.36	0.44	0.46
Tonga		1599.00	0.12	1.00	0.60	7.76	4.33	0.27	0.42	1.68	16.64	0.42	0.47	0.26

Source: DHS country level survey data

Table 5: Aggregated children under 5 outcomes at the ethnic group level

Ethnicity	Country	Dtp1	Dtp2	Dtp3	Polio0	Polio1	Polio2	Polio3	BCG	Measles	Vaccine-ever	Homedelivery	Ethnic-mort-rate
Mossi	Burkina Faso	0.91	0.87	0.82	0.90	0.93	0.90	0.81	0.96	0.74	0.92	0.25	0.07
Adja	Benin	0.76	0.71	0.61	0.81	0.81	0.71	0.38	0.89	0.63	0.87	0.07	0.06
Fon		0.71	0.66	0.58	0.84	0.83	0.76	0.50	0.90	0.62	0.85	0.03	0.06
Yoruba		0.76	0.72	0.64	0.77	0.83	0.76	0.51	0.85	0.63	0.80	0.13	0.04
Bas-kasaietKwihi	Congo RD	0.81	0.73	0.60	0.50	0.88	0.80	0.55	0.82	0.67	0.91	0.15	0.06
UbangietItimbiri		0.61	0.50	0.37	0.26	0.82	0.72	0.52	0.66	0.58	0.84	0.41	0.07
Basele-k-man		0.82	0.75	0.62	0.53	0.89	0.80	0.64	0.84	0.68	0.90	0.10	0.07
Kasai-Katanga-Ta		0.69	0.61	0.48	0.41	0.84	0.75	0.59	0.73	0.53	0.86	0.33	0.09
Gbaya	Central Africa	0.65	0.47	0.30	0.43	0.64	0.45	0.29	0.72	0.36	0.49	0.58	0.09
Banda		0.72	0.55	0.41	0.53	0.73	0.55	0.39	0.75	0.42	0.53	0.54	0.08
Baoule	Ivory Coast	0.75	0.70	0.62	0.67	0.85	0.77	0.64	0.82	0.59	0.79	0.58	0.07
Senoufo		0.67	0.59	0.51	0.65	0.84	0.75	0.62	0.72	0.56	0.89	0.41	0.12
Burkina Faso		0.72	0.64	0.56	0.66	0.85	0.75	0.62	0.78	0.53	0.85	0.44	0.07
Arabchoa/peul/ha	Cameroon	0.75	0.65	0.52	0.57	0.85	0.76	0.62	0.79	0.56	0.82	0.66	0.11
Biu-mandara		0.67	0.58	0.46	0.42	0.86	0.78	0.62	0.72	0.51	0.84	0.72	0.12
Adamaoua-Oubangu		0.76	0.67	0.56	0.57	0.86	0.78	0.61	0.82	0.55	0.84	0.63	0.11
Grassfields		0.92	0.89	0.84	0.91	0.93	0.89	0.76	0.95	0.76	0.84	0.08	0.06
Bamilike-Bamoun		0.93	0.86	0.76	0.87	0.92	0.84	0.71	0.96	0.71	0.95	0.03	0.04
Beti/Bassa/Mbam		0.85	0.76	0.64	0.72	0.89	0.78	0.57	0.91	0.65	0.91	0.20	0.08
Amhara	Ethiopia	0.67	0.56	0.42	0.29	0.84	0.75	0.55	0.70	0.59	0.83	0.75	0.06
Oromo		0.60	0.50	0.36	0.20	0.79	0.69	0.51	0.63	0.47	0.77	0.86	0.07
Tigrie		0.89	0.80	0.69	0.26	0.93	0.87	0.73	0.91	0.74	0.92	0.87	0.07
Fang	Gabon	0.47	0.41	0.35	0.62	0.60	0.47	0.32	0.83	0.61	0.83	0.14	0.07
Kola-Kele		0.57	0.49	0.41	0.63	0.71	0.59	0.44	0.82	0.63	0.79	0.33	0.05
Nzabi-Duma		0.50	0.43	0.34	0.69	0.65	0.50	0.37	0.89	0.61	0.89	0.09	0.05
Shira-puni-Vili		0.51	0.44	0.36	0.67	0.67	0.52	0.36	0.91	0.66	0.91	0.08	0.04
Akan	Ghana	0.94	0.89	0.78	0.78	0.94	0.85	0.73	0.96	0.76	0.89	0.22	0.04
Ewe		0.93	0.88	0.78	0.78	0.94	0.87	0.75	0.96	0.76	0.92	0.29	0.05
Mole-Daybani		0.93	0.88	0.81	0.79	0.93	0.87	0.79	0.96	0.74	0.90	0.31	0.05
Soussou	Guinea	0.80	0.69	0.52	0.77	0.87	0.73	0.51	0.89	0.63	0.89	0.45	0.06
Peul		0.64	0.50	0.34	0.51	0.78	0.59	0.39	0.74	0.50	0.78	0.67	0.08
Malinke		0.72	0.60	0.47	0.66	0.82	0.71	0.51	0.81	0.55	0.84	0.61	0.11
Kalenjin	Kenya	0.92	0.89	0.84	0.67	0.93	0.88	0.76	0.94	0.72	0.89	0.49	0.03
Kikuyu		0.96	0.93	0.87	0.89	0.96	0.93	0.77	0.98	0.80	0.97	0.14	0.04
Luhya		0.96	0.92	0.83	0.67	0.96	0.91	0.77	0.97	0.76	0.96	0.48	0.04
Luo		0.94	0.90	0.80	0.80	0.94	0.87	0.67	0.94	0.74	0.97	0.33	0.07
Bassa	Liberia	0.80	0.65	0.49	0.64	0.88	0.76	0.55	0.85	0.56	0.92	0.50	0.06
Grebo		0.66	0.52	0.38	0.56	0.83	0.73	0.49	0.74	0.51	0.85	0.51	0.09
Kpelle		0.83	0.73	0.59	0.70	0.90	0.80	0.64	0.89	0.61	0.92	0.56	0.06
Bambara	Mali	0.77	0.70	0.59	0.62	0.79	0.70	0.45	0.82	0.64	0.80	0.37	0.07
Peul		0.72	0.66	0.55	0.58	0.75	0.67	0.42	0.76	0.60	0.75	0.41	0.08
Sarakhole-Sonink		0.75	0.70	0.58	0.61	0.77	0.70	0.40	0.79	0.63	0.81	0.39	0.05
Dogon		0.56	0.51	0.37	0.41	0.63	0.52	0.30	0.63	0.51	0.67	0.71	0.08
Chewa	Malawi	0.93	0.90	0.84	0.68	0.92	0.87	0.75	0.95	0.78	0.90	0.29	0.08
Tumbuka		0.93	0.90	0.86	0.76	0.92	0.88	0.78	0.96	0.78	0.91	0.15	0.07
Lomwe		0.94	0.92	0.87	0.70	0.93	0.90	0.79	0.96	0.82	0.91	0.23	0.09
Yao		0.94	0.91	0.86	0.69	0.93	0.89	0.75	0.95	0.80	0.91	0.23	0.08
Ngoni		0.92	0.89	0.85	0.74	0.92	0.87	0.77	0.94	0.79	0.87	0.21	0.08
Emakhuwa	Mozambique	0.86	0.78	0.69	0.85	0.86	0.76	0.62	0.91	0.72	0.80	0.51	0.05
Xichangawa		0.93	0.89	0.82	0.93	0.92	0.85	0.74	0.96	0.79	0.93	0.17	0.08
Cisena		0.88	0.82	0.73	0.84	0.87	0.80	0.68	0.90	0.70	0.74	0.41	0.07
Hausa	Nigeria	0.21	0.17	0.13	0.23	0.71	0.64	0.55	0.22	0.20	0.73	0.88	0.12
Igbo-Ibo		0.84	0.79	0.72	0.79	0.84	0.79	0.54	0.87	0.62	0.83	0.20	0.09
Yoruba		0.83	0.77	0.67	0.76	0.85	0.77	0.51	0.88	0.61	0.88	0.20	0.06
Djerma	Niger	0.57	0.47	0.38	0.36	0.60	0.48	0.36	0.61	0.40	0.38	0.67	0.09
Haoussa		0.40	0.29	0.20	0.22	0.45	0.31	0.20	0.44	0.27	0.34	0.80	0.13
Mande	Sierra Leone	0.91	0.87	0.75	0.93	0.91	0.86	0.74	0.95	0.76	0.91	0.29	0.13
Temne		0.88	0.80	0.66	0.87	0.88	0.79	0.65	0.94	0.69	0.91	0.53	0.10
Wolof	Senegal	0.90	0.85	0.78	0.79	0.90	0.84	0.60	0.95	0.74	0.93	0.26	0.05
Pulaar		0.83	0.77	0.68	0.63	0.86	0.78	0.56	0.88	0.69	0.87	0.44	0.06
Serer		0.90	0.86	0.78	0.80	0.90	0.85	0.62	0.95	0.73	0.94	0.27	0.05
Adja-Ewe-mina	Togo	0.88	0.82	0.71	0.82	0.90	0.81	0.58	0.92	0.63	0.89	0.14	0.06
Kabye-Tem		0.89	0.85	0.77	0.83	0.91	0.86	0.63	0.93	0.66	0.89	0.31	0.07
Para-gourma-Akan		0.91	0.88	0.81	0.83	0.92	0.87	0.69	0.94	0.73	0.88	0.48	0.07
Baganda	Uganda	0.86	0.76	0.61	0.70	0.87	0.73	0.51	0.91	0.66	0.88	0.20	0.07
Other		0.90	0.82	0.68	0.72	0.90	0.81	0.54	0.94	0.70	0.92	0.47	0.06
Bemba	Zimbabwe	0.92	0.88	0.80	0.50	0.92	0.87	0.72	0.92	0.75	0.88	0.28	0.05
Tonga		0.89	0.84	0.78	0.47	0.89	0.82	0.70	0.89	0.74	0.74	0.42	0.04

Source: DHS country level survey data

3.2 Identification strategy and estimation equations

We assume the following causal relationship between the number of slaves that were taken from an individual's ethnic group and the individual's current level of trust as estimated by Nunn and Wantchekon (2011):

$$trust_{i,e,l,c} = \alpha_c + \beta\ slave\ exports_e + \Gamma \mathbf{X}_{i,e,l,c} + \Omega \mathbf{X}_{i,e,l,c} + \Phi \mathbf{X}_{l,c} + \Psi \mathbf{X}_e + \varepsilon_{i,e,l,c} \quad (1)$$

where $trust_{i,e,l,c}$ is the trust level of individual i from ethnic group e living in location l in country c, $slave\ exports_e$ is the measure of the number slave exported by the ethnic group e, $\mathbf{X}_{i,e,l,c}$ denotes a set of individuals socio-demographics covariates,$\mathbf{X}_{l,c}$ set of district ethnicity controls and $\mathbf{X}_e$ is a vector of ethnicity level variables.

We then instrument for trust at the ethnic group level through the number of slave exported and estimate the following baseline model for the individual determinants of child vaccination decision:

$$Vaccin_{i,m,e,l,c} = \alpha_0 + \beta\ slave\ exports_e + \Gamma \mathbf{X}_{m,e,d,c} + \Omega \mathbf{X}_{i,e,d,c} + \Phi \mathbf{X}_l + \Psi \mathbf{X}_e + F_l + \varepsilon_{i,m,e,l,c} \quad (2)$$

The dependent variable $Vaccin_{i,m,e,l,c}$indicates the likelihood that a child with index i born to a mother m, the latter originating from ethnic group e and currently living in location l which can either corresponds to the (village,city,district) and country c . Our first relationship of interest is the slave trade indicator variable (dummy =1 for slave raided group) $slave\ exports_e$ for mothers originating from groups that were historically affected by the slave trade (Nunn and Wantchekon, 2011). We introduce a rich set of control variables at different levels.

In our baseline estimation, F_l stands for location fixed effect (which corresponds to the smallest geographical area at the village, city or district level). Exploiting variations at the local level allows in addition to our identification strategy to control for a potential heterogeneity in the health supply side and omitted variables . Then we account for any country or regional level heterogeneity such as differences in national health policy, the quality of national institutions, colonial history, ethnic discrimination.

The vector $\mathbf{X}_{m,e,d,c}$ of controls includes a set of mother and households individual socio-demographic characteristics as parents employment status, mother education but also literacy status. It controls also for the individual assessment of the availability of health service at the local level which is a verbatim response "whether distance to health district" is a problem or not. This variable is important since it allows to account for the effect of the more frequently investigated supply side impediment to health in Africa. We also take into account household resources allocation through gender of household headship, female decision making. The surveyed literature has pointed the role of information (Besley and Burgess, 2003). We introduce controls for mother's frequency of listening radio or watching TV, but also direct indicators for wealth status of the household through wealth index measures. Religion is also controlled for through five religion fixed effect (catholic, protestant, Muslim, traditional African religion and others).

The conditioning set $\mathbf{X}_{i,e,d,c}$ includes the mother relevant fertility history as age at first birth, the total children ever born, her starting age of sexual activity, more precisely actual children composition of the household is also taken into account. Indeed, the number of actual living children is also accounted for, the mother fertility preferences through important birth interval variables which might affect time allocation towards well-being of each child, their individual assessment for the ideal number of children and whether last child was desired or not. Child specific controls include the birth order, the sex with female for reference, and place of delivery (health facility versus home). The focus at the local level allows also to introduce subsequently a rich contemporaneous and

historical control set at the local level suggested in the previous work on contemporary local development in Africa.We thus follow (Michalopoulos and Papaioannou, 2013) and control for population density at the local level which likely affect facility of coverage, luminosity at the local level as proxy for economic development and geographical controls (distance to water, geographical elevation, distance to the country border, distance to the sea, distance to the current capital city), existence of natural resources (petroleum sites, diamond sites), malaria suitability and agriculture suitability of the area (included in $\mathbf{X}_l$), but also a range controls for conflicts and politics and social unrest at the ethnic homeland level (included in $\mathbf{X}_e$) . We also introduce indicator for ethnic group affected by more recent colonial shock which split same ethnic group in different post-colonial countries and subsequently affected likelihood of conflict and discrimination by the central government (Michalopoulos and Papaioannou, 2016).

In our vector of controls we introduce ethnic specific important pre-colonial characteristics related to institutions given their importance for development trajectories (Acemoglu et al., 2001). One main indicator variable stands for whether the mother originated from an ethnic group that were historically centralized. The centralization feature is captured by ethnic group past institutional feature corresponding to Murdock's degree of jurisdictional hierarchy beyond the local level used in (Gennaioli and Rainer, 2007, Michalopoulos and Papaioannou, 2013). We group stateless ethnicities and small chiefdoms with no and one level of jurisdictional hierarchy beyond the local level as fragmented ethnic groups and paramount chiefdoms and centralized states with two level of jurisdictional hierarchy or more as historically centralized groups. Using the binary variable allows to mitigate measurement errors associated to imprecise coding by Murdock. In this respect we follow Gennaioli and Rainer 2007 in their cross-coutnry analysis. By introducing past pre-colonial centralization we hope to achieve two important goals. First, we are able to isolate the potential effect of historical level of development at the ethnic level on contemporaneous health outcomes as investigated in the literature (Gennaioli and Rainer 2007, Michalopoulos and Papaioannou, 2013). Second we are able to account for the interaction between institutions and social norms, here trust, as discussed in the literature on the mechanism of long-run cultural persistence (Spolaore and Wacziarg, 2013). Moreover we hypothesize a cultural avenue of interpretation for the effect of past centralization. Individuals' from centralized ethnic with stronger jurisdictional hierarchy and state control were likely to face more rigid social norms of behavior and less independence for adopting innovative health technologies such as immunization. A possible explanation might be that their developed limited norms of cooperation through reduced incentives for cooperation in large centralized group. Anderson and Borwn (2010) hypothesize that centralization could have a negative effect on communication, coordination and trust between different group members. It might also be due to necessity for compliance with centralized decision making power with negative perception towards immunization.

3.3 Results : Global effect of slave trade on vaccination decision

In Table 6, panel A, we report results from baseline control estimates of a linear probability model of equation (2) with location level (district, city, village) fixed-effect. The results are qualitatively in line with predictions on the socio-demographic controls of public health suggesting that we have a good model of mother's immunization decision making. Indeed, employment status of the mother has a positive and significant effect on child immunization, employed mother's are nearly 4 percentage points more likely to

immunize their children against measles than unemployed, more interestingly the number of education years of the mother do not affect immunization only through effective literacy. This finding suggest that when it comes to promoting child health through mother education , it is not having some schooling that matters but effective capacity to read and write. Mothers identifying distance to the health facility as a problem are less significantly likely to immunize their children. Female headed households have negative effect on immunization whereas households where the female take decisions related to health have statistically significant effect. The negative effect of female headed households might be due to the fact that they are more likely to be poorer as the literature in intra-household resource allocation has shown. The result is confirmed when the focus is made on the effect of the wealth index, relative to the poorest 20% of the sample being member of the richest 20% have 5 percentage point increase in likelihood of receiving measles vaccine. Similarly, children from families with catholics religious background are more likely to get vaccines than those from Muslim whereas traditional religions have a negative effect. The previous finding highlight the challenge facing modern biomedicine in different cultural and religious context. As illustrated by the widely documented case of majority Muslim Northern Nigeria and resistance to polio vaccines and coexistence of biomedicine with traditional African medical practices and healing across the continent.

Panel B of Table 6 provides evidence on the effect of fertility preferences. More experienced mothers in the sense that they are older are more likely to immunize their children. High fertility rate have overall negative effect in immunization and there is no evidence of discrimination against female child as literature in other regions such as India could have shown. Interestingly, children's delivered at home are 3 percentage points less likely to be immunized than those born in a health facility. The result is in line with policies encouraging delivery in health facilities, in addition to medical safety, as opportunity to provide lifesaving advice and informations to the mother relative to the child health.

First, we present the result from our baseline estimates for equation (2) in the Table 5 below. We find a negative and statistically significant effect of slave trade on mother's decision to immunize their children. This result is consistent across our most conservative specification at column (1) in Table 5 where we introduce location level (district,city,village) fixed-effect. In this specification, we exploit variations between mothers differentially affected by the slave trade at the local level. Failing to control for location fixed-effect but just country fixed-effect in column(2) reduce the AdjustR^2 from 21% to 15%. In column (2) and (3) , we estimate an alternative country fixed effect specification with present day location controls such as availability of public service such as electricity, water, conflicts controls that might harm health service provision, locations geographical, and colonial controls, and past ethnic homeland controls in equation (3). Respondents mothers from slave affected ethnic group are on average near 4 percentage points less likely to immunize their children relative to those from slave free ethnic group. The results confirm the hypothesis of existence of direct vertical socialization to distrust values by the family of the descendants of slave raided groups. The size of the effect is robustness of the coefficients across specifications in column 1, 2 and 3. More interestingly relative to other socio-demographic and technical controls, the effect of internal norms of distrust (Nunn and Wantcheckon, 2011) as explanatory power for heterogeneity in health outcomes across individuals is sizable. Its size ranges around the effect of being employed mother relative to non-employed, slightly below that of moving from the less 20% to the highest 20% of the wealth index. The variations induced by historical exposure to slave

trade is higher than that predicted for mother literacy or distance to health facility. The gain from delivering at a health facility 3.14 percentage points can be interpreted as being totally offset by the historical "hazard" of being born in low cooperation ethnic family . This interpretation allows to quantify the likely effect that cultural transmission might have on the likelihood to immunize children. When we control for location fixed-effect, being member of split group is no longer significant, what matters is the negative effect of centralization on today propensity to immunize.

In Table 15 (in appendix) , we reestimate the baseline (column 1) location fixed-effect linear probability model in different restricted sample where there is respectively variations at the location level between individuals on the split group dimension (column 2) , effect slave trade (column 3) and slave trade plus centralization (column 4). This restricted sample allows to test robustness to strict clusters where there is variation across the main independent variable of interest. The estimates are also robust to continuous independent slave trade variable defined as the number of slaves exported by the group (see Table 16 below). As it is shown, the estimates are in the same range from -0.0387 to -0.0483 across different specifications. Interestingly, the adjusted R^2 increase from 21 to 28% when we restrict to locations where there is variations between mothers on the slave trade treatment. Moreover,we do not find any evidence of being member of a split group at the local level. This absence of effect suggest that differential access or discrimination in terms of geographic location is the main channel through which split group membership is negatively correlated with access to public goods.There is no evidence of cultural persistence associated to being member of split group. The negative effect of past centralization is also robust across different specifications. One would have expected a positive effect given the previous evidence of past centralization and current economic development captured by light density at night (Michalopoulos and Papaioannou, 2013). We argue that when focusing on whether the individual is from centralized ethnic group or not rather than geographical perspective focusing on ethnic homeland or country level, we are able to capture the "cultural component" of past centralization as historical institutions affecting behavior. It is also possible to understand centralization as having differential effect depending on the type of public good considered as Gennaioli and Rainer (2007) distinguish between high spillover and low spillover good. Following their intuition which classifies immunization as a "high spillover" good like public roads contrary to education or child mortality which has localized effect, we argue that immunization calls for a degree of individual motivations and trust which are all "attitude-related" traits crowded-out by rigid vertical hierarchies (Anderson and Borwn (2010)). In this management and organization science, centralization is understood as "the degree to which decisions are made by fewer individuals who are higher in the hierarchy rather than by a wider group of employees throughout the organization."(Anderson and Borwn (2010))

Table 6: Panel A : Lpm estimates of the individual determinant of measles immunization : Individual socio-demographic controls

	(1)
	h9_measles
	b/se
group exports slave (=1)	-0.0387**
	(0.0161)
centralization	-0.0342***
	(0.0129)
split group	-0.0108
	(0.0103)
father employed	0.0168
	(0.0199)
mother employed	0.0469***
	(0.0047)
mother education years	0.0007
	(0.0013)
mother literacy	0.0198***
	(0.0027)
distance to health a problem (=1)	-0.0157***
	(0.0048)
female head	-0.0126**
	(0.0056)
female health decision	0.0096***
	(0.0030)
freq listen radio	0.0059***
	(0.0021)
freq tvwatch wealth	0.0072**
	(0.0029)
wealth (ref:poorest)	ref.
i.wealth index20	0.0095*
	(0.0057)
i.wealth index40	0.0202***
	(0.0067)
i.wealth index60	0.0373***
	(0.0081)
i.wealth index80	0.0556***
	(0.0104)
religion (ref:muslim)	ref.
i.catholic	0.0203**
	(0.0090)
i.protestant	0.0087
	(0.0089)
i.traditionnal	-0.0263*
	(0.0144)
i.others	-0.0191
	(0.0137)

Table 6 Continued,Panel B: Lpm estimates of the individual determinant of measles immunization : Indiviudal fertility preferences controls

	(1)
	h9_measles
	b/se
i.age at firstbirth (15/24)	0.0106
	(0.0083)
i.age at firstbirth (25/34)	0.0082
	(0.0140)
i.age at firstbirth (35/47)	0.0117
	(0.0423)
mother current age	0.0796***
	(0.0048)
total children	0.0112***
	(0.0019)
number birth last 5 years	-0.0395***
	(0.0040)
first sex age	0.0016
	(0.0011)
age at first birth	-0.0064***
	(0.0009)
i.living child (3/4)	-0.0111
	(0.0090)
i.living child ($\geq$ 5)	-0.0337***
	(0.0117)
i.total birth (3/4)	0.0653***
	(0.0098)
i.total birth ($\geq$ 5)	0.1889***
	(0.0138)
i.birth interval (>2)	-0.0316***
	(0.0082)
i.birth order (2/4)	-0.1326***
	(0.0059)
i.birth order (5/18)	-0.3446***
	(0.0101)
female child	0.0085***
	(0.0033)
home delivery	-0.0314***
	(0.0055)
ideal number of child	0.0012
	(0.0009)
not wanted last child	-0.0014
	(0.0046)
constant	0.6466***
	(0.0346)
Baseline individual controls	Yes
Location FE	Yes
R-squared	0.212
N observations	82467
N clusters	7478

The equation controls include subsequently only baseline controls related to mothers demographics characteristics, household resources allocation,decsion making,fertility preferences and children controls.

p<0.10, p**<0.5, p***<0.01*

Source: DHS surveys

Table 7: Lpm estimates of the Individual determinants of measles Vaccinations

	(1) Measles b/se	(2) Measles b/se	(3) Measles b/se
group exports slave (=1)	-0.0387**	-0.0336***	-0.0341***
	(0.0161)	(0.0102)	(0.0101)
Baseline controls	Yes	Yes	Yes
Location controls	No	Yes	Yes
Loc. hist. controls	No	Yes	Yes
Conflicts controls	No	Yes	Yes
Ethnic homeland	No	No	Yes
Location FE	Yes	No	No
Country FE	No	Yes	Yes
R-squared	0.212	0.152	0.152
N observations	82467	80142	80088
N cluster	7669	7355	7351
N country	18	18	18

p<0.10, p**<0.5, p***<0.01*

Source: DHS surveys

3.4 Detailed example and discussion on the importance of the effect

Of the 825 ethnic groups from Michalopoulos and Papaioannou (2016) compilation from Murdock's 1967 Ethnographic Atlas and Nunn and Wantchekon (2011), 150 groups (36%) are slave exporting groups with 287 slave free groups. For the 437 groups for which the indicator is available, 36% are centralized groups. For example Kikuyu from Kenya are a slave raided group with fragmented historical organization whereas Kipsigi from Kenya are slave free group coded as centralized group according to Murdock's data. Other slave raided ethnic group are Western African Hausa from Northern Nigeria, Yoruba and Ibo located in the south of Nigeria and close to the Gulf of Guinea. While the two former were centralized in the past, the Ibo was relatively a fragmented group with small kingdoms. Nearby these groups there are the Bauchi from Eastern Nigeria identified as no affected by the slave trade. Our most conservative estimation with location fixed effect predicts estimation ranging from 4 to 5 percentage points decrease in the likelihood of immunization for children from slave raided group relative to those from slave free group (Table 5 bis). This effect is in the range of other traditional economic determinants of health outcomes such as being part of the 20% wealthiest household relative to the poorest 20%. The negative effect of historical exposure to slave trade is predicted as relatively higher than employment status of the mother, or self assessment of distance to health facility as a problem. This estimate suggests thus that the cultural dimension involved in immunization decision is relatively high with respect to other traditional socio-demographic variables such as household income, access to health facility, literacy but also religion or control of birth intervals (see Table 6, panel A et B above). To calibrate the size of the effect, we focus on a particular puzzle studied in the literature in many case

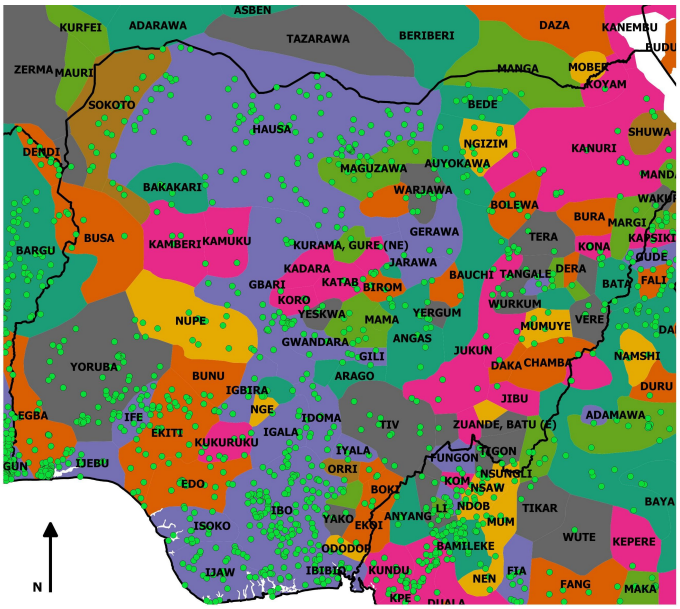

Figure 3: Zoom in Nigeria

studies : the Hausa ethnic group in Northern Nigeria. In our sample 20% of Hausa children are immunized against measles. Had this group been not exposed to the trade, our estimates predicts an increase of nearly 4 percentage points from 20 to 24% which corresponds to 20% increase in the coverage rate (an upper bound since Hausa have the lowest rate in our sample). Using a worldwide representative dataset from all 193 WHO member states, Hall and Jolley (2011) predict that 1% increases in MCV1 coverage rate is associated 2% decrease in disease incidence in the same year and the following year. If we calibrate these estimates relative to our 20% increase in MCV1 coverage rate in the Hausa ethnic group, our estimates predict 40% drop in measles incidence in the ethnic group. In Nigeria, in the period 2011-2014, the country has experienced an average number of 21,249 cases of measles infection implying that our upper bound estimate of 40% drop in incidence rate leads to 8500 children infections avoided. This figure, although an upper bound, is sizable and given its high fatality rate in endemic regions in sub-Saharan Africa such as Northern Nigeria ranging from 5-10% or it might reach 20%-30% fro children in sanitary emergency context such as refugee camp or displaced populations in conflict prone areas (Moss, 2007). Indeed, exposure to slave trade is not a policy variable. The insight behind these quantitative calibration exercise is to point out the life-saving and probably cost effectiveness on investing on the cooperative attitudes and building perceptions of populations in the context of policy intervention and different health program implementation. This investment might probably take the form of deep redefinition of the public health system in these African countries. Actually, it is an academic debate whether there even exist a true public health system in the traditional acceptance of the term. Building trust from the public might thus be a condition for its proper design and effectiveness.

4 Robustness Checks

4.1 Ruling out the effect of other historical pre-colonial ethnic group characteristics

So far, we have shown the negative and significant effect past exposure to slave trade have on likelihood of childhood immunization against measles (and other types of vaccines as shown in appendix). We have argued that the negative effect is through norms of mistrust and non-cooperative behavior inherited from parents and transmitted in the actual choice they make for their children. Recent studies qualitatively assessing determinant of Human Papillomavirus (HPV) uptake by parents from African origin in a Nothern England support these argument even outside African context (Mupandawana and Cross, 2016). The authors document that parents resistance against the cervical cancer preventive vaccine for their young aged 12-13 girls was based on fear of promiscuity, possible future infertility and negative unknown side effect of the new vaccine. The parents thus implicitly refereed to cultural norms or preferences of sexual and fertility behavior they wished to transmit to their children. As a result, taking HPV was interpreted as a signal for unrestrictive sexual behavior for young girls contradicting cultural or religious norms. Thus so far we have argued for a mistrust interpretation channel based on evidence from African historiography, recent epidemics outbreak and evidence from case studies population behavior and narratives, recent academic literature linking low levels of trust with the history of slave trade (Nunn and Wantchekon, 2011) , the robust cross-country correlation between change in public trust and immunization performance over time. However, one might be concerned whether exposure to slave trade is not systematically correlated to other precolonial ethnic features susceptible to affect current individual immunization decision that either we do not control for, that our identification strategy does not allow to rule out, or that are making systematically different slave exposed group from those not exposed in a relevant manner for current immunization decision. We follow the strategy by (Michalopoulos and Papaioannou, 2016) in their study of the effect of split ethnic group on current conflict in Africa., we identify several possible candidate and discuss to which extent our strategy is able to rule them out. First possible explanations are geographic specificities of slave exporting ethnic homeland. In Table 6, Panel A, the relationship between slave exporting status and several geographical and ecological traits are shown. The slave raiding regions are associated with larger ethnic homeland as robustly shown in column 7 of the Table and to be endowed by natural resources such as rivers and lakes and more malaria prone. Interestingly, our strategy exploit finer geographical level than the ethnic homeland which corresponds to locations such as the village, the city or the district. Moreover, we include location fixed effect in our baseline estimates and exploit variations within locations. In addition, our estimates are robust to direct controls for the previous geographical and ecological indicators.

In Table 6, Panel B , we also test the effect of other precolonial location characteristics such as prevalence of conflict in the respondent ethnic homeland of origin, split ethnic group, membership or distance to pre-colonial Kingdom or empire. The slave trade measure is not significantly correlated to any of these indicators. Absence of systematic correlation with split groups status also confirm the informativeness of controlling for another historical shock more recent than the slave trade which is the colonial period. The most restrictive estimation exploiting individual variations do not show persistence of this colonial episode features through internal norms once we control for households

economic status as the literature suggest.

We explore more detailed historic ethnic characteristics with respect to past dominant economic activity and political organization in Panel C of Table 6. From the results, we find that societies more dependent on agriculture for subsistence were significantly slave prone relative to those ethnic groups for which animal husbandry was the principal activity. The relationship might be explained by the fact that agricultural societies are more likely to be sedentary and develop more complex political, social and hierarchical institutions where individual property right exist as Column 5 suggest. Interestingly, the result shows that political centralization, which is one historical institutional dimension controlled for is not significantly correlated with slave trade, ruling out spurious correlation due to multicollinearity of the two variables. Similarly class stratification and prevalence of past historical prevalence of polygyny is not associated to slave trade as opposed to present prevalence as shown by Dalton (2013) for West Africa (note that all the estimates include continent geographic region fixed effect). According to the effect past ethnic group level of development, one could have argue that poorer ethnic group were more affected by the slave trade leading to worse economic and health outcomes unaccounted mechanism. However, this explanation is unlikely since African historiography suggest that more densely populated regions exported more slaves and had relatively higher level of economic development (Nunn, 2008 documents the question building on Barry 1992 and Inokori 2003). Our approach accounts for household economic status, but even if the previous channel was operating it would have just negatively biased the negative effect of mistrust and non cooperation inherited norms. Interestingly, our previous regressions in Panel C do not suggest any such channel in the data.

Given our focus on ethnic traits likely to affect cultural norms, in Panel D we introduce other pre-colonial ethnic group norms present in Murdock's 1967 Ethnographic Atlas database. Those are indicators for societal rigidity in general, rigidity in girl's norms of pre-marital sexual behavior which we dichotomized from early marriages of females and insistence on virginity as rigid norms to weak censure on pre-marital sexual activity to free permission as rigid norms. The results in Panel D shows that slave trade is not significantly associated with any of these social rigidity variable, a finding which can be interpreted as confirming the exogenous character of the shock controlling for the historical geographical location of ethnic group, in particular the proximity to the Atlantic coast for the transatlantic slave trade. It is documented in African historiography that Europeans slave traders did not know much about African societies hinterland at the onset of the trade. The situation even remained even until the beginning of the "scramble for Africa" which resulted in artificiality of the border drawing of colonial states at the Berlin conference in 1885-1886 (see Michalopoulos and Papaioannou, 2016 for an extensive discussion). However, in contrast to our slave trade indicator, past institutional centralization have significant correlation with the ethnic group social rigidity indicators. Interestingly, the relation is not monotonic, societal rigidity is positively but non significantly correlated with centralization whereas specific sexual norms of young girls is significantly correlated with centralization at 10% level. More centralized group are more rigid towards females in terms of sexual behavioral norms. This finding is interesting in our context, since norms of sexual behavior towards women are strongly linked to fertility norms and preferences relevant for mother and child health outcomes such as attitudes towards contraception, acceptance of HPV against cervical cancer as shown in the case in minority dominated schools in Nothern England. Clan marriages (by Michalopoulos and Papaioannou, 2016) indicates prevalence of endogamous marriages at the ethnic group

level, the negative correlations shows that centralized groups were significantly less prone to endogamous marriage. This could be the result that the centralized groups were larger political entities where interpersonal ties were likely to be weaker than keen based relationship in smaller more egalitarian groups. Endogamous marriage might be the result of strategic behavior of intergenerational transmission of values and norms of the group. Overall the Column 5 and 6 of Table 6, Panel D on the link between centralization and more rigid social attitudes are avenue in direction of confirming our cultural interpretation of the negative effect of past centralization on immunization shown and discussed previously. This finding is more interesting since it provides additional evidence to the widely proven relationship between institutions and culture and their interplay. It is shown in cross-country analysis that centralization have positive effect on public goods provision such as education, infrastructure and health (Gennaioli and Rainer, 2006). Our finding at least confirms that cross-country analysis on social norms could hide important features of the relationship between past institutions and current outcomes. Larger and centralized groups might have been more efficient for taking advantage of scales economies for roads or electricity infrastructures provision, or in lobbying the post-colonial government. In contrast through more rigid individual norms of behavior, they might be less efficient in adopting modern health technique such as immunization. It might be the result of compliance with opposing central authorities, or resistance to innovation.

In order to add support to our cultural interpretation, we introduce other qualitative evidence from verbatim response in the DHS survey module. When asked whether they would hide family member infection with tuberculosis, 43 % (8,786 respondents) of respondent mothers said they would keep it secret. Nearby 4% (1,315 respondents) and 3% (1,069 respondents) respectively refused a free HIV test and Hemoglobin test with possible treatment in case of illness. Perhaps more instructive and direct evidence, mothers were asked why they didn't delivery at the health facility (question m_65, mother module DHS survey), 32 % of respondents stated that it was not necessary and more than 14 % that it was not customary showing here the influence of culture as much as those pointing to transport infrastructure (15%) and much more than those indicating financial reasons related to cost (4%). Moreover, only 5% stated that husband or family did not allow them to deliver at the health facility. This response indicate that mothers are able to make the decision for their own and we are not essentially capturing decision of others in the household. These qualitative results are presented in Table 9.

Table 8: Panel A, Geographical and Ecological correlates of slave trade

	(1) slave dummy b/se	(2) slave dummy b/se	(3) slave dummy b/se	(4) slave dummy b/se	(5) slave dummy b/se	(6) slave dummy b/se	(7) slave dummy b/se
Log Surface Land Area	0.0536**	0.0383	0.0680***	0.0862***	0.0323	0.0386	0.1024***
	(0.0234)	(0.0241)	(0.0249)	(0.0180)	(0.0248)	(0.0242)	(0.0204)
Lake Indicator		0.1010*	0.1013**	0.1098***	0.1086*	0.1071*	0.0931**
		(0.0571)	(0.0507)	(0.0408)	(0.0566)	(0.0565)	(0.0417)
River Indicator		0.1023**	0.0657*	0.0294	0.1015**	0.1031**	0.0249
		(0.0418)	(0.0362)	(0.0312)	(0.0406)	(0.0410)	(0.0325)
Land Elevation			-0.1340				0.0504
			(0.0959)				(0.0594)
Land suitable for Agriculture			0.4110***				0.1370
			(0.1451)				(0.1216)
Malaria Suitability Index				0.3799***			0.3620***
				(0.0895)			(0.0790)
Distance to the Coast				-0.0004***			-0.0004***
				(0.0001)			(0.0001)
Diamond Mine Indicator					0.0140		-0.0649
					(0.0883)		(0.0690)
Petroleum Plant Indicator					0.1446**		0.0097
					(0.0646)		(0.0655)
Nearby Groups in the Same Family						0.1591*	0.0904
						(0.0847)	(0.0714)
Adj R-squared	0.079	0.095	0.127	0.242	0.101	0.104	0.252
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N ethnic groups	825	825	825	825	825	825	825

The Table 8 reports linear probability model estimates of the correlation between ethnic groups exporting slaves and geographical, ecological and natural resources. The data are compilation from (Michalopoulos and Papaioannou, 2016) orginating from Murdock's (1959) Ethnolinguistic map 1967's Ethinographic Atlas.

p<0.10, p**<0.5, p***<0.01*

Source: DHS surveys

Table 8, Panel B: Ethnic group historical (Pré-colonial) characteristics and slave trade

	(1) slave dummy b/se	(2) slave dummy b/se	(3) slave dummy b/se	(4) slave dummy b/se	(5) Ln exports b/se	(6) slave dummy b/se	(7) slave dummy b/se	(8) slave dummy b/se	(9) slave dummy b/se
Lake Indicator	0.0972*	0.0992*	0.0952*	0.1005*	0.2834	0.0989*	0.1004	0.0996	0.1031*
	(0.0561)	(0.0563)	(0.0541)	(0.0552)	(0.4618)	(0.0589)	(0.0624)	(0.0610)	(0.0564)
Lake Indicator	0.1016**	0.1006***	0.0968**	0.1024**	0.3830	0.1020**	0.1024**	0.1022**	0.1002**
	(0.0414)	(0.0370)	(0.0394)	(0.0419)	(0.2522)	(0.0415)	(0.0421)	(0.0416)	(0.0418)
Log Surface Land Area	0.0347	0.0387	0.0365	0.0380	0.0112	0.0372	0.0381	0.0377	0.0367
	(0.0237)	(0.0239)	(0.0236)	(0.0246)	(0.1507)	(0.0231)	(0.0241)	(0.0235)	(0.0235)
Pre-colonial Conflict Indicator	0.1093								
	(0.0857)								
Distance to Pre-colonial Conflict		-0.0173							
		(0.1177)							
Discontinuous border			-0.0166						
			(0.0213)						
Split ethnic group				0.0050	0.2170				
				(0.0355)	(0.2810)				
Pre-colonial Kingdom Indicator						0.0118			
						(0.0572)			
Distance to Pre-colonial Kingdom							-0.0057		
							(0.1287)		
Log distance to pre-colinial empire								-0.0013	
								(0.0114)	
Major city in 1400 indicator									0.0805
									(0.0817)
Adj R-squared	0.097	0.095	0.097	0.095	0.062	0.095	0.095	0.095	0.096
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N ethnic group	825	825	825	825	825	825	825	825	825

The Table 9 reports linear probability model estimates of the correlation between ethnic groups exporting slaves and group historical (Pré-colonial) characteristics. The data are compilation from (Michalopoulos and Papaioannou, 2016) orginating from Murdock's (1959) Ethnolinguistic map 1967's Ethinographic Atlas.

p<0.10, p**<0.5, p***<0.01*

Table 8, Panel C: Ethnic group historical (Pré-colonial) dominant economic activity,political organization and slave trade

	(1) slave dummy b/se	(2) slave dummy b/se	(3) slave dummy b/se	(4) slave dummy b/se	(5) slave dummy b/se	(6) slave dummy b/se	(7) slave dummy b/se	(8) slave dummy b/se
Complex Settlement Patterns	0.1731***							
	(0.0461)							
Lake Indicator	0.0854	0.0611	0.0424	0.1153	0.0827	0.0923	0.0604	0.0698
	(0.0576)	(0.0569)	(0.0586)	(0.0763)	(0.0574)	(0.0595)	(0.0717)	(0.0629)
River Indicator	0.0905*	0.0879**	0.0718	0.0960*	0.0874*	0.1043**	0.1188**	0.1192**
	(0.0486)	(0.0440)	(0.0490)	(0.0541)	(0.0476)	(0.0518)	(0.0495)	(0.0492)
Long Land Area	0.0351	0.0507**	0.0568**	0.0308	0.0445*	0.0185	0.0211	0.0218
	(0.0266)	(0.0246)	(0.0272)	(0.0311)	(0.0269)	(0.0291)	(0.0256)	(0.0270)
Dependence on Agriculture		0.0519***						
		(0.0155)						
Animal Husbandry			-0.0676***					
			(0.0127)					
Local Elections				-0.0875				
				(0.0856)				
Inheritance Rule for Property					0.2024**			
					(0.0885)			
Political Centralization						0.0493		
						(0.0617)		
class Stratificaton							0.0213	
							(0.0561)	
Prevalence of Polygyny								0.0029
								(0.0646)
Adj R-squared	0.132	0.128	0.143	0.090	0.105	0.103	0.095	0.097
N ethnic groups	451	487	487	344	374	437	394	478

The Table 15 reports linear probability model estimates of the correlation between ethnic groups exporting slaves and group historical (Pré-colonial) economic activity,political organization. The data are compilation from (Michalopoulos and Papaioannou, 2016) orginating from Murdock's (1959) Ethnolinguistic map 1967's Ethinographic Atlas.

p<0.10, p**<0.5, p***<0.01*

Table 8, Panel D: Ethnic group historical (Pré-colonial) social rigidity norms, slave trade and centralization

	(1) slave dummy b/se	(2) slave dummy b/se	(3) slave dummy b/se	(4) centralization b/se	(5) centraliazation b/se	(6) centralization b/se
Societal Rigidity	-0.1937			0.1597		
	(0.1987)			(0.2558)		
Rigidity of gils sexual norms		-0.1047			0.1394*	
		(0.0813)			(0.0806)	
Clans Marriage			-0.0683			-0.1123**
			(0.0528)			(0.0471)
Adj R-squared	0.428	0.178	0.110	0.192	0.143	0.140
N ethnic groups	29	178	396	29	168	360

The Table 16 reports linear probability model estimates of the correlation between ethnic groups exporting slaves and group historical (Pré-colonial) social rigidity . The data are compilation from (Michalopoulos and Papaioannou, 2016) orginating from Murdock's (1959) Ethnolinguistic map 1967's Ethinographic Atlas.

p<0.10, p**<0.5, p***<0.01*

Table 9: Reason respondent didn't deliver at health facility

Variable	sample	Mean
cost too much	16537	.04499
facility not open	16537	.0130616
open too far/no transport	16537	.1522041
husband/family didn't allow	16537	.050251
not necessary	16537	.3271452
not customary	16537	.1445244

strandard deviations indicate high variations across time and countries

Source: DHS surveys

4.2 Falsification test: Slave trade has no impact on Malaria insecticide treated bednets usage

We attempt to provide additional evidence that slave trade is negatively correlated with vaccination decision through its impact on individual's cooperative attitude. In oder to do this, we study the link between slave trade and the decision to use a more standard and less mistrust prone health product which is malaria bed net. In fact, malaria is an endemic and severe disease in the sub-Saharan African region accounting for more than 90% of worldwide malaria deaths. A parasite called plasmodium is responsible for the disease and is transmitted to human by a mosquito vector biting during afternoon and at nights. Then an efficient preventive method is to sleep under insecticide treated bed nets (ITN). We argue that malaria prevention by sleeping under ITNs should be less trust sensitive than vaccination decision and imply less negative effect so that adult decision to sleep under bed net should be less trust sensitive and not correlated to the individual level of trust. Among adult who had bed net 70% reported their slept under the net the last night before interview. We test whether decision to use bed nets is correlated to slave trade and found no effect as expected in the following Table 10 and Table 11 estimated according to same specification as baseline equation (2) where only the dependent variable take the value one if the adult slept under the bed net.

A possible concern might be that From falsification test slave trade is not correlated to blood test refusal, hiv test refusal and use of bednet against malaria by adult in the household. In line with no mistrust dimension for malaria however more evidence at the local level on blood test refusal and hiv refusal according to literature on colonial medical health interventions. What is possible to do for the more recent colonial shocks and more available data at the local level.

Table 10: Falsification test: effect of slave trade on the decision to use malaria insecticide-treated bet net

	Adult use of malaria IT Net
	b/se
group exports slave(=1)	-0.0041
	(0.0193)
Individual controls	Yes
Location present controls	No
Loc. hist. controls	No
Conflicts controls	No
Ethnic homeland	No
Location (village,city,district) FE	Yes
Adj R-squared	0.367
N observations	80675
N clusters	6960

standard errors are in parenthesis

p<0.10,p**<0.5,p***<0.01*

Source: Data DHS surveys

Table 11: Falsification test: effect of slave trade on the decision to use malaria insecticide-treated bet net

	(3) Adult use of malaria IT Net b/se
ln (1 + number of slave exports)	-0.0003
	(0.0026)
Individual controls	Yes
Location present controls	No
Loc. hist. controls	No
Conflicts controls	No
Ethnic homeland	No
Location (village,city,district) FE	Yes
Adj R-squared	0.367
N observations	80675
N clusters	6960

standard errors are in parenthesis

p<0.10, p**<0.5, p***<0.01*

Source: Data DHS surveys

4.3 Endogenous location choice

Another possible concern might be that location choices are endogenous so that individuals choose their present day location according their cooperative preferences and the quality of the expected health supply. The self-selection in migration might have imply that individuals relocating from slave raided groups to slave free areas are systematically different those doing the opposite in their child health preferences. The point worth to be raised but there are many plausible argument allowing to discard this selective migration hypothesis. First, the argument hypothesize a very sophisticated reasoning by the migrants which are often driven by economic dimension such as employment prospect, or the existence of social network and relatives. Second, it not necessarily the individual who decides to vaccinate the child (the mother for example) who has decided to migrate in the first place. In the same manner, one should also assume that the household which migrated in the new location is the same that take the contemporaneous vaccination decision which is not necessarily the case for many household in the sample given the long historical time window. For instance, the migration might have taken place two or more generations before the household survey take place discarding more the idea of systematic difference correlated to vaccination decision.

5 What are the potential channels?

5.1 Theoretical considerations

We propose an interpretation of the pioneering work by Bisin and Verdier (2001) in the transmission of cultural traits to study and conceptualize previously observed heterogeneity on immunization decision across ethnic groups in Africa. It is now a well-established

idea that ethnic diversity is negatively correlated to various public goods provision through ethnic-fragmentation since the pioneering work by Easterly and Levine (1997). They identify ethnic polarization as exacerbating the public choice problem through disagreement over the type of public good to provide and public policy to implement. This situation result in negative effect on economic outcomes in ethnic fictionalized societies. I attempt to "zoom" at the finer level of transmission of these cultural values, beliefs and norms that subsequently shapes heterogeneity of preferences and behavior towards public goods *provision*. Our approach, in contrast, will emphasize the less studied case of public health *consumption* : particularly attitudes towards children immunization. In their influential model, Bisin and Verdier (2001) distinguish between two mechanisms of transmission of cultural traits : one through direct socialization by the parents from inside the family *"direct vertical"* socialization and socialization by society realized through the individual's environment by adopting attitudes of neighbors and peers or learning (teachers). This second channel is the one they quote as *horizontal and oblique socialization*. A fundamental assumption in their model is that of "imperfect empathy" meaning that parents while being altruistic towards their children evaluate their child's utility only through their own subjective valuations. A direct consequence is that the parents experience some benefit from having children sharing their own cultural trait or preferences. As quoted in Spolaore and Wacziarg (2013) (358), they argue that such "cultural transmission mechanisms have very different implications than evolutionary selection mechanisms with respect to the dynamics of the distribution of the traits in the population (298)". In the evolutionary model the transmission mechanism of cultural trait is assumed to be monotonically increasing in the exogenous "material payoff" associated to this trait whereas in the cultural transmission mechanism "the intergenerational transmission of cultural traits involves economic decisions of rational agents (the cultural parents), the transmission mechanism is not necessarily monotonic in material payoffs, as it depends on the parents' altruistic evaluation of their children's actions" (299). The interest of their model is in predicting the long run heterogeneous distribution of preferences in the population in a stable equilibrium when direct vertical socialization in the family and the horizontal and oblique influence from the society operate as substitute in the cultural transmission mechanism. Moreover, it explains the persistence or assimilation of minorities' cultural traits as the result of interactions between parents direct socialization efforts (which is costly) and the characteristics of the environment in which they occur.

we argue as documented previously that sub-Saharan Africa is an ideal setting for conceptual interpretation emerging from this model. The setting is suitable to provide empirical evidence for a set of theoretical predictions emerging from this cultural transmission mechanisms. First, in African countries distinct ethnic groups live in the same country and cultural persistence in an established fact. Second, the history of colonialism lead to emergence of modern nation-states which implied mobility and relocation of populations from different ethnic homeland. This process have resulted in people from different ethnic background (cultural background) living in the same location. Third, African societies features a juxtaposition of pre-colonial medical practices with modern biomedicine, alongside populations overall hold both traditional beliefs, values and social norms inherited from the past. All these three factors combined with advocacy for modern public health norms and practices, make Africa an ideal setting.

Concretely, in the light of the Bisin and Verdier (2001) model, we assume that current heterogeneity in cooperation preferences (particularly distrust) are result of intergenerational cultural transmission from ancestors differentially impacted by the slave trade.

This idea has been extensively shown and documented by Nunn and Wantchekon (2011) and related work as discussed in the background of the paper. Trust (or mistrust symmetrically) and related subsequent cooperative behavior are values that parents wish to transmit to their offspring (Tabellini, 2008). In our case, we assume that parents are transmitted norms of trust or distrust by their parents in the previous period depending on whether they are descendants from slave exporting group or not and the intensity of the slave trade in their own ethnic group of origin. According to the mechanism modeled by Bisin and Verdier , the intensity of direct vertical transmission depend first on whether in the studied African context vertical and horizontal transmission are perceived as substitute. Bisin and Verdier (2001) intuitively define substitution as situations where parents invest less effort in direct socialization of their child whenever the cultural trait they wish to transmit is dominant in the society. The argument is that in such configuration they child adopt this trait with higher probability.

They show that the existence of cultural substitution is a necessary condition for heterogeneous and globally stable preferences distribution in the population. Alongside, they model provides a rich set theoretical predictions :

i) "When family and society are substitutes in the transmission mechanism, in fact, families will socialize children more intensely whenever the set of cultural traits they wish to transmit is common only to a minority of the population" and the corollary hypothesis

ii) "families which belong to a cultural majority will not spend much resources directly socializing their children, since their children will adopt or imitate with high probability the cultural trait most predominant in society at large, which is the one their parents desire for them" (300).

In our setting, we attempt to empirically infer parent's inherited trust values from the first period in their actual choice of cooperation for their children (decision to immunize their child) in the second period in different contextual environment. Given that actual individual behavior is determined in part by beliefs and values that the individual hold, we argue that parent's decision to immunize might be understood as incorporating an experience of cultural transmission decision. For an easier understanding , immunization decision could coincides with other decision taken by parents on behalf of their children. For example decision for schooling young girls (even for boys at the early time of the colonial period), female genital cutting in some regions of Asia, Northern Africa and sub-Saharan Africa, or girl's selective abortion in India. When confronted with these decision, parents enter in an arbitrage based on their actual knowledge, they decision making heuristics from their cultural backgrounds (Nunn and Wantchekon, 2011), their explicit preferences for transmitting their own cultural trait, their own experiment in the current environment they live (relatives, neighbors, public authorities) (see the discussion below of the work by Mupandawana and Cross, 2016 on young girls from African origin migrant parents and Human Papillomavirus (HPV) against cervical cancer vaccine).

In our setting, there are four distinctive types of parents making decision on behalf of their children : parents from ethnic group whose ancestors are affected by the slave trade, for whom norms of distrust have thus persisted, and who still live in the same ethnic homeland as their ancestors; parents from slave raided ethnic group who have relocated to a place different from their ancestors homeland location; parents from slave free ethnic group still living in the same ethnic homeland as their ancestors; and finally parents from slave free ethnic group having relocated to a place different from that of their ancestors. Data of individual current location are from DHS survey that we combined with data for slave exporting ethnicities constructed by Nunn (2008) and used in other studies.

First, we test the existence of direct vertical socialization to distrust values by the family of the descendants of slave raided groups. If this is the case, exposure to the past history of slave trade so that there is a transmission of mistrust values today (Nunn and Wantchekon, 2011) should have a direct negative effect on the likelihood to behave cooperatively today, and as a consequence immunize their children.

Second, we test the existence of horizontal socialization (from neighbors, peers) by simultaneously introducing an indicator for whether the individual is from a group affected by the slave trade and also whether the individual currently live in a location historically affected by the slave trade. The rationale for this test is similar to others in the literature distinguishing internal norms versus external environment spillovers (Nunn and Wantchekon 2011, Guiso et al. 2004). For individuals who live in the same ethnic homeland as their ancestors, internal and external treatment are the same so that "migrant" in the sample (which represent 56% children for which parents' declared ethnicity name differ from current ethnic homeland name they are located in) allows the identification of location and horizontal spillovers, which are the effect from trustworthiness of neighbors or authorities in a location historically affected by the salve trade.

Third, we study the relative effect of direct vertical versus horizontal/oblique transmission and their implications for the hypothesis of substitution between direct vertical versus horizontal transmission. Theoretically proposition i) and ii) means the following in the African context :

H1: If family and society are substitute in the transmission mechanism, the average negative effect of inheriting distrust norms and currently living in trustworthy environment (slave trade affected our ethnic group and we now live in slave free location) should not be significantly different from those who were not affected by the slave trade but who now live in a slave affected location. In other words, direct vertical socialization by parents have similar effect of horizontal socialization by neighbors similar to parents. We empirically test it by distinguishing the four possible cases: group is slave free raided-location free (00); group affected-location free (10); group free-location raided (00); group affected-location (10); group affected-location affected (11). The results are from estimation of variants of equation 5) and are displayed in Table 9.

H2 : We test heterogeneity of direct vertical socialization effect according to the size of the ethnic group in the country. Parents' direct socialization are decreasing in the size of their ethnic group in the country. So that the negative effect of inherited distrust is conditional on the number of individuals from slave raided group. To test this hypothesis, we first interact group slave trade indicator with the share of ethnic group in the country.

5.2 Empirical evidence for horizontal versus vertical transmission

Next, we test for evidence of horizontal transmission of norms of mistrust quoted in (Nunn and Wantchekon, 2011) as "external factors" associated to the contemporaneous ethnic homeland of location relative to ethnic homeland of origin. We supplement the previous equation (2) and obtains the following :

$$Vaccin_{i,m,e,l,c} = \alpha_0 + \beta\ slave_e + \theta\ slave_l + \Gamma \mathbf{X}_{m,e,d,c} + \Omega \mathbf{X}_{i,e,d,c} + \Phi \mathbf{X}_l + \Psi \mathbf{X}_e + F_c + \varepsilon_{i,m,e,l,c} \quad (3)$$

where $slave_l$ is an indicator for whether the individual's currently live in an ethnic homeland that were historically affected by the slave trade. The results are presented

in Table 12 below, living in a location historically affected by the slave trade also has a negative and significant effect on the likelihood of children immunization. The estimates are consistent across specifications in column 1 and 2 where standards errors are clustered at both the location and ethnic homeland level. The effect θ of the location slave trade can be understood as the impact of living in slave raided area relative to non slave raided area.What can be understood as negative spillovers of distrust norms from neighbors and peers or as the effect of horizontal socialization in the Bisin and Verdier (2001) framework. In their study, Nunn and Wantchekon (2011) interpret this location effect as possible effect of slave trade on quality of local institutions or trust-worthiness of other individuals living in the location.

Table 12: lpm estimates of the Individual determinants of measles Vaccinations : evidence for vertical versus horizontal transmission of culture of mistrust

	(1) measles b/se	(2) measles b/se
group exports slave (=1)	-0.0249**	-0.0244**
	(0.0127)	(0.0123)
location exports slave (=1)	-0.0239**	-0.0282**
	(0.0121)	(0.0117)
Baseline controls	Yes	Yes
Location controls	Yes	Yes
Loc. hist. controls	Yes	Yes
Conflicts controls	Yes	Yes
Ethnic homeland	No	Yes
Location FE	No	No
Country FE	Yes	Yes
R-squared	0.153	0.154
N observations	80088	80088

p<0.10, p**<0.5,p***<0.01*

Source: DHS surveys

We now turn to the investigation of the relative importance of direct versus horizontal socialization on the different groups present in our sample. In order to do this, we explicitly distinguish between four types of individuals : those born from ethnic groups which were ethnic free in our sample and now living in ethnic homelands that were also ethnic free,(this group is indexed as 00 where the first figure indicate group status and the second the location status group in the following taxonomy) , the related group (01 indexed below) is born to slave free ethnic origin but currently live in slave raided ethnic homeland , the third group is born to slave raided ethnic group but now has relocated to slave free regions (indexed 10) in the following and finally group born to slave raided ancestors and living in an ethnic homeland area of slave raided descendants (indexed as 11). We estimate variant of the following equations where, $\Gamma\mathbf{X}_{m,e,d,c}+\Omega\mathbf{X}_{i,e,d,c}+\Phi\mathbf{X}_{l}+\Psi\mathbf{X}_{e}+F_{c}=Vector\ of\ controls$, each group is taken as reference in turn :

$$Vaccin_{i,m,e,l,c}=\alpha_0+\beta_{01}\ slave_{01}+\beta_{10}\ slave_{10}+\beta_{11}\ slave_{11}+Vector\ of\ controls+\varepsilon_{i,m,e,l,c} \quad (4)$$

where $slave_{ij}$is an indicator dummy variable for different groups as defined previously and β_{ij} is the associated coefficient. The results from the different alternative estimations are presented in Table 13. Column 1 confirms our previous results, the effect of slave trade on probability of immunization is negative for all groups affected either through direct vertical socialization by the parents or the horizontal transmission channel. Parents from slave raided ethnic group in non affected location, from only location affected and from both ethnic group and location affected by the slave trade have respectively -0.0482, -0.0598 and -0.0613 corresponding to an average of -5 percentage points less chance of immunizing their children against measles. The coefficient is slightly increasing depending on whether the individual is affected through inherited internal norms of distrust or just through the location spillovers and through both channels. This finding leads to the prior that there exist an enforcement effect stemming from being descendants of slave exporting ethnic group and thus having inherited norms of mistrust and the fact of living in slave exporting ethnic homeland with descendants having inherited norms of mistrust. In column 2 of Table 13, we test the relative effect of direct vertical socialization by comparing the coefficient of the group $slave_{10}$ to the that of $slave_{01}$, the parents that have been vertically socialized are our reference group, we find that there is no significant difference for the negative effect of slave trade through either the vertical or horizontal channel. However, the negative and significant at 10% of the coefficient $slave_{11}$ provides some evidence of enforcement from being from slave raided group and living in slave affected area where norms of mistrust are already prevailing. The Column 3, where the location-only affected group is the reference shows that once affected through external norms, individuals from slave exporting group do not significantly perform less than those internally affected. Comparing the results from Column 2 and 3 suggests that the enforcement effect is from external environment to internal norms of behavior. Parents might be adjusting their direct socialization strategy when they are from slave raided group and face a non trustworthy environment in the direction of hypothesis H1, however we find some evidence of an enforcement effect by the external environment. The estimates in Column 4 confirms the positive effect of having no slave contact on the probability of measles immunization relative to all the other group.

Table 13: LPM estimates of the Individual determinants of measles Vaccinations : Testing relative importance between vertical and horizontal transmission channel

	(1)	(2)	(3)	(4)
	h9_measles	h9_measles	h9_measles	h9_measles
	b/se	b/se	b/se	b/se
slave group location (=0 and =0)	ref.	0.0447***	0.0534***	0.0583***
		(0.0130)	(0.0163)	(0.0122)
slave group location (=1 and =1)	-0.0613***	-0.0143*	-0.0060	ref.
	(0.0122)	(0.0083)	(0.0145)	
slave group location (=0 and =1)	-0.0593***	-0.0129	ref.	0.0011
	(0.0162)	(0.0159)		(0.0143)
slave group location (=1 and =0)	-0.0482***	ref.	0.0065	0.0122
	(0.0130)		(0.0161)	(0.0083)
centralization	-0.0594***	-0.0595***	-0.0595***	-0.0595***
	(0.0074)	(0.0074)	(0.0074)	(0.0074)
Baseline controls	Yes	Yes	Yes	Yes
Location controls	Yes	Yes	Yes	Yes
Loc. hist. controls	Yes	Yes	Yes	Yes
Conflicts controls	Yes	Yes	Yes	Yes
Ethnic homeland	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
R-squared	0.152	0.152	0.152	0.152
N observations	80142	80142	80142	80142
N country	18	18	18	18

p<0.10, p**<0.5,p***<0.01*

Source: DHS surveys

Next we test the hypothesis for heterogeneous effect of direct socialization by the parents depending on the size of the ethnic group in the country and estimate variant of the following equation :

$$Vaccin_{i,m,e,l,c} = \alpha_0 + \theta_1\ slave_e + \theta_2\ size_e + \theta_3\ slave_e * size_e + Vector\ of\ controls + \varepsilon_{i,m,e,l,c} \quad (5)$$

Here the size of the ethnic group captures the extent to which the individual cooperation norms are likely to be shared by other in the society. Bisin and Verdier (2001) hypothesized that this has an effect on parents direct incentives to socialize their children. One can imagine two possible outcomes, one through which the number of people sharing the individual's norm enforce the effect of direct socialization by the parents through higher likelihood for imitation. The other possible outcome is that higher probability for children adopting the desired values by the parents crowd-out the effort for direct socialization by the parents. Introducing controls for size of the different ethnic group also prevents that our result are just driven by the size of individuals from affected ethnic group in the country and allows to rule out issues related to ethnic discrimination of minorities. The results in Table 14 show that the size of the ethnic group are not driving the negative effect of direct socialization by parents to norms of distrust on immunization. When interacting slave exports dummy with indicator for majority ethnic group in

Column 1 of Table 14 the negative effect of inheriting distrust norms from parents of slave exporting ascendants does not vanish and the size (-0.0341) is similar to our most conservative estimate at Table 5 previously shown. We alternatively introduce other measures of ethnic group size such as the share of people from the same ethic group at Column 3, which enters with no significant effect while our negative effect remains precisely and significantly estimated. Seemingly at Column 4, we introduce 7 size fixed effect controls for the rank of ethnic group in the country relative to the majority group. Only the second largest group enters significantly and positively showing that majority groups are not systematically doing better and ruling out ethnic discrimination explanation for our results. Most indicators dummy for the size of the group are not at all significant and the negative effect is still persistent and even stronger. Our results do not support H2, there is not statistical evidence of differential effect according to the size of the ethnic group even though the predictions are interesting to explore further to understand strategic interactions of minority and majority ethnic groups.

Table 14: LPM estimates of the Individual determinants of measles Vaccinations : Testing the heterogeneity effect relative to ethnic group size at the country level

	(1)	(2)	(3)	(4)
	h9_measles	h9_measles	h9_measles	h9_measles
	b/se	b/se	b/se	b/se
group exports slave(=1)	-0.0341**	-0.0344**	-0.0393**	-0.0523***
	(0.0173)	(0.0167)	(0.0167)	(0.0181)
group majority(=1)	-0.0054	-0.0088		
	(0.0485)	(0.0094)		
group exports x majority	-0.0037			
	(0.0500)			
group share in country			0.0061	
			(0.0443)	
group majority				ref.
group rank 2				0.0300**
				(0.0129)
group rank 3				0.0186
				(0.0138)
group rank 4				-0.0253+
				(0.0164)
group rank 5				0.0025
				(0.0185)
group rank 6				-0.0322
				(0.0251)
group rank 7				0.0179
				(0.0435)
group rank 8				-0.0845
				(0.0591)
centralization (=1)	-0.0322**	-0.0323**	-0.0346***	-0.0424***
	(0.0131)	(0.0131)	(0.0133)	(0.0140)
split group (=1)	-0.0109	-0.0110	-0.0108	-0.0105
	(0.0104)	(0.0104)	(0.0103)	(0.0109)
Baseline controls	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes
R-squared	0.212	0.212	0.212	0.213
N observations	82467	82467	82467	82467
N Location	7478	7173	7478	7478

Lpm controlling for size of the ethnic group at the country level. Interactions and controls for the size of the ethnic group the individual belong to are introduced. Dummy indicators for belonging to the largest group (majority), the share of individuals from ethnic group in country and the rank (decreasing order) of ethnic group in country according to size are subsequently introduced.

*p¡0.10,**p¡0.5,***p¡0.01

Source: DHS surveys

6 Conclusion

In this paper, we focus on individual determinant of immunization and show that culture captured by inherited norms of non-cooperative behavior through parent's intergenerational transmission of past ethnic group exporting slaves has a negative effect on the likelihood of measles vaccination. We argue that the findings could be interpreted as causal and provide evidence ruling out potential competing explanation such as other pre-colonial ethnic institutions and social norms and level of economic development . In addition, we provide qualitative evidence that our hypothesized cultural channel in health service demand is supported by respondents mothers to survey questions determining the decision to deliver at health facility. Next we perform falsification test with the use of alternative health product in adult decision to sleep under insecticide treated bed net and show that it is not affected by past exposure to the slave trade. We interpret this result as a consequence that malaria is not trust sensitive relative to child vaccination leading to non correlation with slave trade. Alongside these main results, we propose an interpretation of the hypothesized value transmission model and find that direct transmission of cultural norms by the parents and the negative spillovers from the environment are equally likely explaining the negative effect of exposure to the trade on individual choices. Moreover, the results are robust to controlling for different indicators related to the size of the ethnic group the individual belong to. We interpret this result as allowing to rule out traditional discriminatory and social polarization effect explanations.

Our work thus adds empirical evidence that these norms of mistrust also restrict individual's true cooperative attitudes and lead to lower health performance at the society level. Most of the literature on public service delivery in developing countries focus on the supply side of public goods or service provision rather than the demand side. This work suggests that improving cooperation of service users have a positive impact on likelihood of policy success, particularly immunization. In terms of policy implications, our findings call for direct early childhood interventions to build desirable pro-social preferences: through the education system for example. For instance in latin America, Hogares Communitarios in Colombia are implementing programs implying both direct childhood educational programs but also community interventions with the parents.

However, our study face some limitations since we do not observe direct measure of trust of the mothers that we instrument through past ethnic exposure to slave trade. This might lead to measurement errors and perhaps omitted variables bias if slave trade picks-up other features directly affecting vaccination decision that we do not control for.

Still our approach so far contribute by providing some quantitative evidence for the relative importance of cultural factors besides technical and socio-demographic factors which are traditional health policy intervention in sub-Saharan Africa. It opens the doors for studying the expansion of epidemics according to geographical locations and cultural background of different ethnic groups for instance. Transmission of EVD from vectors to human have been documented to be related to geographical locations (forestry), economic and food consumption activities such as bush and forest hunting. Even after outbreak of an epidemic, traditional practices such as the way of dealing with deceased relatives dead bodies might favor epidemic expansion. These might be an interesting avenue for future research. Other fruitful direction might be related to another important shock through violent medical colonial intervention that shaped Africa's modern biomedicine and public health perception.

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Appendix

Table 15: Lpm estimates of individual determinants of measles vaccinations : restricted sample

	(1) h9_measles full sample b/se	(2) h9_measles split variation b/se	(3) h9_measles slaVe variation b/se	(4) h9_measles slave and central variation b/se
group exports slave (=1)	-0.0387**	-0.0428**	-0.0387**	-0.0483*
	(0.0161)	(0.0188)	(0.0165)	(0.0261)
centralization	-0.0342***	-0.0408***	-0.0749***	-0.0918***
	(0.0129)	(0.0149)	(0.0290)	(0.0341)
split group	-0.0108	-0.0121	0.0042	-0.0341
	(0.0103)	(0.0105)	(0.0194)	(0.0333)
Baseline controls	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes
R-squared	0.212	0.221	0.289	0.143
N observations	82467	25781	11745	4169
N cluster	7478	2698	1258	562

LPM estimates of children measles vaccination using the cluster fixed-effect specification accross different samples of clusters. For all equations the standard errors are clustered at the cluster (location: district-city-village) level. The equation controls include only individual controls related to mothers demographics characteristics,household resources allocation,decsion making,fertility preferences and children controls.Sample in (1) : no restrictions in the baseline sample. Sample (2) :restriction to location with variation on split ethnic groups . Sample (3) : at least 2 different level of slave trade between different ethnic groups in location. Sample (4): at least two 2 different level of slave trade and 2 different level of centralization between different ethnic groups in location.

p<0.10, p**<0.5, p***<0.01*

Source: DHS surveys

Table 16: LPM estimates of indiviudal determinants of measles vaccination (Continuous slave exports measure): restricted sample

	(1) h9_measles full sample b/se	(2) h9_measles split variation b/se	(3) h9_measles slaVe variation b/se	(4) h9_measles slave and central variation b/se
Ln (1 + Number of slave) group	-0.0028*	-0.0024+	-0.0038**	-0.0089**
	(0.0015)	(0.0016)	(0.0017)	(0.0036)
centralization	-0.0339***	-0.0391***	-0.0683**	-0.0924***
	(0.0129)	(0.0148)	(0.0289)	(0.0337)
split group	-0.0112	-0.0127	0.0098	-0.0359
	(0.0104)	(0.0105)	(0.0200)	(0.0335)
Baseline controls	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes
R-squared	0.212	0.221	0.289	0.144
N	82467	25781	11745	4169
N cluster	7478	2698	1258	562

LPM estimates of children measles vaccination using the location fixed-effect specification accross different samples of clusters. For all equations the standard errors are clustered at the cluster (location: district-city-village) level. The equation controls include only individual controls related to mothers demographics characteristics,household resources allocation,decsion making,fertility preferences and children controls.Sample in (1) : no restrictions in the baseline sample. Sample (2) :restriction to location with variation on split ethnic groups . Sample (3) : at least 2 different level of slave trade between different ethnic groups in location. Sample (4): at least two 2 different level of slave trade and 2 different level of centralization between different ethnic groups in location.

p<0.10, p**<0.5, p***<0.01*

Source: DHS surveys

Table 17: Logit with location fixed-effect estimates of indiviudal determinants of measles vaccinations : restricted sample

	(1) h9_measles full sample b/se	(2) h9_measles split variation b/se	(3) h9_measles slaVe variation b/se	(4) h9_measles slave and central variation b/se
group exports slave (=1)	-0.1957**	-0.2276**	-0.1953**	-0.2333*
	(0.0809)	(0.0945)	(0.0820)	(0.1317)
centralization	-0.1876***	-0.2309***	-0.3912***	-0.4911***
	(0.0695)	(0.0796)	(0.1453)	(0.1742)
split group	-0.0602	-0.0681	0.0146	-0.1874
	(0.0529)	(0.0537)	(0.0976)	(0.1712)
Baseline controls	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes
R-squared				
N observations	74927	22789	10144	3676
N cluster	5531	1940	902	411

Logit estimates of children measles vaccination for the cluster fixed-effect model specification accross different samples of clusters . For all equations the standard errors are clustered at the location: district-city-village level.The equation controls include only individual controls related to mothers demographics characteristics,household resources allocation,decsion making,fertility preferences and children controls.Sample in (1) : no restrictions in the baseline sample. Sample (2) :restriction to location with variation on split ethnic groups . Sample (3) : at least 2 different level of slave trade between different ethnic groups in location. Sample (4): at least two 2 different level of slave trade and 2 different level of centralization between different ethnic groups in location.

p<0.10, p**<0.5, p***<0.01*

Source: DHS surveys

Table 18: Full POLIO Vaccination sequence : Intensive margin

	(1) Polio3time b/se	(2) Polio3time b/se	(3) Polio3time b/se	(4) Polio3time b/se	(5) Polio3time b/se	(6) Polio3time b/se
group exports slave (=1)	-0.0063	-0.0214**	-0.0322***	-0.0239**	-0.0239+	-0.0219
	(0.0170)	(0.0088)	(0.0093)	(0.0098)	(0.0163)	(0.0165)
location exports slave (=1)				-0.0218***	-0.0218*	-0.0220*
				(0.0080)	(0.0128)	(0.0130)
centralization	0.0011	-0.0230***	-0.0196***	-0.0199***	-0.0199***	-0.0205***
	(0.0077)	(0.0037)	(0.0044)	(0.0044)	(0.0077)	(0.0077)
split group	-0.0062	-0.0362***	-0.0320***	-0.0325***	-0.0325***	-0.0332***
	(0.0114)	(0.0061)	(0.0070)	(0.0070)	(0.0106)	(0.0109)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Location present controls	No	No	Yes	Yes	Yes	Yes
Loc. hist. controls	No	No	Yes	Yes	Yes	Yes
Conflicts controls	No	No	Yes	Yes	Yes	Yes
Ethnic homeland	No	No	No	No	No	Yes
Location FE	Yes	No	No	No	No	No
Country FE	NO	Yes	Yes	Yes	Yes	Yes
R-squared	0.253	0.156	0.161	0.162	0.163	0.163
N	84944	84944	82458	82404	82404	82404
N district	7670	7670	7357	7353	9545	9545
N country	18	18	18	18	18	18

LPM estimation of full children vaccination accross all doses of Polio vaccines. For all specifications the standard errors are clustered at the cluster (location: district-city- village) level. For equation (5) and (6) standard errors are double clustered at both respondent cluster and ethnic homeland level. The equation controls include subsequently only baseline controls related to mothers demographics characteristics,household resources allocation,decsion making,fertility preferences and children controls. The location (cluster) current controls include : population density, measures of luminosity, indicator for Lit pixels, geogrpahicdistance to water point.The location geographic and hsitorical controls for malaria suitability,agricultural suitability, distance to water, number of diamond mines, number or dummy of petrolium plants,distance to capital, distance to sea, elevation, distance to border, dummy for coastal location. The conflicts controls include all types of conflicts, violence and riots that has taken place at the ethnic homeland of location. The ethnic homeland controls include distance of centroid of ethnic homeland to current capital city, distance to border, coastal dummy, dummy for ethnic homeland where capital are currently located.standard errors are in parenthesis

p<0.10, p**<0.5, p***<0.01*

Source: DHS surveys