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15 April 2013

Online at <https://mpra.ub.uni-muenchen.de/46234/>
MPRA Paper No. 46234, posted 16 Apr 2013 05:41 UTC

Communitarianism, Oppositional Cultures, and Human Capital Contagion: Theory and Evidence from Formal versus Koranic Education *

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April 2013

Abstract

We analyze the implications of communitarianism—the tendency of people to organize into separate culturally homogeneous groups—for individual and group inequality in human capital accumulation. We propose a non-cooperative social interactions model where each individual decides how much time to invest in *human capital* versus *ethnic capital*, and his utility from investment in either form of capital is increasing in the investment of his ethnic group in that form of capital. We find that, in equilibrium, the demand for human capital is affected positively by individual and group ability, and negatively by group size. Moreover, two groups that are *ex ante* identical in ability distribution may diverge in human capital accumulation, with divergence only occurring among their low-ability members. The latter always coordinate on the same type of investment, showing a contagion or herding effect. Furthermore, we find that ethnic and group fragmentation increases the demand for human capital. We validate these predictions of the model using household data from a setting where ethnicity and religion are the primary identity cleavages. We document persistent ethnic and religious inequality in educational attainment. Members of ethnic groups that historically converted to Christianity fare better than those whose ancestors converted to Islam. Consistent with theory, there is little difference between the high-ability members of these groups, but low-ability members of historically Muslim groups choose Koranic education as an alternative to formal education. Also, the descendants of ethnic groups that were evenly exposed to both religions outperform those whose ancestors had contact with only one religion, and local ethnic fragmentation increases the demand for formal education.

JEL classification numbers: A13, C72, I21, N3.

Keywords: Communitarianism, group inequality, human capital, Koranic education, contagion.

*We are grateful to Gamal Atallah, David Autor, Victoria Barham, Lori Beaman, Moussa Blimpo, Serge Coulombe, Yazid Dissou, Steven Durlauf, Christian Ebeke, Fernanda Estevan, Marcel Fafchamps, Andrew Foster, Gilles Grenier, Renate Hartwig, Louis Hotte, Najib Khan, Mariko Klasing, Christopher Ksoll, Paul Makdissi, Ted Miguel, Petros Milionis, Louis-Philippe Morin, Muthoni Ngatia, Nathan Nunn, Louis Putterman, Debraj Ray, Roberto Serrano, Pedro Vicente, Leonard Wantchekon, Myra Yazbeck and Thierry Yogo for comments and encouragement. We also thank seminar participants at ITAM and the University of Ottawa, and conference participants at the 2012 CSAE Meeting at the University of Oxford, the 2012 EEA-ESEM Meetings in Málaga, and the 2013 North American Winter Meeting of the Econometric Society in San Diego. Pongou gratefully acknowledges the Social Sciences and Humanities Research Council of Canada grant 230614-190299-2001, and thanks the Department of Economics of the University of Oxford for hospitality.

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1 Introduction

Inequality across social groups with distinct identities and cultures is one of the most important issues facing modern societies. Disparities in economic opportunities, employment, earnings, and asset holding are generally perceived as symptoms of discrimination against the less well-off groups, which often leads to social animosities, riots, and violent conflicts.¹ In a perfectly competitive market economy, group inequality partly results from group-level differences in the levels of human capital. A large body of literature has suggested that such differences are in part attributable to cultural factors (e.g., Ogbu (1978), Fordham and Ogbu (1986), Fordham (1996), Austen-Smith and Fryer (2005)), with some groups adopting an oppositional attitude towards formal education, and others encouraging or pressuring their members into intensive community activities that leave little time for human capital acquisition.² However, the analysis of the individual and group factors that influence the educational choice of individuals is still in its infancy. Given the grave social consequences of individual and group inequality, undertaking such an analysis is important for informing the design of public policy.

In this paper, we analyze the implications of *communitarianism*, that is, the tendency of people to organize into culturally homogeneous groups which act as closed networks, for individual and group inequality in human capital accumulation.³ The set of potential groups arises exogenously, but adherence to group values is endogenous. Education, through which human capital is built, is promoted by a secular state as a universal value. Each individual chooses how much time to invest in acquiring education, and how much to invest in strengthening his relationship with his community. We study the determinants of such a choice, focusing on the interplay of individual characteristics such as ability with group characteristics such as group size and ability. From our findings, we also identify a new mechanism through which social fragmentation affects human capital demand. We test the theoretical predictions using nationally representative household data from Nigeria, where ethnicity and religion are the primary identity cleavages. We document considerable ethnic and religious inequality in educational attainment, and show that these differences can be traced back to historical religious conversion during the colonial era. Members of ethnic groups that historically converted to Christianity fare better than those whose ancestors converted to Islam. Consistent with theory, the descendants of ethnic groups that were evenly exposed to both religions outperform those whose ancestors had contact with only one religion, and local ethnic fragmentation increases the demand for formal schooling.

1.1 An Overview of the Model

Our theoretical setup is a non-cooperative social interactions game in which we consider a society composed of several ethnic groups. Each agent can invest in ethnic capital and/or human capital. By investing in ethnic capital, we mean that the individual spends time in his ethnic community, either

¹See, e.g., Mitra and Ray (2010), Esteban and Ray (2011), and Sen (1973).

²See Section 2 for a comprehensive literature review.

³We note that the word *communitarianism* has been used in different contexts. Traditionally, it has been used to define a philosophy or ideology that emphasizes the importance of community in individual and political life. We use it to define the organization of a society into distinct self-centered communities.

attending schools run by the community or participating in community-run projects for the betterment of the group as a whole. By investing in human capital, we mean that the individual spends time in activities that in the future will lead to higher personal returns for him, in particular, we mean he attends state-run school.

The benefits to the agent from investing in either kind of capital depend on how many people of his ethnicity also invest in the same kind of capital. For instance, by investing in ethnic capital, an agent builds stronger ties with those from his ethnic group who also invest in ethnic capital. This may later help him to find a livelihood within the ethnic community. On the other hand, the more an agent invests in human capital, the stronger are his ties to those in his ethnic community who also invest in human capital, and using those connections, he might land a job in the higher paying formal or skilled sector. Hence, the higher the community investment in the form of capital in which the agent is more invested, the higher his utility.⁴ Naturally, this can be motivated through thinking of positive network effects. In the absence of these network benefits, the individual is better off investing in human capital, as the formal sector is associated with higher wages than the informal (or unskilled) sector.

We further assume that each agent is endowed with a certain level of ability that positively affects his utility. Ability enters the utility function so that for any positive level of human capital investment, a person with higher ability generates higher utility (this assumption is equivalent to saying that the acquisition of human capital is less costly to agents with higher ability).

We show that the number of Nash equilibria of this social interactions game is at least one and at most two, depending on group exogenous characteristics (group size and ability distribution).

1. If a group is small⁵, then there is a unique equilibrium in which all members invest in human capital regardless of their ability. This is so because small communities offer little "social capital" benefits, hence, each individual is better off trying for a higher wage in the skilled sector regardless of his ability.

2. If a group is large and rich in ability, then there exists a unique equilibrium in which all members invest in human capital. In fact, we show that the high-ability members of a group always invest in human capital. However, low-ability members care more about the size of the network to which they belong. Therefore, if a group is rich in ability, meaning that the number of high-ability individuals in the group is large, low-ability members will follow the crowd of these high-ability individuals in investing in human capital, because if they invest in ethnic capital instead, they will only form a small network, which does not generate enough social benefits.

3. If a group is large and poor in ability, then there exist two equilibria. In one, all members of the group invest in human capital. In the other, high-ability members invest in human capital whereas low-ability members invest in ethnic capital. These predictions show that if the number of low-ability individuals is large, they will all coordinate on the same type of investment to form a large network,

⁴This assumption reminds the "strategic complementary" assumption well known in the literature (see, e.g., Glaeser and Scheinkman (2000) on some of its formulations). See also Belhaj and Deroian (2011) for a similar assumption in a context in which agents allocate time between two activities.

⁵There exists a threshold such that a group is considered small if its size is below that threshold, and large otherwise.

therefore either investing in human capital or in ethnic capital.

The findings stated in (2) and (3) reveal that low-ability individuals simply follow the crowd in choosing a type of capital, suggesting a *contagion* or *herding* effect (Banerjee (1992)). Unlike in Banerjee (1992), however, herding in our model is driven by the fact that low-ability individuals gain from associating themselves with others.

Overall, the findings uncover new important individual- and group-level determinants of human capital demand in a simple unified framework. They also explain cross-group differences in human capital accumulation. The key testable predictions implied by these findings are the following:

- T1-1.** Two groups that are not necessarily identical will converge in human capital accumulation if they are sufficiently small or if they are sufficiently rich in ability, *ceteris paribus*. In fact, it follows from (1) and (2) that their members will all invest in human capital.
- T1-2.** Two large groups that are *ex ante* identical in size and ability distribution may diverge in human capital accumulation. Such a divergence, however, would only occur among the low-ability members of both groups. This prediction follows immediately from (3).
- T2.** A person's demand for human capital is positively affected by his ability and his group's ability. This derives from (2).
- T3.** A person's demand for human capital is negatively affected by his group's size. This comes from the fact that members of smaller groups invest more in human capital as stated in (1).
- T4.** Ethnic and group fragmentation positively affects the demand for human capital. In fact, fragmentation leads to smaller groups, and members of small groups are more likely to invest in human capital as stated in (1).

The findings stated in (T1-1) and (T1-2) have important implications for the empirical analysis of cross-group differences in human capital accumulation. (T1-1) implies that observed cross-group differences in this outcome may disappear if we control for some observable individual and group characteristics. But (T1-2), which derives from the existence of two equilibria in large groups that are not sufficiently rich in ability (3), implies that in a multivariate regression of human capital on group identity, controlling for all "imaginable" variables related to both factors may not erase group differences in the outcome. However, as the theory predicts, differences across groups will persist only among their low-ability members. Such a divergence in human capital may be determined, as we will see in the next section, by a historic shock which pushes one group into one equilibrium and the other group into a different equilibrium. To the best of our knowledge, these findings are new. Furthermore, they offer a new mechanism through which ethnic and group fragmentation may affect economic outcomes. For instance, the result stated in (T4) implies that individuals residing in more ethnically diverse areas should demand more education than those residing in less diverse areas. It also implies that members of a tribe that is more fragmented, say, along religious lines, should demand more education than members of a less fragmented tribe. In the next section, we show how we empirically test the model.

1.2 Highlights of the Empirical Test

We empirically test the predictions of the model in the context of Nigeria, where ethnicity and religion emerge as the two most important dimensions of identity. This country is composed of over 250 ethnic groups, and counts numerous religious denominations which we shall categorize as Christian and Muslim for our purpose. It is common to aggregate the different ethnic groups based on linguistic and cultural affinities into five major categories: The Hausa/Fulani/Kanuri of the core North, The Igbo of South East, the Yoruba of the South West, The Isoko/Urhobo/Edo/Ijaw/Efik/Ibibio of the Niger-Delta region, and the Tiv/Igala/Idoma/Gwari of Central Nigeria also known as the Middle-Belt region (NISER (1997)).

There is a long documented history of a diverging attitude of Christians and Muslims towards formal education in Nigeria, with the former being usually pro-schooling, and the latter resisting it as a western "imperialist" institution (see Section 4.1). This is consistent with the existence of there being two possible equilibria in large groups. Islam spread and consolidated in most of what later became northern Nigeria by the *Jihad* of Uthman Dan Fodio about 1804. Historical records show that Koranic schools were established in these regions, offering a holistic education primarily consisting of teaching Arabic literacy and recitation of the Qur'an from early childhood to adolescence (Fafunwa (1974), Ajidagba (1998)). Western-type education was introduced by the Wesleyan Christian Missionaries in 1842 in the south. Its curriculum consisted of literary education in the reading, writing, arithmetic and religion, preparing its recipients for new job opportunities as teachers, church evangelists or pastors, clerks and interpreters. Many Muslims resisted this form of education and continue to do so even in the present day, just as Christians viewed Koranic education as largely irrelevant. This reality is evidenced in Figure 1, which shows the Christian-Muslim gap in formal educational attainment by age. Muslims are at a disadvantage early on, and fall further behind over time, lagging Christians by more than 4 years of education by age 24.

We examine the distribution of Christians and Muslims across ethnic groups in Nigeria, presented in Figure 2. Christians are more concentrated among the Igbo (95%), the Niger-Delta (94%), the Middle-Belt (67%) and the Yoruba (52%), but are the fewest among the Hausa/Fulani/Kanuri (0.5%). Muslims are more concentrated among the Hausa/Fulani/Kanuri (99%), the Yoruba (46%) and the Middle-Belt (31%), but are least represented among the Igbo (0.3%) and the Niger-Delta (2.4%). The Yoruba are therefore more balanced or fragmented along religious lines than other ethnic groups, and therefore should demand more formal education if our theoretical prediction is correct. It is also important to note that the varying distribution of religious beliefs across ethnic groups in Nigeria mostly reflects differences in historical exposure to Christian and Islamic activities in this country. Nunn (2010) provides compelling empirical evidence for the fact that the descendants of people that were exposed to European missionaries in Africa more likely self-identify as Christian today, which shows that Christian beliefs and values were transmitted across generations from parents to children until the present day. In Section 4.1, we also argue that the same can be said about the generational diffusion of Islam. These facts ensure that religious affiliation, as ethnic or tribal affiliation, is exogenous, which is useful for our econometric identification.

We also examine the facts about investment in ethnic capital, proxied by investment in Koranic education.⁶ The statistics, presented in Figure 3, are self-explanatory. Among the Hausa/Fulani/Kanuri, 23.5% of children have only a Koranic education, in stark contrast to the Igbo (0.1%), the Yoruba (0.4%), the Niger-Delta (0.4%) and the Middle-Belt (2.7%). Clearly, Koranic education is an important alternative to formal education. Therefore, if our theory is correct, the Hausa/Fulani/Kanuri people should lag behind in terms of formal schooling, whereas the other groups will tend to converge.

We now look at cross-ethnic differences in investment in formal education, presented in Figure 4. Yoruba, Niger-Delta, and Igbo children, with 10 years of education by age 24, are consistently more educated than the Middle-Belt (8 years) and the Hausa/Fulani/Kanuri (4 years). Children in this latter group, which is predominantly Muslim, as we have seen above, are most likely to invest in Koranic education, losing ground with respect to investment in human capital early on, and their disadvantage grows with age as they acquire education at a much lower speed.

We now attempt to explain these cross-group differences in formal educational performance, basically testing our predictions (T1-1) and (T1-2). They may be attributable to demographic and socioeconomic conditions that are known to vary across ethnic groups in most countries. In multivariate analyses, we therefore control for a range of individual and household level demographic and socioeconomic variables. The advantage of the Yoruba over other ethnic groups declines in magnitude, but remains statistically significant.

Given that the formal educational infrastructure may not be evenly supplied across different regions, the remaining differences could be due to the fact that some ethnic groups benefit more than others. To address this issue, we control for neighborhood fixed effects, as individuals residing within the same neighborhood have the same exposure to educational supply.⁷ We find that the differences between the Yoruba, the Igbo and the Niger-Delta no longer persist, but the Middle-Belt and the Hausa/Fulani/Kanuri still lag behind the Yoruba. However, the disadvantage of the Middle-Belt vanishes among the 5-9 and the 15-19 year old individuals, whereas that of the Hausa/Fulani/Kanuri remains economically and statistically significant across all age groups.

The convergence among certain ethnic groups or tribes is consistent with the prediction stated in (T1-1), whereas the diverging outcome of the Hausa/Fulani/Kanuri is consistent with the prediction stated in (T1-2). Indeed, that the Hausa/Fulani/Kanuri individuals continue to lag behind after we control for a range of factors clearly corroborates our earlier observation that investment in ethnic capital (often in the form of religious education) is heavier in that group as compared to other groups. However, according to our theory, high-ability individuals are more likely to choose human capital over ethnic capital regardless of their group attachment to an oppositional norm. This implies that cross-ethnic differences in educational performance should be small among high-ability individuals and more pronounced among those of low ability. We test and validate this theoretical prediction, using parental education and wealth as proxies for child ability.⁸ Furthermore, to control for common

⁶There are several forms of ethnic capital in reality, but the only one for which we have data is Koranic education. As we show in Section 4.1, the Muslim regions of Nigeria have historically supported Koranic schools as an important means of building ethnic capital.

⁷A neighborhood in the data is a small area. It is a census tract.

⁸Ability is hard to observe in practice. However, a very large literature in Biology and Labor Economics shows that

religious factors inherent in Islam, we replicate this test for Muslim individuals only, and we find that the poor performance of Hausa/Fulani/Kanuri children relative to all other groups persists only for those children whose parents have no education or are very poor, clearly validating prediction (T1-2).

Next, we test the prediction that an individual, regardless of his ability, is more likely to invest in human capital if the number of high-ability individuals in his ethnic group is sufficiently large, as stated in (T2). We proxy the number of high-ability individuals in an ethnic group by the neighborhood-level share of adults in that group with at least a secondary school education. We do the computation for each ethnic group, and estimate the effects of the resulting variables on education, controlling for all relevant variables, including parental education and wealth (our proxies for child ability). We validate the model prediction. For example, a one-point increase in the neighborhood share of educated Hausa/Fulani/Kanuri adults increases education by 5.2 years among Hausa/Fulani/Kanuri children, but has little effect on children from other tribes. In general, these effects are mostly confined within ethnic groups, showing a clear network effect.

Furthermore, we test prediction (T3) that individuals belonging to smaller ethnic groups are more likely to invest in human capital than those belonging to larger groups. We test this prediction in three different ways. First, we split the sample into Christians and Muslims, and estimate cross-ethnic differences in educational attainment for each religious group. Consistent with the theory, we find that educational attainment is higher for individuals belonging to ethnic groups where their religion is less represented. For instance, Christian Igbo perform poorer than Christian Yoruba, whereas Muslim Igbo perform better than Muslim Yoruba, which is consistent with there being more Christians among the Igbo than the Yoruba, and less Muslim among the former than the latter. The second way to test (T3) consists of comparing Muslims to Christians in each ethnic group. We find that Muslims do better than Christians in ethnic groups in which they are less represented such as among the Igbo and the Niger-Delta. Similarly, Christians perform better than Muslims when they do not constitute a large share of an ethnic group like among the Hausa/Fulani/Kanuri. The third way to test (T3) is to estimate the effect of an individual's ethnic group representation in a neighborhood on his educational attainment. For each individual, we compute the share of his ethnic group in the neighborhood in which he resides, and use the resulting variable to predict his education, while controlling for all other variables. We find that individuals belonging to smaller groups perform better than those belonging to larger groups.

As a corollary of the latter prediction, ethnic fragmentation should have a positive effect on the demand for formal education as stated in (T4). Indeed, we find that individuals who reside in more ethnically heterogeneous neighborhoods have more education. Interestingly, when we control both for

parental socioeconomic status as determined by education and wealth are good proxies for child ability measured by IQ and cognitive and non-cognitive skills (Løken, Mogstad and Wiswall (2011), Currie (2009), Currie and Moretti (2003), Lundborg, Nilsson and Rooth (2012), Almond and Currie (2011)). Indeed, higher parental SES has a positive effect on a range of children's health indicators (Case, Lubotsky and Paxson (2002), Glewwe (1999), Pongou, Ezzati and Salomon (2006), Pongou, Salomon and Ezzati (2006), Currie (2009)), and better health in childhood positively affects mental and cognitive ability (Weinreb et al. (2002), Glewwe and Jacoby (1993), Chang et al. (2002), Currie (2009), Currie and Stabile (2006), Currie (2000)), as well as productivity in adulthood (Currie et al. (2010)).

the size of an individual's ethnic group and ethnic fragmentation, only the latter variable remains statistically significant, further validating the model mechanism that the positive effect of ethnic fragmentation on the demand for formal education is just a reflection of the positive effect of ethnic minority status on this outcome.

The rest of the paper is organized as follows. In Section 2, we situate our study within the literature. Section 3 presents the theoretical model and its predictions. We test the model in Section 4, and conclude our study in Section 5. All the proofs are collected in an appendix.

2 Closely Related Literature

Our paper is related to works linking ethnic identity and educational choice/employment decision. An important contribution to this literature is Fordham and Ogbu (1986). They advance the "oppositional culture" hypothesis to explain the low educational performance of African American students. They claim that African American students view school education as part of white norms from which they wish to disassociate themselves. Any black student striving to excel in school is viewed as "acting white". This line of thought has also been pursued in economics by Austen-Smith and Fryer (2005) who model the phenomenon of "acting white" by allowing agents to signal their types to the job market as well as to their peers. Bloch and Rao (2001) show that in the presence of statistical discrimination, high productivity members of the minority group have an incentive to adopt the social behavior of the dominant group. Battu, Mwale and Zenou (2005) consider a model of employment and choice of identity, where members of minority groups can choose to downplay their identities and identify more with the mainstream culture and hence be more likely to be employed but at the cost of alienating themselves from their ethnic community. Selod and Zenou (2006) look at a search-matching model where agents use racial networks to find jobs. The probability of the job arriving also depends on the distance from job. Patacchini and Zenou (2006) look at school performance by blacks and whites. In their model, the school performance of all students turns out to be a function of the human capital (education) levels of parents as well as the average human capital of parents of friends. Their result is consistent with Borjas (1992) who finds that a child's human capital is totally determined by the parent's human capital as well as the average human capital of his ethnic community. Borjas (1992) also argues that if parents' human capital differs by ethnicity, this is likely to persist across several generations. Our results are consistent with Borjas (1992). However, we differ from the previous literature in that we simultaneously consider individual and group level determinants of educational investment. In this respect, our identification of a threshold size below which any ethnic group has all its members investing in human capital is new.

Our study also contributes to the literature linking religion to economic prosperity. Studies on this topic have mainly focused on the effect of Protestantism on economic growth, inspired by the Max Weber's theory that the Protestant work ethic was the main reason for which Protestant regions were more economically prosperous than Catholic regions in Europe.⁹ Sascha Becker and Ludger

⁹See, e.g., Barro and McCleary (2003, 2005), Blum and Dudley (2001), Guiso, Sapienza and Zingales (2003, 2006),

Woessmann (2009) propose a "human capital theory of Protestant economic history", arguing that because Martin Luther wanted Protestants to read the Bible by themselves, Protestants promoted universal schooling, which in turn generated the human capital needed for economic activities. The effect of Islam on human capital accumulation or growth has attracted less attention. Most of the few studies on this use cross-country data, and therefore cannot adequately separate the effect of religion from other country level factors that may affect outcomes. In contrast, we use household-level data that enable us to control for neighborhood fixed effects, allowing us to address endogeneity issues related to self-selection into certain areas or to the non-random supply of formal educational infrastructure.

By showing that inequalities in human capital accumulation across ethnic and religious groups in Nigeria are partially due to the fact that certain members of historically Muslim communities choose Koranic education as an alternative to formal education, we prove that these inequalities are also a consequence of differential historical exposure to Christianity and Islam during the colonial period. In this regard, our findings are consistent with studies on the historical origins of differences in cultures, norms, and economic outcomes (Guiso, Sapienza and Zingales (2008), Nunn (2009), Tabellini (2010), Nunn and Wantchekon (2011)).

Our paper is also related to the very large literature on conformity and the formation and persistence of identity, culture, and social norms.¹⁰ Akerlof and Kranton (2000) incorporate the psychology and sociology of identity into an economic model of behavior, and show that identity determines economic outcomes. In their model, identity is defined by "a person's self-image" and her assigned category, each category being characterized by a set of prescriptions and norms indicating the behavior to which individuals in the category should conform. Conforming to or deviating from her category-prescribed norms results in gains or losses in identity. The model sheds light on differences in school achievement across different categories of students. Bisin, Patacchini, Verdier and Zenou (2010) present a model of identity formation, where the identity of the child depends on the parents' socialization effort and on how assimilated the child is with the dominant outside culture. Munshi and Wilson (2010) look at the role of identity in mobility. As in our model, they allow people to choose between two forms of capital accumulation, and this choice determines the probability of social mobility. Bodenhorn and Ruebeck (2003) study the cost and benefits of adopting a mulatto or a black racial identity among the African-American population in the mid-nineteenth century.

Our assumption that ethnic groups play the role of social networks through which members may obtain information about job opportunities is consistent with empirical studies that have found social contacts to play an important role in labor market and other economic outcomes (Granovetter (1973, 1995), Fafchamps (2003)). Similar assumptions have motivated theoretical studies on the role of exogenous networks on employment and inequality (e.g., Calvó-Armengol and Jackson (2004, 2005), Montgomery (2001), Topa (2001), Zenou (2009)). Importantly, our empirical findings also corroborate this assumption, as the positive effects of community human capital on youth education are mostly

George Becker (1997), Glaeser and Sacerdote (2008), Goldin and Katz (2000), Glaeser and Glendon (1998).

¹⁰See, e.g., Bernheim (1994), Akerlof (1980), Glaeser and Scheinkman (2000), Kandel and Lazear (1992), Fershtman and Weiss (1998), Kandori (1992), Akerlof (1980), and Currarini, Jackson and Pin (2008).

confined within ethnic groups.

There are only a few empirical studies that have examined the effect of identity on education and employment, and most of them focus on the U.S., Canada and Europe (e.g., Fordham and Ogbu (1986), Ainsworth-Darell and Downey (1998), Fryer and Levitt (2004), Austen-Smith and Fryer (2005), Fryer and Torelli (2009), Constant and Zimmermann (2008), Battu and Zenou (2010), Pendakur and Pendakur (2005), Calvó-Armengol, Patacchini and Zenou (2009)). With a notable exception (Ainsworth-Darell and Downey (1998)), there is a large consensus in these literatures that identity matters in determining outcomes, with those who adopt an oppositional culture or those who do not integrate or assimilate with the majority culture lagging behind.

While our model contains some of the elements of all these other studies (e.g., peers effects, segregation, strategic complementarities, etc.), our analysis, scope and results differ in some important respects. Our main contribution consists of identifying important individual- and group-level determinants of human capital versus ethnic capital accumulation. First, our findings imply that group-level differences in human capital do not necessarily need to be explained by differences in initial attitude towards education or ability. In fact, two *ex ante* identical groups may end up diverging in average educational attainment (see prediction (T1-2)). The only default explanation for such a divergence is that the two groups are separated. Second, by treating different ethnic groups as separate local economies as in Lundberg and Startz (1998), we identify a threshold such that when the size of an ethnic group is smaller than the threshold, all its members will choose to invest in human capital (as opposed to ethnic capital). Importantly, this result implies that members of the same ethnic group who reside in different locations within a country are likely to differ with respect to how they accumulate human capital, with smaller subgroups faring better than larger subgroups. This result sheds light on the observation that second and subsequent generation migrants whose parents have left their region of origin to settle in another region within a country generally do better than their co-ethnics who have remained in their homeland. While this has usually been explained by the positive selectivity of migrants, our results suggest that the same outcome would obtain even if migrants do not differ from non-migrants in terms of ability distribution. Moreover, we find that an individual's attachment to an oppositional culture depends on his ability and on the average ability of the members of his ethnic community, and we test all these predictions empirically.

We also find theoretically and empirically that local ethnic fragmentation, by creating smaller groups, positively affects the demand for formal education. Given the essential role of human capital in the production of wealth in technologically advanced societies (Gary Becker (1962, 1964), Galor and Weil (2000), Acemoglu (2009), Mincer (1974)), our results imply that local ethnic fragmentation may have a positive effect on local economic growth by positively affecting the likelihood that individuals pursue formal education. Other studies have shown that ethnic fragmentation slows economic growth and negatively affects the supply of public goods (e.g., Easterly and Levine (1997), Miguel and Gugerty (2005), see Alesina and Ferrara (2005) and Costa and Kahn (2003) for a comprehensive review of literature). In general, these other studies postulate that different ethnic groups, for diverse reasons, find it difficult to cooperate in order to induce and/or enforce optimal economic policies. But the

evidence on this is mixed, as a recent study has shown that ethnic diversity is associated with positive economic growth in Africa (Cinyabuguma and Putterman (2011)). Also, using firm-level data, Ellison, Greenbaum and Mullin (2010) show that more heterogeneous offices in a firm enjoy less social goods such as cooperation and satisfaction, but perform better than those that are more homogeneous. By proposing a new mechanism through which ethnic fragmentation affects human capital "demand", we view our theoretical and empirical findings as complementary to the existing body of research, which, unlike our study, has essentially focused on the effect of ethnic fragmentation on the "supply" of public goods. To our knowledge, our study is the first to document theoretically and empirically the effect of ethnic fragmentation on the demand for schooling, while controlling for the supply of educational infrastructure.

3 The Model

3.1 Setup

A society is partitioned into C ethnic groups G_1, \dots, G_C .¹¹ Each ethnic group G_c ($c = 1, \dots, C$) is a local social interactions economy

$$G_c = (E_c, (U_i)_{i \in E_c}, (a_i)_{i \in E_c})$$

where E_c is the set of individuals belonging to the group, U_i the utility function of individual i , and a_i the ability level of i . For each $c = 1, \dots, C$, E_c is finite and we denote its cardinality by n_c .

A local economy G_c is therefore entirely defined by its exogenous features which are its group size, its utility profile, and its ability distribution. In what follows, we describe the characteristics of each individual in a group and the decision problem he faces.

In each group, each individual i is endowed with one unit of time that he invests in "ethnic capital", denoted by k_i^e , and "human capital", denoted by k_i^h . We therefore assume that investments in both types of capital are such that:

$$k_i^e + k_i^h = 1, \text{ with } k_i^e \geq 0 \text{ and } k_i^h \geq 0.$$

Human capital can be thought of as formal or mainstream education, whereas ethnic capital may be accumulated by attending religious schools run within the ethnic community or by spending time within the community.

We also assume that the benefit to an individual from investing in either form of capital is increasing in the total investment by his ethnic community in that form of capital. This assumption can be motivated by thinking that an individual is more likely to find a job in the sector in which he has invested if the number of the members of his ethnic group who have also invested in the same sector is

¹¹In this theoretical model, the phrase "ethnic group" designates a culturally homogeneous group such as a tribe or a religion. In the empirical section, we will distinguish between ethnicity and religion, the former referring to membership in a tribe.

higher. Indeed, if we think of an ethnic group as a network through which an individual gets jobs, then an individual's job search network is as strong as the number of other individuals of his community who choose to invest in the same form of capital as him. For each ethnic group G_c , we define total investment in ethnic capital and human capital by the variables E_c^e and E_c^h , respectively, where:

$$E_c^e = \sum_{i \in E_c} k_i^e$$

and

$$E_c^h = \sum_{i \in E_c} k_i^h.$$

Our assumption then translates into a utility function where the benefit from k_i^h (resp. k_i^e) is increasing in E_c^h (resp. E_c^e).

We further assume that the ability of each individual i is bounded below by 1: $a_i > 1$. Also, investing in human capital is more valuable for higher ability individuals.

All the variables defined above enter the utility function of each individual i as follows:

$$U_i = U(E_c^h, E_c^e, k_i^h, k_i^e, a_i)$$

As per our discussion above, the utility function has two main features. First, it exhibits a form of strategic complementarities between an individual and his ethnic group in that an individual's utility is positively affected by increased investment of his ethnic community in the form of capital in which he is more invested. Second, investing in human capital should be more valuable for high ability individuals. To capture these two features, we envision a natural utility function of the form:

$$U(E_c^h, E_c^e, k_i^h, k_i^e, a_i) = E_c^h * k_i^h + a_i * k_i^h + E_c^e * k_i^e.$$

Proposition 1 below states most of the important properties of this utility function.

Proposition 1 *Let $G_c = (E_c, (U_i)_{i \in E_c}, (a_i)_{i \in E_c})$ be a local economy where:*

$$U_i = U(k_i^h, k_i^e, a_i, E_c^h, E_c^e) = E_c^h * k_i^h + a_i * k_i^h + E_c^e * k_i^e.$$

We have the following properties:

P1. *If $E_c = \{i\}$, i will invest only in human capital no matter his ability.*

P2. *If $E_c^h \geq E_c^e$, then $\frac{\partial U}{\partial k_i^h} > 0$.*

P3. *If $E_c^h \leq E_c^e$, then $\frac{\partial U}{\partial k_i^h}$ will be negative for low levels of a_i but positive for high levels of a_i .*

P4. *The marginal benefits of total community investments are such that:*

$$\frac{\partial U}{\partial E_c^h} > 0 \text{ if } k_i^h \geq 1/2 \text{ and } \frac{\partial U}{\partial E_c^e} > 0 \text{ if } k_i^e \geq 1/2.$$

P5. *For any $k_i^h > 0$, $\frac{\partial U}{\partial a_i} > 0$.*

The proof of this proposition is in the appendix. Property (P1) says that if an ethnic group has only one member, this member is better off investing in human capital than in ethnic capital. Obviously, there are no benefits from networking in a one-person community, which implies that one is better off choosing the more lucrative form of investment which is human capital. Properties (P2)-(P4) describe a form of strategic complementarities between an individual and his ethnic group. Property (P2) says that if the majority of the community is invested in human capital, an individual's benefits are increasing in his investment in human capital as well. Indeed, given that most of his community is invested in human capital, his network in the skilled sector is stronger than in the unskilled sector. Hence, he is better off the more he invests in human capital. Property (P3) says that if the majority of the community is invested in ethnic capital, a member's utility is either decreasing or increasing in human capital depending on his ability. This property takes into account the ability of the person. Had ability not been a factor, we might have expected utility to be always decreasing in investments in human capital whenever the community is more invested in ethnic capital. This property allows for the possibility that high-ability individuals may still prefer human capital investments. Property (P4) says that if an individual is more invested in one form of capital, his utility is increasing in his ethnic community's total investment in that form of capital. This again highlights the network benefits. Property (P5) says that an individual's utility is increasing in ability as long as he invests any positive amount in human capital. This property is equivalent to saying that investing in human capital is less costly for higher-ability individuals.

In the next section, we state our main theoretical results and derive testable implications. It is important to note that these results are valid for an infinite class of utility functions and not just the utility function defined above. In fact, our results are valid for the class of utility functions satisfying properties (P1)-(P5) in Proposition 1. This class is infinite, as any positive affine transformation of the utility function defined above satisfies these properties. Some utility functions that may not be obtained by an affine transformation of our benchmark utility function satisfy these properties as well, such as the utility obtained by replacing a_i by $\sqrt{a_i}$.

3.2 Main Results

Each local economy G_c is a non-cooperative social interactions game. The concept of Nash equilibrium, defined below, therefore appears as a natural solution concept for this game.

Definition 1 *A Nash equilibrium for each economy G_c is a vector $K_h^* = (k_i^{h*})_{i \in E_c}$ of human capital choices such that for any individual i and alternative strategy $k_i^{h'}$, we have:*

$$U(k_i^{h*}, k_{-i}^{h*}, a_i) \geq U(k_i^{h'}, k_{-i}^{h*}, a_i)$$

where

$$\begin{aligned} U(k_i^{h*}, k_{-i}^{h*}, a_i) &= U(k_i^{h*}, E_c^{h*}, a_i) \text{ and} \\ U(k_i^{h'}, k_{-i}^{h*}, a_i) &= U(k_i^{h'}, E_c^{h*} - k_i^{h*} + k_i^{h'}, a_i) \end{aligned}$$

with

$$E_c^{h*} = \sum_{i \in E_c} k_i^{h*}.$$

A Nash equilibrium of the global economy (the economy consisting of all the local economies) is a vector whose components are the Nash equilibria of the local economies.

We now state our main results, which we prove in the appendix. Our first result says that if a group is small enough, its members will always choose to invest in human capital regardless of their ability. This follows intuitively, since small communities offer little network benefits; each member is therefore better off investing in human capital and being able to search in the more lucrative formal sector. This result is a generalization of property (P1) in Proposition 1.

Proposition 2 *There exists a threshold \underline{E} such that all the members of an ethnic community of size smaller than \underline{E} will choose to invest only in human capital in equilibrium, which means that $K_h^* = (1, \dots, 1)$.*

Our second result says that in large enough ethnic groups, high-ability members always fully invest in human capital regardless of the choices of the other members of the community. Intuitively, an individual of sufficiently high ability who invests in human capital always derives a higher utility level than if he invest a fraction of his time in ethnic capital.

Proposition 3 *A Nash equilibrium K_h^* is such that for an ethnic community E_c of size greater than \underline{E} , there exists a_c^* such that individuals with ability higher than a_c^* will always choose to invest in human capital.*

The next result states that in a large community, if the number of high-ability individuals is few, low-ability individuals will invest in the "same" form of capital, which could be ethnic capital or human capital. However, if the number of high-ability individuals is sufficiently large, the remaining members of the community, regardless of their ability, will choose to invest in human capital.

Proposition 4 *A Nash equilibrium K_h^* is such that for any ethnic community E_c of size greater than \underline{E} ,*

- *If the number of individuals with ability higher than a_c^* is not too large, the remaining individuals of the ethnic community will either choose to invest in human or ethnic capital.*
- *If the number of individuals with ability higher than a_c^* is large enough, the remaining individuals of the ethnic community will also choose to invest in human capital.*

Intuitively, this result is driven by the fact that low-ability members will not derive much benefit from ethnic capital if there are too few of them. Thus, when the number of high-ability members is large enough, given that these individuals always choose to invest in human capital (Proposition 3),

the remaining members of the community are better off investing in human capital as well. When the number of high-ability members is not too large, the low-ability members are always better off choosing the same form of investment because they care more about the network benefits.

The fourth result says that ethnic fragmentation positively affects the demand for human capital. This result follows from the fact that ethnic fragmentation results in smaller ethnic groups, and members of small ethnic groups are more likely to invest in human capital (Proposition 2), *ceteris paribus*.

Proposition 5 *Let $P = \{E_1, \dots, E_C\}$ and $P' = \{E'_1, \dots, E'_{C'}\}$ be two partitions of N where P' results from splitting one or more ethnic groups in P . Assume that the probability of the realization of each of the two equilibria of large groups is the same across these groups. Then, the average level of human capital accumulated is higher under P' than under P .*

3.3 Number of Nash Equilibria

We summarize the finding in Propositions 2-5 in terms of the number of Nash equilibria, and derive testable implications. In each local economy, the number of Nash equilibria is at least 1 and at most 2 depending on exogenous group characteristics which are size and ability distributions:

Summary 1 *The number of Nash equilibria in a local economy depends on its exogenous characteristics as follows:*

1. *If the group is small enough, all members invest in human capital (**1 equilibrium**).*
2. *If the group is large and rich enough in ability, all members invest in human capital (**1 equilibrium**).*
3. *If the group is large and poor in ability, there are **2 equilibria**:*
 - (a) *In one equilibrium, all members invest in human capital.*
 - (b) *In the other equilibrium, high-ability members invest in human capital and low-ability members invest in ethnic capital.*

3.4 Testable Implications

The summary of our findings in the previous section clearly shows that the demand for human capital by an individual is affected positively by his ability and his group's ability, and negatively by his group's size. Furthermore, the findings have implications for group inequality in human capital investment. We empirically test the following predictions of the model.

T1-1. Two groups which are not necessarily identical will converge in human capital accumulation if they are sufficiently small or if they are sufficiently rich in ability, *ceteris paribus*.

T1-2. Two groups which are identical in size and ability distribution may diverge in human capital accumulation. Such a divergence, however, would only occur among the low-ability members of both groups.

T2. Being a member of an ability-rich ethnic group positively affects the demand for human capital.

T3. Being in a smaller group positively affects the demand for human capital.

T4. Ethnic and group fragmentation increases the demand for human capital.

The first prediction (T1-1) comes from items (1) and (2) of Summary 1, according to which members of groups that are sufficiently small or rich in ability all invest in human capital. In this case, there is clearly no cross-group difference in human capital level. The second prediction (T1-2) derives directly from item (3) according to which there are two Nash equilibria if a group is sufficiently large and poor in ability. It implies that two *ex ante* identical groups may find themselves in different equilibria. The empirical implications are deep. Especially, it means that human capital group differences do not imply that one group is smarter than the other *ex ante*. It also means that in a multivariate regression of human capital on group identity, group differences may not disappear after all imaginable controls are included. However, when two groups differ in human capital investment, that divergence only occurs among the low-ability members of both groups. This is because the high-ability members of each group always invest in human capital regardless of group characteristics, so there is cross-group convergence among them. Our third prediction (T2) that members of groups that are rich in ability invest more in human capital regardless of their individual ability comes from item (2) of Summary 1. The fourth prediction (T3) that being in member of a smaller group increases the demand for human capital comes from item (1) of Summary 1. This prediction also implies that if an ethnic group is split by religion, then the smallest subgroup will invest more in human capital. Also, it implies that ethnic groups that are more spatially dispersed invest more in human capital than groups that are more concentrated, even holding ability distribution fixed. Our fifth testable prediction (T4) comes from the fact that ethnic fragmentation leads to smaller ethnic groups, and small groups invest more in human capital. In the next section, we will test each of these predictions of the model.

4 The Empirical Test

We test the predictions of the model using data from Nigeria, where ethnicity and religion have emerged as the two most important dimensions of identity. We do not have any evidence that the specific ethnic groups in the country promote or discourage formal education. However, religion is clearly a factor in the decision of certain individuals to acquire education. In the next section, we briefly document the historical role of Christianity and Islam in the spread of formal and religious education in Nigeria.

4.1 Religion and Education in Nigeria: A Historical Perspective on the Development of an Oppositional Culture

Islam was spread and consolidated in most of what later became northern Nigeria by the Jihad of Uthman Dan Fodio about 1804. Historical records show that the introduction of Islam was accompanied by the spread of its own form of holistic education (Fafunwa (1974), Ajidagba (1998)). Islamic education and Arabic learning were simultaneously taught in schools in the region. As a result of the political and social influence which Islam and Koranic learning conferred on those possessing it, many rulers employed Islamic scholars as administrators and Islamic education was supported by northern Nigerian leaders and Northern Region Ministry of Education. Unlike modern formal schools, Islamic schools operate with an open-ended structure that allows each student to pursue an individual course of study. There is no clear-cut division into primary, secondary and tertiary levels. There is no progression from one class to another and from one level to another, with examination barriers erected along the way. There are no age limits or rigid timetable with neatly timed periods for subjects (Umar (2003), Abdurrahman and Canham (1978)). Islamic knowledge is acquired through a master-disciple relationship sustained by face-to-face oral instructions that transmit spiritual guidance, moral authority, piety and blessing (Mohammed and Khan (1981)).

Despite the perception of great spiritual value, one obvious potential disadvantage of this educational curriculum is its focus on Arabic, which is not the language of literature, instruction and correspondence in Nigeria. Also, the transmission of spiritual and moral values is privileged over the acquisition of other forms of knowledge and skills that are valued in a market economy (Suleiman (1995), Sulaiman (2001), Okoye and Yau (1999)).

Western-type education was widely introduced in Nigeria following the arrival of Wesleyan Christian missionaries at Badagry in 1842. Although literary education in the 4Rs (reading, writing, arithmetic and religion) was predominant, this new missionary education prepared the recipients for new job opportunities, as teachers, church evangelists or pastors, clerks and interpreters. Emphasis was also placed on character training. Most of the missions established primary schools and, initially, little emphasis was given to secondary or tertiary education. But following pressure from influential church members, who were rich merchants and emigrants living in Lagos, the CMS Grammar School was established in 1857 in Lagos.

Western-type education spread more quickly in the south than in the north of Nigeria in part because of the skepticism of the Muslims with regards to the value of an education proposed by Christian missionaries. It is estimated that there were about 25,000 Koranic schools already in existence in northern Nigeria in 1914. Thus, the spread of western-style education met stiff opposition except among the indigenous peoples of the North Central geopolitical zone, where Christian missionaries did succeed in establishing schools, at times in collaboration with Government. Abdulkarim (2010) links the educational orientation of Muslim communities and their reluctance to embrace western-oriented education to the belief that it was not supportive of Islamic education, and possibly actively tried to destroy it. Consequently the phenomenon of educational dualism has been historically entrenched in Nigeria (Umar (2003)).

Several scholars have argued that Koranic schools in northern Nigeria are an alternative to formal education, and in fact represent an institutionalized resistance to it (see, e.g., Winters (1987), Koehl (1983), Urwick (1984)). Bray (1981) identified Kano State, the largest Hausa/Fulani state in Nigeria, as one of the states in which implementation of the 1976-1980 Universal Primary Education scheme encountered the most difficulty, owing to the strength of the "rival" tradition of Koranic education and to the low level of existing enrolment in "western-type" schools. A survey of 1,998 pastoral Fulani reported that about half (50%) had Koranic education, forty percent had no education, and only seven percent had either formal or both mainstream and Koranic education (Iro (2007)). In a 1993 nationwide survey, NISER (1997) recorded the widespread of Koranic education among ethnic groups in northern Nigeria generally, and notably among Hausa/Fulani/Kamuri. The data shows that 23.5% of the Hausa/Fulani/Kamuri children aged 5-24 attended Koranic schools and this proportion constitutes 95% of youth of that age group who attended such schools throughout the country.

Recent changes have given rise to new Islamic schools called the madrasa, some of which offer a modified national public school curriculum. Yet they differ in their fundamental institutional orientation. School administrators actively foster Islamic identity and awareness among students and teachers through congressional prayers, images of the Islamic world, and Islamic dress for females (Umar (2003)). While these features collectively create a distinctly Islamic atmosphere in these schools, it is the curricular emphasis on Arabic and Islamic Studies that really shape their Islamic character and orientation, and differentiate them from both the old Islamic educational institutions and Nigeria's public schools. Among other goals, madrasa curriculum aims to foster Islamic identity and consciousness with competencies in Arabic and Islamic studies to "equip students to orient their lives in accordance with Sharia" (Umar (2003)), whereas the national curriculum aims at "self-realization, better human relationship, individual and national efficiency, effective citizenship, national consciousness, national unity, as well as towards social, cultural, economic, political, scientific and technological progress" (Federal Government of Nigeria (1981)).

4.2 Data

This study utilizes a sample of 30,746 male and female individuals aged 5-24, pooled from the 1999 and 2003 Nigeria Demographic and Health Surveys. They are nationally representative, and were designed to provide representative estimates of population and health indicators for all regions and ethnic groups of the country. They used a two-stage probabilistic sampling technique to select clusters (or neighborhoods) at the first stage and households at the second stage. Clusters were selected from each State of the country. The surveys used household questionnaires to obtain information on members of a household, housing characteristics including living facilities, household composition, and place and region of residence. The individual questionnaires for males and females provided information on demographic, socioeconomic and cultural characteristics including gender, age, education, marital status, migration status, religion, and ethnicity.

The outcome variable we analyze is the number of years of education acquired. Our main independent variable is ethnicity (or membership in a tribe). The DHS data provided information on 113

ethnic groups. In this study, we borrow from the NISER (1997) classification and aggregate these groups into five major categories: the Hausa/Fulani/Kanuri of the core North, The Igbo of the South East, the Yoruba of the South West, The Isoko/Urhobo/Edo/Ijaw/Efik/Ibibio of the Niger-Delta region and the Tiv/Igala/Idoma/Gwari of the Central region, also known as the Middle-Belt. There was a mixture of other groups that do not fit into these core groups. This mixture is labeled in this study as "Other ethnicity". It is important to note that, except for the category "Other ethnicity", these groupings represent the best approximation of distinct cultural identities in Nigeria, mirroring geographical, economic, political and religious enclaves (NISER (1997)).

In order to explain cross-ethnic differences in educational attainment, we control for a range of individual, household and neighborhood level factors, the details of which are presented in Table 1. These factors are inspired by the vast literature on human capital, and they measure various inputs into education. Their levels are likely to vary across ethnic groups. The individual level variables are child gender, age and relationship to the household head. The inclusion of the latter variable could be explained by the fact that parents may tend to invest more in biological children, but kinship obligations vary across ethnic lines, and some ethnic groups may tend to differentiate less between biological and non-biological children. The household level factors controlled for are the characteristics of the household head (gender, age, education and religion), as well as household wealth per capita.¹² We also control for neighborhood fixed effect, therefore taking into account all community-level variables.

4.3 Empirical Results

4.3.1 Cross-Ethnic Differences in Educational Attainment: Convergence and Divergence

We test our first two predictions (T1-1) and (T1-2) regarding cross-ethnic differences in educational attainment. We use specifications of the form:

$$Educ_{ir} = Ethnicity_i \alpha + X\beta + \mu_r + \varepsilon_{ir} \quad (1)$$

where $Educ_{ir}$ is the number of years of education attained by a person i living in neighborhood r , and $Ethnicity_i$ a vector of ethnic groups (or tribes) including Hausa/Fulani/Kanuri, Igbo, Niger-Delta groups, Middle-Belt groups and "Other ethnicity". The Yoruba ethnic group is the reference group. X is a vector of variables including individual, household and neighborhood level variables; μ_r captures the neighborhood effect, and ε_{ir} is the individual random effect. α is the main parameter of interest. Because of differential supply of education across neighborhoods and the possible correlation between neighborhood and ethnicity (i.e. $E(\mu_r Ethnicity_i) \neq 0$), we estimate neighborhood fixed effects. This

¹²Household wealth is an asset-based index. It is constructed based on possession of assets such as the physical quality of the home (materials for roof, wall, and floor), means of personal transportation (bicycle, motorcycle, car), and household durables (radio, TV, video, electricity, piped water, etc.). We construct this index using the principal component analysis (Filmer and Pritchett (2001), Montgomery et al. (2000)). We then divide it by the number of household members.

ensures that the supply of education is similar for all individuals living in the same neighborhood and that α only estimates differences in the demand for education. Because ethnicity (or tribe), like race, is exogenous¹³, the estimate of α measures the causal effect of ethnic-related cultural factors on educational attainment. After controlling for a range of individual, household and neighborhood level characteristics, we argue that the remaining differences in educational attainment across ethnic groups is consistent with the existence of two equilibria as predicted by the theory. In one of these equilibria, low-ability children invest in ethnic capital, expressing attachment to an oppositional culture.

The results are presented in Table 2. We note substantial differences between groups. Column (I), which includes only the ethnicity dummies, shows that Igbo, Niger-Delta, Middle-Belt and Hausa/Fulani/Kanuri children lag behind their Yoruba counterparts by an average of 0.49, 0.42, 1.81 and 4.05 years of education, respectively. In subsequent columns (Columns (II)-(V)), we control for a range of factors to determine how much of these differences can be explained by the data. Column (II) controls for child characteristics including age, gender, and relationship with the household head, as well as a dummy indicator for the year 2003. We find that the relative disadvantage of Middle-Belt and Hausa/Fulani/Kanuri children over Yoruba children falls, whereas the advantage of the latter over other ethnic groups increases, although the coefficients do not differ much from those of Column (I). This indicates that cross-ethnic differences in educational achievement are unlikely to be explained by child factors.

In Column (III), we additionally control for household characteristics including the household head's age, gender, education and religion, as well as place of residence and household wealth. Controlling for parental education in particular is consistent with studies that have shown a causal impact of this variable on child education (see, e.g., Black, Devereux and Salvanes (2005)). The estimates show that the Hausa/Fulani/Kanuri children now lag behind the Yoruba children by only 1.6 years of education. When comparing this coefficient to that of Column (I), we estimate that over 60% of the education gap between the two groups can be explained by the relative socioeconomic disadvantage of the Hausa/Fulani/Kanuri children and by religious factors. We also note that the relative disadvantage of Middle-Belt children compared to their Yoruba counterparts decreases by almost 50%. However, the gap between the Yoruba and the other groups (Igbo, Niger-Delta) continues to grow. In Column (IV), we control for state fixed effects, but the differences do not disappear.

We now seek to determine whether the remaining differences could be explained by the supply of education, as this might vary across neighborhoods within a state. Since we do not have data on the supply of education, we control for neighborhood fixed effects (Column (V)), relying on the assumption that individuals residing within the same neighborhood likely enjoy access to the same educational infrastructure supplied by the federal government, the state or any other organization. We find that the advantage of Yoruba children over their counterparts from other ethnic groups declines in magnitude and statistical significance. Indeed, the Igbo and Niger-Delta children are no longer lagging behind (Column (V)). However, the Middle-Belt and Hausa/Fulani/Kanuri children are still trailing

¹³In the literature, ethnicity and race are always considered exogenous (e.g., Fryer and Levitt (2004)) because they are not choice variables. Membership in a tribe or a racial group is by birth.

their Yoruba counterparts by 0.65 and 0.96 years of education, respectively, strongly suggesting that a lower demand for (rather than a limited supply of) education explains the poor performance of the former.

As incentives to invest in education might vary by age, we try to understand whether cross-ethnic differences in educational achievement depend on child age. In Table 3, we replicate the analysis of Table 2 for four separate age groups: 5-9 (Panel A), 10-14 (Panel B), 15-19 (Panel C) and 20-24 (Panel D). Qualitatively, the findings do not differ much from those obtained in Table 2. In all age groups, the advantage of Yoruba children over the Igbo and the Niger-Delta disappears when all variables are controlled for (Columns (V)). Further, the relative disadvantage of the Middle-Belt children is only visible among the 10-14 and the 20-24 year olds. However, Hausa/Fulani/Kanuri children consistently lag behind, with their distance to the Yoruba increasing with age. We also note that the model fits the data pretty well, as it explains over 60 percent of the variation in the outcome (Columns (III)-(V)).

The results validate prediction (T1-1) on the possibility of ethnic groups converging in the average level of education. We note that convergence occur among the Yoruba, the Igbo and the Niger-Delta, and to a certain extent the Middle-Belt, which have comparable sizes. The diverging outcome of the Hausa/Fulani/Kanuri, which are much larger in size, is consistent with the existence of an equilibrium in which certain individuals in that group invest only in ethnic capital, as stated in (T1-2). Indeed, Figure 3 supports this view, as it shows that among the Hausa/Fulani/Kanuri, 23.5% of children have only a Koranic education, in stark contrast to the Igbo (0.1%), the Yoruba (0.4%), the Niger-Delta (0.4%) and the Middle-Belt (2.7%). We will also show next, to complete the test of prediction (T1-2), that cross-ethnic differences in educational investment are pronounced only among children of low ability.

4.3.2 Cross-Ethnic Differences in Educational Attainment are Concentrated in Low-Ability Individuals Only

In this section, we complete the test of prediction (T1-2) that cross-ethnic differences in education should be more pronounced among low-ability individuals due to the fact that high-ability children choose education over ethnic capital, regardless of the degree of adherence of their group to oppositional norms.

We proxy an individual's ability by the education of his household's head and by his household's wealth.¹⁴ The results are presented in Table 4. In Panel A, we regress education on ethnicity dummies controlling for all relevant factors (including neighborhood fixed effects) as in Column (V) of Table 2. In Column (I), we use the entire sample, but in subsequent columns, the analysis is restricted to individuals whose parents have no education (Column (II)), primary education (Column (III)),

¹⁴As noted in footnote 8, ability is hard to observe in practice. However, it has been argued that it can be proxied by parental education and wealth, as these factors predict children's IQ and cognitive and non-cognitive skills (Løken, Mogstad and Wiswall (2011), Currie (2009), Currie and Moretti (2003), Lundborg, Nilsson and Rooth (2012)). Some of these studies have demonstrated that these effects are causal, whereas others have argued that they might simply reflect the fact that parents and their offspring share common genes. In either case, parental education and wealth correctly proxy child ability.

secondary education (Column (IV)), and university education (Column (V)). We effectively find that cross-ethnic differences in years of education attained are concentrated among low-ability children. For instance, Hausa/Fulani/Kanuri individuals lag behind their Yoruba counterparts by 1.7 years of education when parents have no education, and by only 0.4 years of education when parents have a university education, with the latter effect being statistically insignificant. In general, cross-ethnic differences in educational attainment become economically smaller and in most cases lose their statistical significance as ability increases.

In Panel B, we replicate the analysis shown in Panel A for Muslim individuals only. This controls for common factors inherent in Islam, but at the same time, allows for the fact that adherence to Islamic norms and traditions may vary across ethnic groups in Nigeria. We find no significant cross-ethnic differences in years of education attained for individuals whose parents have at least a primary level education. But cross-ethnic differences are detectible only among individuals whose parents have no education.

In Panel C, we estimate cross-ethnic differences in educational attainment across quintiles of household wealth. We find huge ethnic inequalities only among poor children (those whose households fall in the first and second wealth quintiles), and in general decrease as household wealth increases. When we replicate this analysis for Muslim individuals only (Panel D), the results are even stronger.¹⁵

In general, our findings validate the prediction of the model that cross-ethnic differences in educational attainment are most likely to be very small among high-ability children, as they all choose human capital over social capital regardless of their ethnic community's adherence to oppositional norms. We note that our results are not driven by the differential supply of education across groups, as we control for neighborhood fixed effects. The findings clearly suggest that among the Hausa/Fulani/Kanuri, it is the low-ability children that invest only in Koranic education, whereas children of comparable ability in other ethnic groups invest in formal education, clearly showing the existence of two equilibria as stated in (T1-2).

4.3.3 The Number of High-Ability Individuals in a Group Positively Affects the Demand for Formal Education Regardless of own Ability

In this section, we test prediction (T2) that an individual who belongs to an ethnic group in which the number of high-ability individuals is large is more likely to choose human capital over ethnic capital, regardless of their own individual ability. We previously used parental education as one of the proxies for child ability. In the same vein, we proxy the number of high-ability individuals in an ethnic group by the proportion of adults (25 year old or older individuals) with at least a secondary or university level education in that group. As our observation units are individuals aged 5-24 years, using the education of those at least 25 years old to proxy for "group" ability guarantees a certain

¹⁵We observe that there are no Muslim Igbo in the 1st, 2nd and 3rd wealth quintiles. The fact that Muslim Igbo belong only to the richest quintiles is evidence supporting the proposition that when a distinct group is small in size, its members tend to do better than when they belong to a large group, perhaps knowing *ab-initio* that their own abilities will determine whether they succeed or perish as they will have little or no significant amount of the social capital which plays a crucial role in determining outcomes in a patronage-based society like Nigeria.

degree of exogeneity of our predictor. It also allows us to avoid the reflection problem as children do not influence the educational choices of adults, it is rather the contrary.

We estimate the following equation:

$$Educ_{ir} = GroupAbility_{ir}\alpha_1 + GroupAbility_{-ir}\alpha_2 + ability_i\alpha_3 + X\beta + \mu_r + \varepsilon_{ir} \quad (2)$$

where $GroupAbility_{ir}$ is the ability of individual i 's ethnic group in neighborhood r ; $GroupAbility_{-ir}$ is a vector of variables, each of which represents the ability of an ethnic group (to which i does not belong) in neighborhood r ; $ability_i$ is the ability of individual i (proxied by parental education and wealth); and X a range of other individual, household, and neighborhood characteristics. We estimate equation (2) using the entire sample first, and then the subsample representing each ethnic group.

Our first set of results is presented in Table 5. We compute the neighborhood share of adults with at least secondary school education in each ethnic group, and use the resulting variables to predict individual education. In each Column (I), we control for seven dichotomous indicators for the year 2003 and for whether an ethnic group is represented in a neighborhood. In each Column (II), we additionally control for parental education and wealth (which proxy child ability) and other relevant factors as listed in Column (IV) of Table 2.

When estimates are based on the entire sample, we find that the number of high-ability Igbo and Hausa/Fulani/Kanuri adult individuals increases children's education in general, while the number of high-ability Yoruba, Niger-Delta and Middle-Belt individuals has the opposite effect when all controls are included. We now restrict the analysis to each ethnic group. In general, the share of educated adults in an ethnic group has its largest positive effect on the education of children belonging to that ethnic group, and in some cases has a negative effect on other ethnic groups. For instance, a one-point increase in the share of educated Yoruba adults increases the education of Yoruba children by 1.7 years (Column (I)) and that of Hausa/Fulani/Kanuri children by 0.6 years, but has a negative (but statistically insignificant) effect on Igbo children. Similarly, a one-point increase in the share of educated Igbo increases education among the Igbo children by 3 years (Column (I)), but decreases education among the Hausa/Fulani/Kanuri children by 2.2 years, and has no effect on other ethnic groups. Likewise, a one-point increase in the share of educated Hausa/Fulani/Kanuri adults increases education by 5.2 years among Hausa/Fulani/Kanuri children, but has little effect on other children. When controls are introduced (Column (II)), these effects diminish, but do not qualitatively change the results.

The results do not change qualitatively if we proxy the number of high-ability individuals by the share of adults with a university level education (Table 6). We still see a strong network effect according to which the proportion of high-ability individuals in a group positively affects individual education in that group.

In general, the findings validate prediction (T2) of the model that an individual who belongs to an ethnic group with a large number of high-ability individuals is more likely to choose human capital over ethnic capital regardless of his own ability. Interestingly, we note that these effects are mostly confined within ethnic groups, as the proportion of high-ability individuals in a given ethnic group

has little impact on children belonging to other ethnic groups in general. This clearly shows that the effect of group ability on an individual's investment in human capital works through within-group peer effects (or contagion). However, our goal was not to test peer effects, as our theoretical prediction (T2) does not involve peer effects as a "primary" predictor of human capital investment, but it highlights the role of group ability instead.

4.3.4 Group Size and Cross-Ethnic Differences in Educational Attainment by Religion

In this section and the next two sections, we test prediction (T3) that being in a smaller ethnic group increases the demand for human capital. We do this in three different ways. First, we estimate cross-ethnic differences in educational attainment (using equation 1) for Christians and Muslims separately.¹⁶ We expect individuals to perform better when their religion is less represented in their ethnic group. In conducting this analysis, we also solve an interesting puzzle: if historically Christian communities are pro-schooling and Islamic communities are anti-western schooling, shouldn't the Yoruba, who are almost half Muslim, be doing worse than the predominantly Christian Igbo and Niger-Delta, or than the Middle-Belt who are only 36% Muslim? We believe that the answer to this question is found in the prediction of our model that small enough groups should do better than large groups (Proposition 2, Prediction (T3)), as members of small groups generate little network benefits from ethnic capital, and thus are better off investing in human capital.

We therefore estimate the effect of ethnicity on educational attainment for Christians and Muslims separately. The results are presented in Table 7. We find that, among Muslims, the Igbo and the Niger-Delta perform better than the Yoruba; the latter are not significantly different from the Middle-Belt, but they do much better than the Hausa/Fulani/Kanuri. This result largely validates the theory, as there are fewer Muslims among the Igbo (0.3%) and the Niger-Delta (2.4%) than among the Yoruba (46%) and the Middle-Belt (31%), and the latter groups have a relatively smaller Muslim population than do the Hausa/Fulani/Kanuri (99%). When comparing Christians, we find that the Yoruba achieve better than the Igbo, the Niger-Delta and the Middle-Belt, but are not significantly different from the Hausa/Fulani/Kanuri. These outcomes are again consistent with the theory.¹⁷ It follows from these analyses that the overall advantage of Yoruba children over the Igbo, the Niger-Delta and the Middle-Belt results from the advantage that the former have among Christians. Similarly, the overall advantage of the Yoruba over the Hausa/Fulani/Kanuri results from the advantage that the former have among Muslims. Also, the Yoruba are clearly the religiously most fragmented ethnic group, which, based on Proposition 5, sheds more light on their highest achievement.

¹⁶This test can also be conducted using a non-linear model where we regress education on ethnicity, religion and interaction terms between ethnicity and religion, controlling for all other relevant variables. But the coefficients on the interaction terms will be a bit more difficult to interpret.

¹⁷Note that although Christian communities have always been pro-schooling, a predominantly Christian ethnic group is certainly more cohesive, which is likely to foster the formation of ethnic-based associations and organizations in which members may invest a lot of their time. Such associations are known to abound in African societies, and their members hold meetings regularly.

4.3.5 Group Size and Cross-Religious Differences in Educational Attainment by Ethnicity: When do Muslims Lag Behind?

The second way to test prediction (T3) is to compare Christians and Muslims in the entire sample and in each ethnic group. We know from Table 2 that, overall, Christians have a higher educational attainment than Muslims. However, based on prediction (T3), we expect this to be true only in ethnic groups where Muslims represent a large share.

We estimate Christian-Muslim differences in educational attainment in the overall sample, and for each ethnic group using equation (1), but replacing ethnicity by a dummy indicator for whether an individual is a Muslim. The findings are presented in Table 8. We find that Muslims lag behind Christians by 1.2 years of education when no controls are added, and by 0.6 years when observable characteristics, including neighborhood fixed effects, are controlled for. However, Christians enjoy an advantage only among the Hausa/Fulani/Kanuri, the Yoruba, and the Middle-Belt, and Muslims perform better among the Igbo and the Niger-Delta. Thus, Muslims lag behind only when they constitute a fairly large population within a group, which is consistent with prediction (T3) of the model.

4.3.6 Smaller Group Size and Ethnic Fragmentation have Positive Effects on Formal Education Demand

The third way to test prediction (T3) that smaller ethnic groups invest more in education than their counterparts in larger groups is to estimate the effect of an individual’s group size in a neighborhood on his educational attainment. As we know, a corollary of (T3) is that local ethnic fragmentation should have a positive effect on the demand for education, which is prediction (T4). To test these two predictions, we estimate the following equation:

$$Educ_{irs} = GroupSize_{ir}\alpha_1 + ELF_r\alpha_2 + ethnicity_i\alpha_3 + X\beta + \mu_s + \varepsilon_{irs} \quad (3)$$

where $GroupSize_{ir}$ is the size of individual i ’s ethnic group in neighborhood r ; ELF_r is the Hirschman-Herfindahl index of ethno-linguistic fragmentation in neighborhood r ¹⁸; and μ_s is state fixed effect.¹⁹ We also control for ethnicity, and all the child, household and neighborhood characteristics included in Column (V) of Table 2. These variables are included incrementally.

To test (T3), we first compute the share of each individual’s ethnic group in the neighborhood in which he resides. A low value therefore indicates affiliation with a small ethnic group. We then regress education on the resulting variable, controlling for all other relevant variables. The findings are presented in Table 9. A one-point increase in the relative size of an individual’s ethnic group decreases his educational attainment by 1.5 years if other variables are not controlled for (Column (I)), by 1.2

¹⁸Let $P = \{E_1, \dots, E_C\}$ be the collection of ethnic groups in a neighborhood r . Denoting the size of an ethnic group E_c by n_c , the Hirschman-Herfindahl index of ethnic fragmentation for that neighborhood is given by:

$$ELF_r = 1 - \sum_{1 \leq c \leq C} \frac{n_c^2}{(n_1 + \dots + n_C)^2}$$

¹⁹Nigeria has 36 states, and each state can be viewed as a collection of neighborhoods. We control for state fixed effects (instead of neighborhood fixed effects as in the previous regressions) because ELF_r varies at the neighborhood level, and so controlling for neighborhood fixed effects would not allow us to estimate its effect.

years if we control for ethnicity (Column (II)), and by 0.2 years if we further control for all child and household characteristics (Column (III)) and state fixed effects (Column (IV)). All these effects are statistically significant at the 1% level, clearly validating (T3).

Finally, we test prediction (T4) that local ethnic fragmentation should have a positive effect on the demand for education. In Columns (V)-(VIII), we replicate the analysis in Columns (I)-(IV), now replacing the relative size of one's ethnic group by the usual index of ethno-linguistic fractionalization computed at the neighborhood level. We find that a one-point increase in that index increases individual education by 2.3 years when no other control is included (Column (V)), and by 0.5 years when controls are included (Column (VIII)). These effects are statistically significant at the 1% level.

Importantly, in Column (IX), we simultaneously control for the neighborhood share of one's ethnic group and ethnic fragmentation, along with all the other variables in Columns (IV) and (VIII). We now find that only ethnic fragmentation has a statistically significant effect, which simply implies, consistent with the theory, that the fact that ethnic fragmentation has a positive effect on the demand for education in Columns (V)-(VIII) is a corollary of the positive effect that being in a smaller group has on this outcome.

5 Conclusion

We study the effect of communitarianism—the tendency of people to organize into separate culturally homogeneous communities which act as closed networks—on individual and group inequality in human capital investment. Ethnic groups are exogenous in our analysis, but adherence to group values is endogenous, as is the decision to invest in human capital. We uncover important individual- and group-level determinants of educational attainment. An individual's demand for human capital is affected positively by his ability and his group's ability, and negatively by his group's size. The findings also imply that even if the distribution of ability is identical across all ethnic groups, these groups may still differ in average educational attainment, with divergence only occurring among their low-ability members, as high-ability individuals always invest in human capital. Moreover, the results show that ethnic and group fragmentation increases the "demand" for human capital. The mechanism is that fragmentation leads to smaller groups, and members of small groups invest more in human capital as they generate little benefits from ethnic capital.

We validate all these predictions of the model using nationally representative household data from Nigeria where tribal affiliation and religion are the primary sources of cultural identification. In particular, we document huge cross-ethnic and religious differences in educational attainment, and explain these differences by the fact that low-ability members of historically Muslim groups (i.e. Hausa/Fulani/Kanuri) choose Koranic education as an alternative to formal education. These findings also demonstrate the long-lasting impacts of differential historical exposure to Christianity and Islam on contemporary differences in educational attainment between ethnic groups in Nigeria. We do not argue that children in the worst-off groups are intrinsically of lower ability as compared to other children. We believe that such a claim would probably be wrong and completely misleading. In

theory, identical groups might achieve different outcomes, with the differences occurring only among their low-ability members, as we also show empirically. Furthermore, we document empirically the positive effect of ethnic fragmentation on the demand for schooling.

The positive effect of group fragmentation on the demand for human capital explains the highest success of the Yoruba, the most religiously fragmented group. The outcomes for Yoruba Muslims also offer a compelling illustration of the fact that an individual may belong to a social group without necessarily adhering to its core values when these are in opposition to mainstream values. Indeed, despite being 46% Muslim, only 0.4% of the Yoruba attend exclusively Koranic schools. In general, we empirically validate the theoretical prediction that members of smaller groups invest more in human capital. This also explains why despite the fact that Muslims lag behind Christians in general, their disadvantage is only apparent in ethnic groups in which they represent a fairly large share.

Our theoretical findings also answer a puzzle raised by John Ogbu (1978) who, reflecting on the educational attainment of African Americans, sought to understand why groups of people of the same ancestry but located in different regions or countries demonstrated different educational achievement. He argued that Black Americans could be partitioned into "voluntary minorities" and "involuntary minorities" (descendants of Blacks who came to the United States through slavery), and that the latter tended to adopt an oppositional attitude towards mainstream culture, including formal education. No such partition of minorities can be achieved in most countries. Yet, our findings show that members of the same ethnic group who are located in different regions of a country are likely to differ with respect to how they accumulate human capital, simply because smaller subgroups perform better than larger subgroups. This may explain why second and subsequent generation migrants whose parents have left their region of origin to settle in another region within a country generally do better than their co-ethnics who remain in their homeland. This will be the case even if the distribution of ability does not differ across the group that left and the one that did not.

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A Appendix: Proof of Propositions

- **Proof. of Proposition 1**

P1. If the individual is the only member of his group, his utility from investing completely in human capital will be:

$$U_i = 1 * 1 + 1 * a_i + 0 = 1 + a_i,$$

whereas his his utility from investing completely in ethnic capital will be:

$$U_i = 0 + 0 * a_i + 1 * 1 = 1$$

Since $a_i > 1$, he is always better off being invested in human capital.

P2. Rewriting the utility function in terms of the investment in human capital, we get:

$$U_i = \left(\sum_{i \in E_c} k_i^h + a_i \right) * k_i^h + \left(n_c - \sum_{i \in E_c} k_i^h \right) (1 - k_i^h).$$

Differentiating the utility function, we get:

$$\begin{aligned} \frac{\partial U_i}{\partial k_i^h} &= E_c^h + k_i^h + a_i - (n_c - E_c^h) - (1 - k_i^h) \\ &= E_c^h + a_i - (n_c - E_c^h) + k_i^h - (1 - k_i^h). \end{aligned}$$

Clearly, if $E_c^h \geq E_c^e$, then $E_c^h \geq n_c - E_c^h$, which implies that the above derivative is positive since $a_i > 1$.

P3. If $E_c^h \leq E_c^e$, using the results from the previous property, we know that $\frac{\partial U_i}{\partial k_i^h} > 0$ if and only if a_i is high enough, or if $a_i > (n_c - E_c^h) - E_c^h + (1 - k_i^h) - k_i^h$.

P4. Differentiating, we have:

$$\frac{\partial U_i}{\partial E_c^h} = k_i^h - (1 - k_i^h),$$

which is always positive if $k_i^h \geq 1/2$.

P5. Differentiating, we get:

$$\frac{\partial U_i}{\partial a_i} = k_i^h,$$

which is positive as long as the individual invests a positive amount in human capital. ■

The proofs of Propositions (2)-(4) are deduced from the following series of lemmas. The first lemma shows that individuals will invest fully in either form of capital, in other words, there will be no partial investments. Intuitively, suppose that the ethnic community of individual i is more invested in one form of capital, then we know that as he keeps transferring his investment to this form of capital, his utility grows. This individual will then compare the benefits from fully investing in ethnic capital versus fully investing in human capital. Lemma 2 shows that for any community size and for any

distribution of ability, there exists some ability threshold such that an individual whose ability level is above the threshold always invests in human capital regardless of the actions of the other members of his ethnic group. Lemma 3 shows that ethnic groups that are sufficiently small have all their members investing in human capital. Lemma 4 shows that in a large enough community, low-ability individuals choose to invest in the same form of capital if they are numerous.

Lemma 1 *In a Nash equilibrium, all individuals will choose to invest fully in either human or ethnic capital.*

Proof. This follows from **(P2)** - **(P3)**. Suppose we have a community E_c and an individual $i \in E_c$. First suppose that $E_c^h \geq E_c^e$ and $k_i^h < 1$. From assumption **(P2)**, we know that if individual i were to deviate to $k_i^h + \delta$, he would be strictly better off. Since, this is true for any level of $k_i^h \in [0, 1]$, we deduce that he will choose to fully invest in human capital.

Now suppose that $E_c^h \leq E_c^e$. In this case, we know from **(P3)** that utility is lowest when investment in ethnic capital is k^* . Hence, the optimal investment in ethnic capital is either 0 or 1. ■

Lemma 2 *In a Nash equilibrium, for each ethnic community E_c , there exists some ability level a_c^* such that any member i with ability $a_i > a_c^*$ chooses to invest only in human capital.*

Proof. We know from **(P3)** and **(P5)** that as an individual's ability increases, he benefits more from investing in human capital. Suppose that all the other members of the community invest in ethnic capital, then we know that there will be some ability threshold, say a_{c1} , such that members with ability above a_{c1} will choose to invest only in human capital. In other words, that a_{c1} is such that:

$$U(1, E_c - 1, 1, a_{c1}) \geq U(0, E_c, 0, a_{c1}),$$

with the inequality being strict for ability levels greater than a_{c1} . To be precise, suppose that the ability distribution in the community is $\{a_1, \dots, a_c\}$. Then, we can partition the community as follows $E_c = \{E_c(a_1), \dots, E_c(a_c)\}$ where $E_c(a_l)$ ($l = 1, \dots, c$) is the set of members with ability level equal to a_l . Moreover, if $a_{c1} \leq a_c$, then there might exist another equilibrium where all individuals with ability greater than a_{c2} and lower than a_{c1} such that $\sum_{y \geq a_{c2}} E_c(a_y) < \sum_{x < a_{c2}} E_c(a_x)$ choose to invest in human capital if the following holds:

$$U\left(\sum_{y \geq a_{c2}} E_c(a_y), \sum_{x < a_{c2}} E_c(a_x), 1, a_x \geq a_{c2}\right) \geq U\left(\sum_{y \geq a_{c2}} E_c(a_y) - 1, \sum_{x < a_{c2}} E_c(a_x) + 1, 0, a_x \geq a_{c2}\right)$$

and

$$U\left(\sum_{y \geq a_{c2}} E_c(a_y), \sum_{x < a_{c2}} E_c(a_x), 0, a_x < a_{c2}\right) \geq U\left(\sum_{y \geq a_{c2}} E_c(a_y) + 1, \sum_{x < a_{c2}} E_c(a_x) - 1, 1, a_x < a_{c2}\right)$$

■

Lemma 3 *In a Nash equilibrium, there exists a threshold size \underline{E} such that in any ethnic community with size below \underline{E} , each individual chooses to fully invest in human capital regardless of his ability.*

Proof. This follows mainly from **(P1)**, from which we know that in a single member community, the individual is better off choosing investment in human capital than in ethnic capital. \underline{E} is greater than or equal to 1. Now suppose that we increase the size of the community. Using **(P4)**, we know that if the rest of community invests in ethnic capital, but the individual invests in human capital, his utility will fall below the level of utility he would generate if he were the only member of the community. Similarly, using **(P4)**, we know that if the rest of community invests in ethnic capital, and the individual invests in ethnic capital too, his utility will increase above the utility level he would generate if he were the only member of the community. In short, the threshold size \underline{E} we are looking for solves:

$$U(1, \underline{E} - 1, 1, 0) \geq U(0, \underline{E}, 0, 0).$$

\underline{E} is such that if the size of a community is smaller than \underline{E} , even a lowest-ability member of that community will not find it beneficial to invest in ethnic capital even if all the other members of the community invest in ethnic capital. ■

Lemma 4 *In a Nash equilibrium, for any ethnic community E_c with size $E_c > \underline{E}$, all members who have ability higher than a_c^* choose to invest in human capital. Further, all members who have ability lower than a_c^* choose to invest in the same form of capital.*

Proof. Given Lemma 1, we know that all individuals will fully invest in either one of the capitals. We also know that if a larger number of individuals (besides an individual i) invest in one type of capital, it follows from **(P2)** and **(P3)** that individual i , if he has ability lower than a_c^* , will also prefer to invest in that form of capital. ■

Proof of Proposition 2

Proof. The proof follows immediately from Lemma 3. ■

Proof of Proposition 3

Proof. The proof follows immediately from Lemma 2. ■

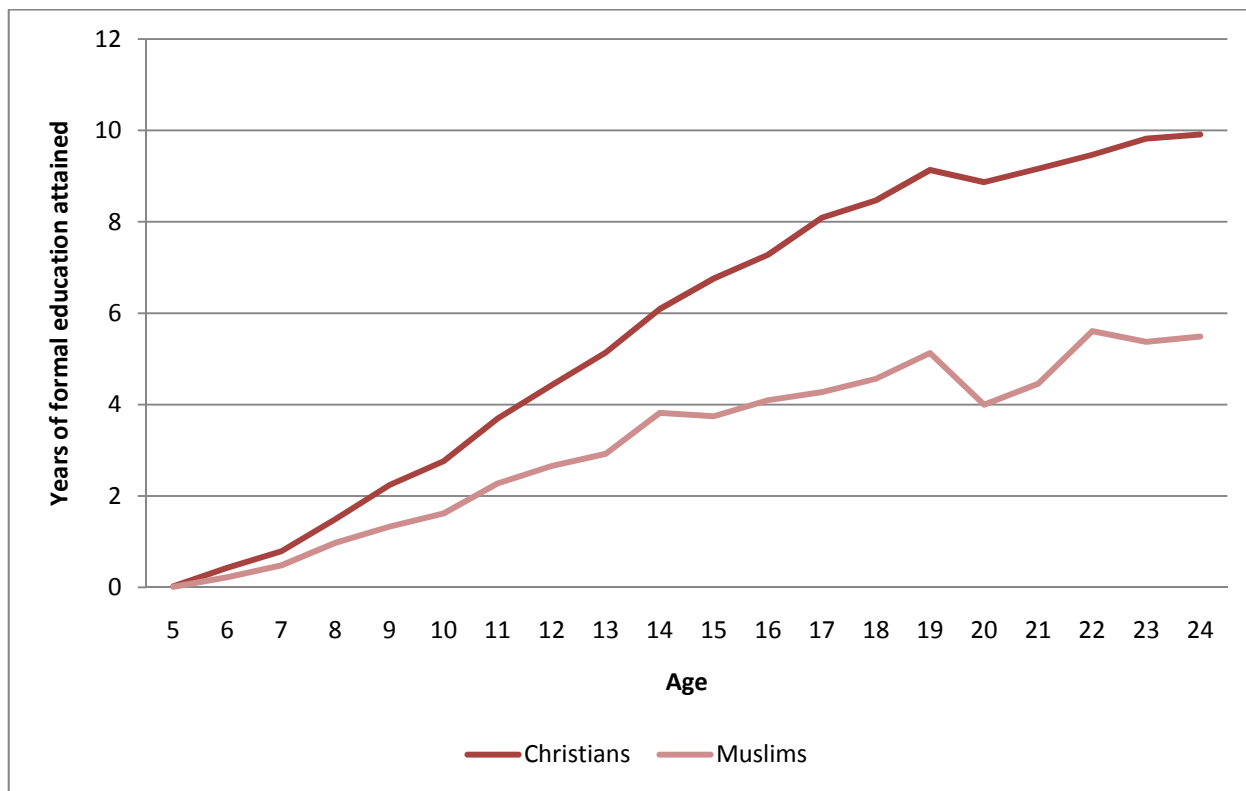
Proof of Proposition 4

Proof. The proof follows immediately from Lemma 2 and Lemma 4. ■

Proof of Proposition 5

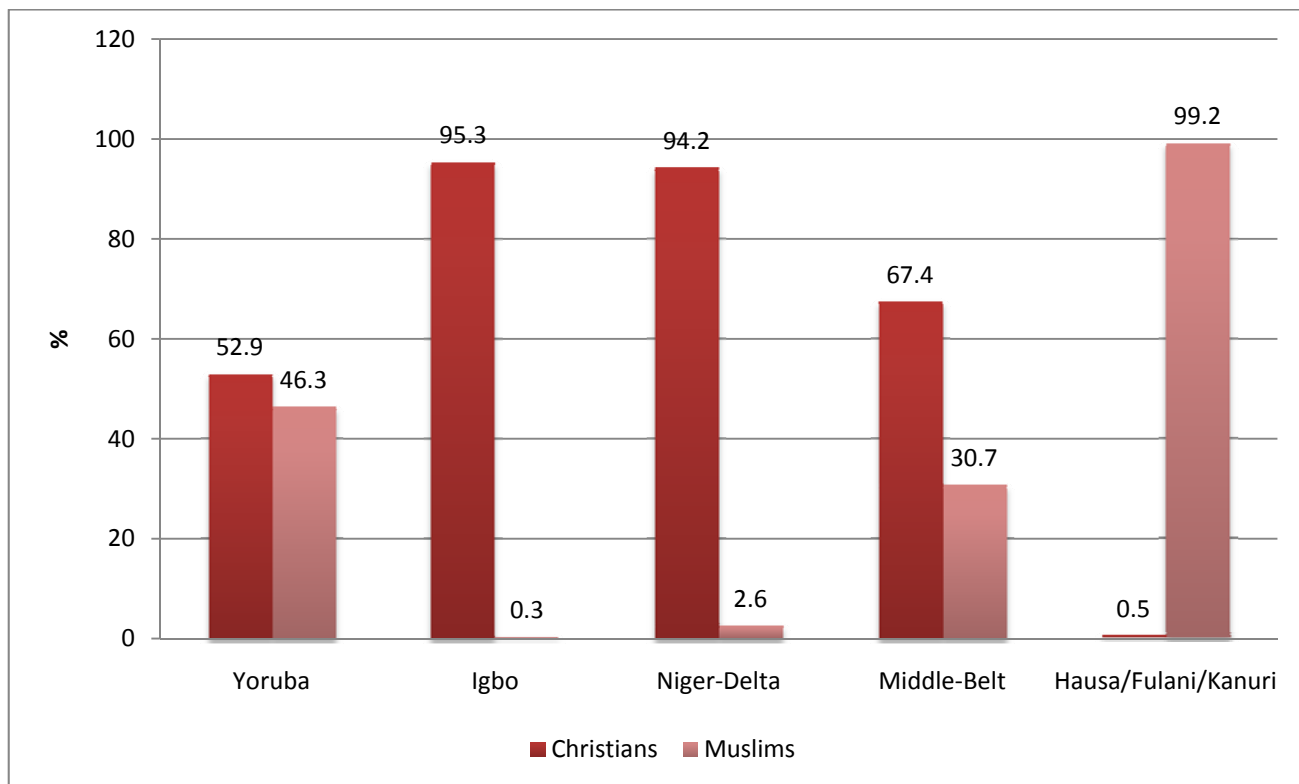
Proof. Under the assumption that the probability of the realization of each of the two equilibria of large groups is the same across these groups, the proof follows immediately from Proposition 2. ■

Figure 1: Average years of formal education acquired by age and religion



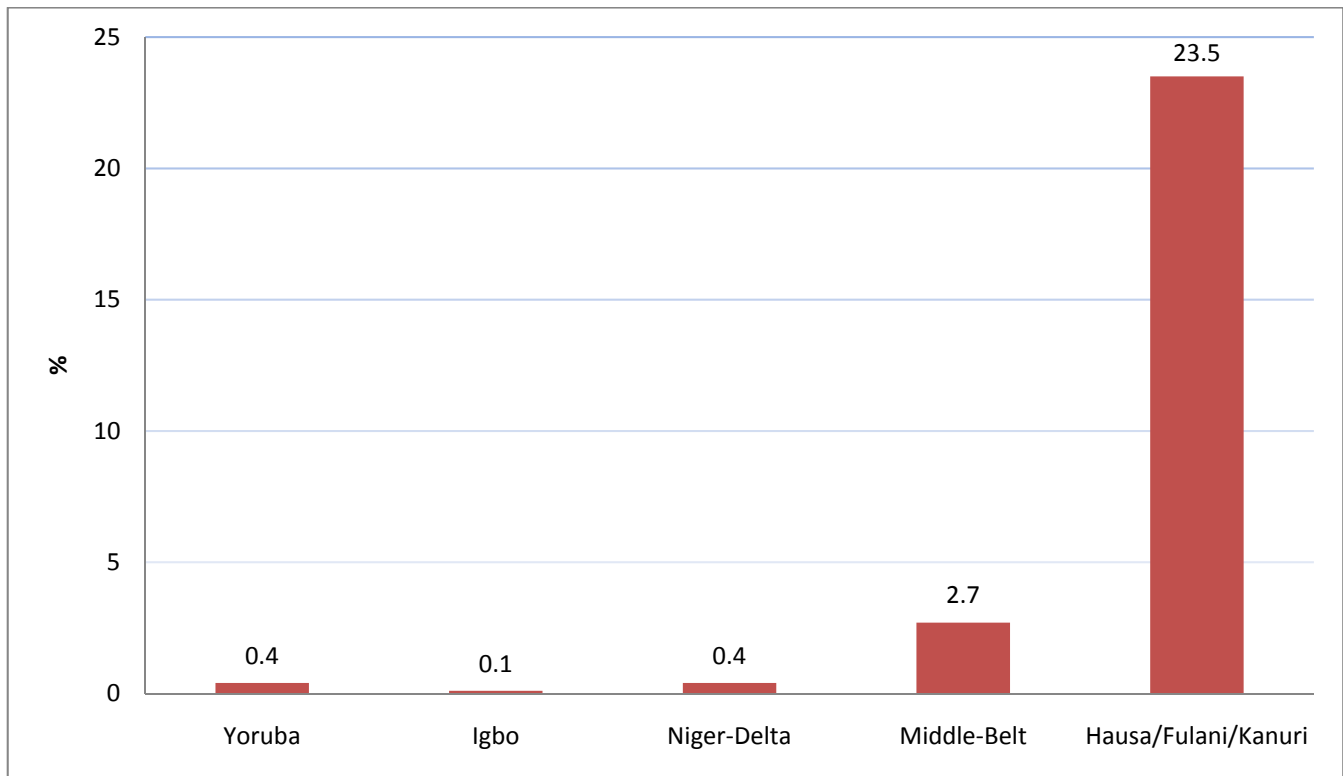
Data Source: Authors' estimates from the 1999 and 2003 Nigeria's Demographic and Health Surveys

Figure 2: Distribution of Christians and Muslims across ethnic groups in Nigeria, 5-24 year olds



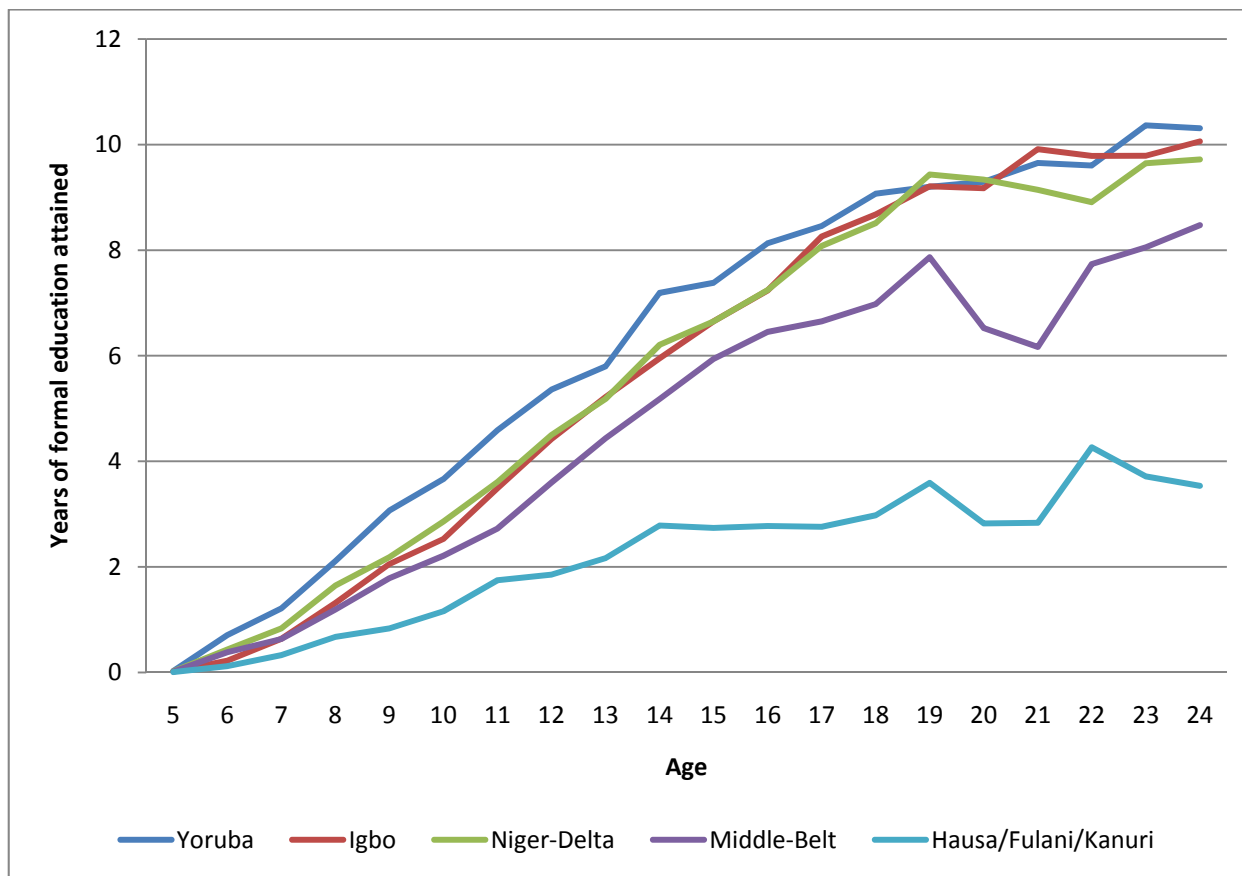
Data Source: Authors' estimates from the 1999 and 2003 Demographic and Health Surveys

Figure 3: Share of individuals 5-24 years old with only Koranic education by ethnicity



Data Source: Authors' estimates from the 1993 Nigeria Migration Survey (NISER (1997))

Figure 4: Average years of formal education acquired by age and ethnicity



Data Source: Authors' estimates from the 1999 and 2003 Demographic and Health Surveys

Table 1: Summary Statistics

| Variables | All | | Yoruba | | Igbo | | Niger-Delta | | Middle-Belt | | Hausa/Fulani/ Kanuri | | Other ethnicity | |
|---|--------|--------|--------|--------|--------|--------|-------------|--------|-------------|--------|-------------------------|--------|-----------------|--------|
| | Mean | S.D | Mean | S.D | Mean | S.D | Mean | S.D | Mean | S.D | Mean | S.D | Mean | S.D |
| Ethnic groups | | | | | | | | | | | | | | |
| Yoruba | 0.156 | 0.362 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Igbo | 0.157 | 0.364 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Niger-Delta | 0.102 | 0.303 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Middle-Belt | 0.084 | 0.278 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Hausa/Fulani/Kanuri | 0.281 | 0.449 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 |
| Other ethnicity | 0.220 | 0.414 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 0.000 |
| Religion | | | | | | | | | | | | | | |
| Christian | 0.516 | 0.500 | 0.529 | 0.499 | 0.953 | 0.212 | 0.942 | 0.234 | 0.674 | 0.469 | 0.005 | 0.070 | 0.590 | 0.492 |
| Muslim | 0.465 | 0.499 | 0.463 | 0.499 | 0.003 | 0.054 | 0.026 | 0.159 | 0.307 | 0.461 | 0.992 | 0.092 | 0.390 | 0.488 |
| Other religion | 0.019 | 0.135 | 0.008 | 0.090 | 0.044 | 0.206 | 0.032 | 0.176 | 0.019 | 0.138 | 0.004 | 0.060 | 0.020 | 0.141 |
| Child characteristics | | | | | | | | | | | | | | |
| Male | 0.488 | 0.500 | 0.506 | 0.500 | 0.476 | 0.499 | 0.505 | 0.500 | 0.485 | 0.500 | 0.476 | 0.499 | 0.492 | 0.500 |
| Age | 13.130 | 5.592 | 13.492 | 5.581 | 13.653 | 5.530 | 13.666 | 5.493 | 13.048 | 5.613 | 12.479 | 5.589 | 13.113 | 5.599 |
| Biological child of household head (HH) | 0.734 | 0.442 | 0.762 | 0.426 | 0.732 | 0.443 | 0.748 | 0.434 | 0.749 | 0.434 | 0.702 | 0.457 | 0.745 | 0.436 |
| Household characteristics | | | | | | | | | | | | | | |
| HH is male | 0.862 | 0.345 | 0.825 | 0.380 | 0.747 | 0.435 | 0.767 | 0.423 | 0.874 | 0.332 | 0.958 | 0.201 | 0.888 | 0.316 |
| HH's age | 47.527 | 13.769 | 50.536 | 14.245 | 48.833 | 13.070 | 48.272 | 13.897 | 48.027 | 14.295 | 44.599 | 13.021 | 47.666 | 13.895 |
| HH has no education | 0.373 | 0.484 | 0.284 | 0.451 | 0.218 | 0.413 | 0.156 | 0.363 | 0.308 | 0.462 | 0.617 | 0.486 | 0.360 | 0.480 |
| HH has Primary education | 0.284 | 0.451 | 0.261 | 0.439 | 0.391 | 0.488 | 0.356 | 0.479 | 0.313 | 0.464 | 0.200 | 0.400 | 0.289 | 0.453 |
| HH has Secondary education | 0.212 | 0.409 | 0.277 | 0.448 | 0.264 | 0.441 | 0.331 | 0.471 | 0.215 | 0.411 | 0.110 | 0.313 | 0.202 | 0.402 |
| HH has University education | 0.123 | 0.329 | 0.168 | 0.373 | 0.119 | 0.323 | 0.147 | 0.354 | 0.154 | 0.361 | 0.071 | 0.256 | 0.140 | 0.347 |
| Urban place of residence | 0.359 | 0.480 | 0.573 | 0.495 | 0.410 | 0.492 | 0.248 | 0.432 | 0.267 | 0.443 | 0.324 | 0.468 | 0.302 | 0.459 |
| Wealth | -0.002 | 1.855 | 0.970 | 1.754 | 0.534 | 1.862 | 0.478 | 1.787 | 0.021 | 1.685 | -0.684 | 1.709 | -0.432 | 1.709 |
| Year 1999 | 0.529 | 0.499 | 0.639 | 0.480 | 0.515 | 0.500 | 0.646 | 0.478 | 0.483 | 0.500 | 0.449 | 0.497 | 0.529 | 0.499 |
| Year 2003 | 0.471 | 0.499 | 0.361 | 0.480 | 0.485 | 0.500 | 0.354 | 0.478 | 0.517 | 0.500 | 0.551 | 0.497 | 0.471 | 0.499 |

Table 2: OLS, state and neighborhood fixed effect estimates of ethnicity on number of years of formal education among 5-24 year old individuals

| | (I) | (II) | (III) | (IV) | (V) |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| Igbo | -0.487 (0.079)** | -0.489 (0.058)** | -0.667 (0.057)** | -0.267 (0.099)** | -0.122 (0.119) |
| Niger-Delta | -0.419 (0.088)** | -0.497 (0.065)** | -0.673 (0.063)** | -0.286 (0.101)** | -0.158 (0.134) |
| Middle-Belt | -1.81 (0.094)** | -1.519 (0.069)** | -1.05 (0.064)** | -0.769 (0.096)** | -0.653 (0.139)** |
| Hausa/Fulani/Kanuri | -4.049 (0.070)** | -3.399 (0.051)** | -1.626 (0.055)** | -1.307 (0.097)** | -0.963 (0.121)** |
| Other ethnicity | -1.869 (0.073)** | -1.622 (0.053)** | -0.847 (0.051)** | -0.454 (0.082)** | -0.48 (0.104)** |
| Child age | | 0.713 (0.016)** | 0.65 (0.015)** | 0.645 (0.015)** | 0.642 (0.015)** |
| (Child age)^2 | | -0.008 (0.001)** | -0.006 (0.001)** | -0.006 (0.001)** | -0.006 (0.001)** |
| Biological child of household head (HH) | | 1.273 (0.039)** | 1.17 (0.039)** | 1.147 (0.039)** | 1.147 (0.039)** |
| Child is male | | 0.423 (0.033)** | 0.386 (0.030)** | 0.391 (0.030)** | 0.386 (0.029)** |
| Year 2003 | | 0.04 (0.033) | 0.021 (0.031) | 0.011 (0.031) | |
| Age of HH | | | 0.045 (0.006)** | 0.044 (0.006)** | 0.035 (0.006)** |
| (Age of HH)^2 | | | 0 (0.000)* | 0 (0.000)* | 0 (0.000) |
| HH is male | | | -0.972 (0.046)** | -0.919 (0.046)** | -0.775 (0.048)** |
| Muslim | | | -0.8 (0.044)** | -0.797 (0.048)** | -0.544 (0.060)** |
| HH has primary education | | | 0.571 (0.040)** | 0.529 (0.041)** | 0.345 (0.042)** |
| HH has secondary education | | | 1.186 (0.049)** | 1.082 (0.050)** | 0.835 (0.052)** |
| HH has university education | | | 1.662 (0.059)** | 1.62 (0.059)** | 1.317 (0.062)** |
| Urban | | | 0.171 (0.036)** | 0.22 (0.038)** | |
| Wealth | | | 0.373 (0.011)** | 0.331 (0.011)** | 0.242 (0.014)** |
| State fixed effect (FE) | NO | NO | NO | YES | |
| Neighborhood fixed effect (FE) | NO | NO | NO | NO | YES |
| Observations | 30746 | 30746 | 30746 | 30746 | 30746 |
| R-squared | 0.137 | 0.539 | 0.615 | 0.613 | 0.602 |

Standard errors in parentheses. In Column (V), Year 2003, Urban and State dummies are removed after neighborhood fixed effects are included because neighborhoods (or census tracts) sampled in 1999 are distinct from those sampled in 2003; similarly, in each year, no neighborhood simultaneously belongs to the urban area and to the rural area or to two states. Therefore, controlling for neighborhood fixed effects subsumes or entirely controls for each of the removed variables.

* significant at 5% level; ** significant at 1% level

Table 3: OLS, state and neighborhood fixed effect estimates of ethnicity on number of years of formal education by child age group

| | Panel A: 5-9 years old | | | | | Panel B: 10-14 years old | | | | |
|---------------------|--------------------------|---------------------|---------------------|---------------------|---------------------|--------------------------|---------------------|---------------------|---------------------|---------------------|
| | (I) | (II) | (III) | (IV) | (V) | (I) | (II) | (III) | (IV) | (V) |
| Igbo | -0.532 (0.046)** | -0.557 (0.040)** | -0.557 (0.042)** | -0.23 (0.073)** | -0.137 (0.093) | -0.897 (0.097)** | -0.915 (0.090)** | -1.137 (0.089)** | -0.6 (0.154)** | -0.316 (0.197) |
| Niger-Delta | -0.395 (0.052)** | -0.412 (0.045)** | -0.425 (0.047)** | -0.178 (0.076)* | -0.071 (0.106) | -0.796 (0.109)** | -0.81 (0.101)** | -1.014 (0.098)** | -0.697 (0.160)** | -0.402 (0.221) |
| Middle-Belt | -0.628 (0.053)** | -0.607 (0.046)** | -0.49 (0.046)** | -0.279 (0.069)** | -0.166 (0.101) | -1.587 (0.117)** | -1.635 (0.108)** | -1.41 (0.100)** | -1.107 (0.150)** | -0.795 (0.227)** |
| Hausa/Fulani/Kanuri | -1.052 (0.039)** | -0.966 (0.034)** | -0.616 (0.039)** | -0.476 (0.069)** | -0.434 (0.089)** | -3.364 (0.088)** | -3.273 (0.081)** | -2.006 (0.086)** | -1.649 (0.151)** | -1.006 (0.194)** |
| Other ethnicity | -0.659 (0.041)** | -0.648 (0.036)** | -0.454 (0.037)** | -0.29 (0.060)** | -0.289 (0.078)** | -1.841 (0.091)** | -1.812 (0.084)** | -1.274 (0.079)** | -0.894 (0.128)** | -0.749 (0.172)** |
| Observations | 10384 | 10384 | 10384 | 10384 | 10384 | 7947 | 7947 | 7947 | 7947 | 7947 |
| R-squared | 0.086 | 0.313 | 0.35 | 0.302 | 0.275 | 0.203 | 0.321 | 0.441 | 0.307 | 0.228 |
| | Panel C: 15-19 years old | | | | | Panel D: 20-24 years old | | | | |
| | (I) | (II) | (III) | (IV) | (V) | (I) | (II) | (III) | (IV) | (V) |
| Igbo | -0.377 (0.139)** | -0.391 (0.133)** | -0.696 (0.125)** | -0.274 (0.218) | -0.46 (0.262) | -0.159 (0.2) | -0.055 (0.191) | -0.279 (0.17) | -0.172 (0.289) | -0.415 (0.353) |
| Niger-Delta | -0.442 (0.154)** | -0.416 (0.148)** | -0.746 (0.137)** | -0.336 (0.213) | -0.505 (0.286) | -0.462 (0.226)* | -0.549 (0.216)* | -0.739 (0.191)** | -0.295 (0.3) | -0.187 (0.406) |
| Middle-Belt | -1.684 (0.177)** | -1.67 (0.169)** | -1.167 (0.149)** | -0.867 (0.217)** | -0.418 (0.322) | -2.715 (0.242)** | -2.363 (0.232)** | -1.227 (0.196)** | -0.851 (0.292)** | -1.387 (0.421)** |
| Hausa/Fulani/Kanuri | -5.534 (0.130)** | -5.124 (0.126)** | -2.578 (0.130)** | -2.158 (0.223)** | -1.24 (0.287)** | -6.62 (0.181)** | -5.871 (0.177)** | -2.472 (0.173)** | -1.884 (0.294)** | -1.74 (0.366)** |
| Other ethnicity | -2.153 (0.133)** | -2.074 (0.127)** | -1.106 (0.114)** | -0.496 (0.183)** | -0.836 (0.238)** | -2.387 (0.186)** | -2.191 (0.178)** | -0.836 (0.153)** | -0.137 (0.245) | -0.473 (0.312) |
| Observation | 6909 | 6909 | 6909 | 6909 | 6909 | 5506 | 5506 | 5506 | 5506 | 5506 |
| R-Squared | 0.279 | 0.341 | 0.503 | 0.311 | 0.165 | 0.276 | 0.338 | 0.547 | 0.371 | 0.188 |
| Controls | NO | YES | YES | YES | YES | NO | YES | YES | YES | YES |
| State FE | NO | NO | NO | YES | | NO | NO | NO | YES | |
| Neighborhood FE | NO | NO | NO | NO | YES | NO | NO | NO | NO | YES |

Standard errors in parentheses. Controls include child (Column (II)) and household (Columns (III)-(V)) characteristics as in Table 2.

*significant at 5% level; ** significant at 1% level

Table 4: OLS, state and neighborhood fixed effect estimates of ethnicity on number of years of formal education by parental SES (or child ability)

| | Panel A: Analysis restricted to children whose household head has: | | | | | Panel B: Analysis restricted to Muslim children whose household head has: | | | | |
|---------------------|--|--------------------------|--------------------------|--------------------------|--------------------------|---|--------------------------|--------------------------|--------------------------|--------------------------|
| | Any or no education | No education | Primary education | Secondary education | University education | Any or no education | No education | Primary education | Secondary education | University education |
| Igbo | -0.122 (0.119) | -1.577 (0.441)** | -0.545 (0.244)* | 0.252 (0.197) | -0.155 (0.25) | 0.99 (0.942) | 5.984 (2.415)* | 0.138 (2.464) | -0.354 (1.833) | 3.162 (2.163) |
| Niger-Delta | -0.158 (0.134) | -0.36 (0.406) | -0.161 (0.274) | 0.041 (0.219) | 0.018 (0.303) | 1.489 (0.537)** | 0.491 (0.788) | -0.219 (1.285) | 2.362 (1.445) | 0.057 (3.429) |
| Middle-Belt | -0.653 (0.139)** | -1.454 (0.351)** | -0.417 (0.261) | -0.507 (0.268) | -0.923 (0.300)** | -0.482 (0.294) | -1.389 (0.551)* | 0.095 (0.761) | -0.766 (0.88) | 0.094 (0.933) |
| Hausa/Fulani/Kanuri | -0.963 (0.121)** | -1.659 (0.292)** | -0.521 (0.255)* | -1.244 (0.259)** | -0.365 (0.296) | -0.724 (0.228)** | -1.512 (0.451)** | -0.424 (0.509) | -0.578 (0.610) | 0.579 (0.808) |
| Other ethnicity | -0.48 (0.104)** | -1.358 (0.278)** | -0.49 (0.203)* | -0.053 (0.191) | -0.555 (0.243)* | -0.42 (0.228) | -1.235 (0.444)** | -0.503 (0.491) | 0.709 (0.636) | -0.012 (0.844) |
| Observations | 30746 | 11474 | 8741 | 6525 | 3793 | 14304 | 7867 | 3158 | 2017 | 1194 |
| R-squared | 0.518 | 0.345 | 0.59 | 0.669 | 0.727 | 0.346 | 0.245 | 0.412 | 0.512 | 0.577 |
| | Panel C: Analysis restricted to children whose households fall into the following wealth quintile | | | | | Panel D: Analysis restricted to Muslim children whose households fall into the following wealth quintile | | | | |
| | 1 st quintile | 2 nd quintile | 3 rd quintile | 4 th quintile | 5 th quintile | 1 st quintile | 2 nd quintile | 3 rd quintile | 4 th quintile | 5 th quintile |
| Igbo | -1.84 (0.498)** | -1.179 (0.727) | 0.463 (0.444) | 0.015 (0.242) | -0.137 (0.154) | | | | 1.442 (2.171) | 1.185 (1.337) |
| Niger-Delta | -0.767 (0.469) | -0.81 (0.516) | -0.18 (0.463) | -0.255 (0.273) | 0.105 (0.185) | -1.621 (0.998) | 0.325 (1.461) | -0.932 (2.234) | 0.509 (1.191) | 2.582 (1.451) |
| Middle-Belt | -1.098 (0.562) | -1.126 (0.521)* | -0.05 (0.441) | -0.781 (0.273)** | -0.293 (0.211) | -2.785 (0.940)** | 0.71 (1.019) | 0.318 (0.913) | -1.108 (0.636) | 0.112 (0.645) |
| Hausa/Fulani/Kanuri | -1.621 (0.406)** | -1.321 (0.435)** | -0.923 (0.399)* | -0.989 (0.246)** | -0.696 (0.195)** | -3.114 (0.635)** | -0.73 (0.760) | -0.761 (0.782) | -1.002 (0.512) | -0.787 (0.413) |
| Other ethnicity | -1.221 (0.383)** | -0.891 (0.388)* | 0.147 (0.341) | -0.43 (0.209)* | -0.525 (0.160)** | -2.911 (0.631)** | -0.236 (0.727) | 0.191 (0.746) | -0.389 (0.517) | -1.126 (0.455)* |
| Observation | 7717 | 4278 | 5910 | 6610 | 6231 | 4611 | 2224 | 2596 | 2769 | 2104 |
| R-Squared | 0.301 | 0.444 | 0.507 | 0.64 | 0.73 | 0.152 | 0.291 | 0.327 | 0.509 | 0.613 |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Neighborhood FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |

Standard errors in parentheses. Controls include child and household characteristics as in Column (V) of Table 2.

* significant at 5% level; ** significant at 1% level

Table 5: OLS and fixed effect estimates of the effects of the neighborhood-level proportion of adults with at least a secondary level education on years of formal education by ethnic group, children 5-24 years old

| Analysis is restricted to children belonging to the following ethnic group: | | | | | | | | | | | | | | |
|---|------------------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|--------------|--------------|---------------------|--------------|-----------------|--------------|
| | Any ethnic group | | Yoruba | | Igbo | | Niger-Delta | | Middle-Belt | | Hausa/Fulani/Kanuri | | Other ethnicity | |
| | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) |
| % sec+ Yoruba | -0.015 | -0.065 | 1.697 | 0.312 | -0.946 | -0.515 | 0.34 | 0.175 | -0.044 | 0.398 | 0.561 | 0.581 | 0.479 | 0.019 |
| | (0.122) | (0.089) | (0.261)** | (0.185) | (0.582) | (0.333) | (0.652) | (0.475) | (0.602) | (0.472) | (0.197)** | (0.174)** | (0.282) | (0.209) |
| % sec+ Igbo | 0.359 | 0.391 | 0.109 | 0.034 | 3.004 | 0.736 | 0.298 | 0.562 | -0.356 | 0.52 | -2.246 | -1.199 | 0.04 | 0.323 |
| | (0.109)** | (0.083)** | (0.319) | (0.178) | (0.241)** | (0.173)** | (0.338) | (0.194)** | (0.335) | (0.290) | (0.430)** | (0.390)** | (0.296) | (0.222) |
| % sec+ Niger-Delta | 0.413 | -0.262 | 0.877 | 0.206 | -0.266 | -0.237 | 0.838 | 0.33 | 0.336 | -1.577 | -0.015 | -0.153 | -0.195 | -0.568 |
| | (0.130)** | (0.097)** | (0.279)** | (0.169) | (0.362) | (0.215) | (0.356)* | (0.248) | (0.740) | (0.644)* | (0.394) | (0.350) | (0.264) | (0.214)** |
| % sec+ Middle-Belt | 0.418 | -0.067 | 0.036 | -0.015 | -0.627 | -0.283 | 0.44 | -0.631 | 0.592 | 0.361 | 0.2 | -0.049 | -0.632 | -0.227 |
| | (0.129)** | (0.093) | (0.311) | (0.173) | (0.563) | (0.337) | (0.691) | (0.476) | (0.411) | (0.343) | (0.210) | (0.185) | (0.290)* | (0.218) |
| % sec+ Hausa/Fulani/Kanuri | 2.797 | 0.788 | 0.381 | -0.115 | 1.075 | 0.349 | -0.566 | -0.083 | 0.677 | 0.904 | 5.187 | 1.607 | 0.412 | 0.182 |
| | (0.130)** | (0.096)** | (0.428) | (0.251) | (0.551) | (0.310) | (0.780) | (0.488) | (0.433) | (0.322)** | (0.184)** | (0.204)** | (0.255) | (0.189) |
| % sec+ Other ethnicity | 1.289 | 0.436 | 0.414 | 0.113 | 1.225 | 0.372 | 0.594 | 0.355 | -0.336 | -0.353 | 0.69 | 0.417 | 3.834 | 1.069 |
| | (0.079)** | (0.057)** | (0.224) | (0.122) | (0.275)** | (0.153)* | (0.205)** | (0.122)** | (0.302) | (0.229) | (0.127)** | (0.114)** | (0.204)** | (0.181)** |
| Observations | 30746 | 30746 | 4782 | 4782 | 4836 | 4836 | 3144 | 3144 | 2587 | 2587 | 8639 | 8639 | 6758 | 6758 |
| R-squared | 0.164 | 0.556 | 0.037 | 0.725 | 0.064 | 0.742 | 0.039 | 0.715 | 0.064 | 0.565 | 0.157 | 0.368 | 0.112 | 0.559 |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| State FE | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES |

Standard errors in parentheses. % sec+ Yoruba, e.g., is the neighborhood level proportion of Yoruba aged 25 or older with at least a secondary level education. For each subsample, Column (I) includes 7 dummy indicators for the year 2003 and the presence of each ethnic group in a neighborhood; Column (II) additionally includes child and household characteristics as in Column (IV) of Table 2.

* significant at 5% level; ** significant at 1% level

Table 6: OLS and fixed effect estimates of the effects of the neighborhood-level proportion of adults with a university level education on years of formal education by ethnic group, children 5-24 years old

| Analysis is restricted to children belonging to the following ethnic group: | | | | | | | | | | | | | | |
|---|------------------|-----------|--------------|---------------|--------------|--------------|--------------|--------------|-------------|--------------|---------------------|--------------|-----------------|--------------|
| | Any ethnic group | | Yoruba | | Igbo | | Niger-Delta | | Middle-Belt | | Hausa/Fulani/Kanuri | | Other ethnicity | |
| | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) | (I) | (II) |
| % univ. Yoruba | 0.017 | -0.033 | 2.478 | -0.132 | 0.069 | 0.275 | -0.08 | -0.523 | -0.501 | -0.175 | 0.385 | 0.701 | 0.416 | -0.296 |
| | (0.117) | (0.088) | (0.356)** | (0.249) | (0.442) | (0.256) | (0.385) | (0.297) | (0.427) | (0.409) | (0.261) | (0.223)** | (0.264) | (0.205) |
| % univ. Igbo | 0.704 | 0.105 | 0.416 | 0.128 | 3.257 | 0.617 | 0.421 | 1.099 | -0.322 | 0.635 | -1.69 | -0.263 | -0.101 | -0.371 |
| | (0.142)** | (0.100) | (0.347) | (0.193) | (0.377)** | (0.249)* | (0.523) | (0.333)** | (0.686) | (0.540) | (0.284)** | (0.244) | (0.311) | (0.225) |
| % univ. Niger-Delta | -0.165 | -0.384 | 0.425 | 0.198 | -1.432 | -0.402 | 2.515 | 0.838 | -1.493 | -1.889 | -1.27 | -1.436 | -0.205 | -0.261 |
| | (0.152) | (0.109)** | (0.311) | (0.174) | (0.377)** | (0.208) | (0.525)** | (0.352)* | (0.979) | (0.866)* | (0.563)* | (0.533)** | (0.309) | (0.242) |
| % univ. Middle-Belt | 0.306 | 0.104 | -0.312 | 0.152 | -0.493 | -0.185 | 0.496 | 0.247 | 1.51 | 0.965 | 0.178 | 0.107 | -1.06 | -0.327 |
| | (0.139)* | (0.099) | (0.380) | (0.220) | (0.504) | (0.299) | (0.664) | (0.489) | (0.440)** | (0.419)* | (0.208) | (0.187) | (0.335)** | (0.246) |
| % univ. Hausa/Fulani/Kanuri | 2.324 | 0.622 | 0.5 | 0.212 | 1.118 | 0.513 | -0.131 | -0.01 | 0.561 | 1.516 | 7.145 | 1.767 | -0.427 | -0.68 |
| | (0.199)** | (0.140)** | (0.819) | (0.501) | (0.751) | (0.412) | (0.916) | (0.540) | (0.734) | (0.622)* | (0.323)** | (0.323)** | (0.332) | (0.241)** |
| % univ. Other ethnicity | 1.369 | 0.521 | -0.24 | 0.04 | 0.696 | 0.25 | 1.024 | 0.252 | -0.86 | -0.139 | 0.996 | 0.778 | 4.714 | 1.415 |
| | (0.107)** | (0.075)** | (0.394) | (0.222) | (0.364) | (0.204) | (0.240)** | (0.141) | (0.288)** | (0.226) | (0.201)** | (0.177)** | (0.285)** | (0.239)** |
| Observations | 30746 | 30746 | 4782 | 4782 | 4836 | 4836 | 3144 | 3144 | 2587 | 2587 | 8639 | 8639 | 6758 | 6758 |
| R-squared | 0.152 | 0.555 | 0.036 | 0.725 | 0.044 | 0.741 | 0.045 | 0.714 | 0.068 | 0.564 | 0.127 | 0.367 | 0.099 | 0.559 |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| State FE | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES |

Standard errors in parentheses. % univ. Yoruba, e.g., is the neighborhood level proportion of Yoruba aged 25 or older with a university level education. For each subsample, Column (I) includes 7 dummy indicators for the year 2003 and the presence of each ethnic group in a neighborhood; Column (II) additionally includes child and household characteristics as in Column (IV) of Table 2.

* significant at 5% level; ** significant at 1% level

Table 7: OLS and neighborhood fixed effect estimates of ethnicity on number of years of formal education by religion

| | Muslims | | Christians | |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (I) | (II) | (III) | (IV) |
| Igbo | 0.853 (1.162) | 0.99 (0.942) | -0.436 (0.214)* | -0.272 (0.118)* |
| Niger-Delta | 1.495 (0.661)* | 1.489 (0.537)** | -0.313 (0.239) | -0.296 (0.132)* |
| Middle-Belt | -0.608 (0.363) | -0.482 (0.294) | -1.115 (0.282)** | -0.703 (0.156)** |
| Hausa/Fulani/Kanuri | -1.234 (0.280)** | -0.724 (0.228)** | -0.493 (0.992) | -0.73 (0.547) |
| Other ethnicity | -0.79 (0.280)** | -0.42 (0.228) | -0.512 (0.211)* | -0.436 (0.116)** |
| Controls | NO | YES | NO | YES |
| Neighborhood FE | NO | YES | NO | YES |
| Observations | 14304 | 14304 | 15869 | 15869 |
| R-squared | 0.003 | 0.346 | 0.001 | 0.696 |

Standard errors in parentheses. Controls include child and household characteristics as in Column (V) of Table 2.

*significant at 5% level; ** significant at 1% level

Table 8: Cross-religious differences in years of formal education within each ethnic group

| | All sample | | Yoruba | | Igbo | | Niger-Delta | | Middle-Belt | | Hausa/Fulani/Kanuri | |
|-----------------|------------|-----------|-----------|-----------|---------|---------|-------------|---------|-------------|---------|---------------------|---------|
| | (I) | (II) | (III) | (IV) | (V) | (VI) | (VII) | (VIII) | (IX) | (X) | (XI) | (XII) |
| Muslim | -1.203 | -0.583 | -0.753 | -0.271 | -0.218 | 0.825 | -0.062 | 0.543 | -0.236 | -0.162 | -1.019 | -0.624 |
| | (0.083)** | (0.062)** | (0.149)** | (0.082)** | (1.183) | (0.603) | (0.753) | (0.406) | (0.287) | (0.196) | (0.492)* | (0.421) |
| Controls | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES |
| Neighborhood FE | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES |
| Observations | 30173 | 30173 | 4743 | 4743 | 4621 | 4621 | 3043 | 3043 | 2537 | 2537 | 8608 | 8608 |
| R-squared | 0.007 | 0.52 | 0.006 | 0.716 | 0 | 0.742 | 0 | 0.712 | 0 | 0.55 | 0.001 | 0.27 |

Standard errors in parentheses. Controls include child characteristics and household characteristics as in Column (V) of Table 2.

* significant at 5% level; ** significant at 1% level

Table 9: OLS and fixed effect estimates of the effects of ethnic group size and ethnic heterogeneity on years of formal education

| | (I) | (II) | (III) | (IV) | (V) | (VI) | (VII) | (VIII) | (IX) |
|---|----------------------------|----------------------------|----------------------------|----------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Neighborhood % of own ethnic group | -1.543 (0.090)** | -1.278 (0.085)** | -0.209 (0.060)** | -0.227 (0.067)** | | | | | -0.046 (0.097) |
| Neighborhood ethnic heterogeneity index | | | | | 2.304 (0.111)** | 2.098 (0.104)** | 0.314 (0.076)** | 0.458 (0.089)** | 0.503 (0.130)** |
| Igbo | | -0.494 (0.079)** | -0.678 (0.057)** | -0.351 (0.102)** | | -0.361 (0.079)** | -0.661 (0.057)** | -0.334 (0.099)** | -0.326 (0.102)** |
| Niger-Delta | | -0.453 (0.088)** | -0.691 (0.063)** | -0.342 (0.102)** | | -0.404 (0.088)** | -0.688 (0.063)** | -0.333 (0.101)** | -0.326 (0.102)** |
| Middle-Belt | | -1.874 (0.094)** | -1.072 (0.065)** | -0.812 (0.097)** | | -1.836 (0.094)** | -1.071 (0.065)** | -0.805 (0.096)** | -0.8 (0.097)** |
| Hausa/Fulani/Kanuri | | -4.014 (0.070)** | -1.629 (0.055)** | -1.338 (0.097)** | | -3.962 (0.070)** | -1.63 (0.055)** | -1.349 (0.097)** | -1.347 (0.097)** |
| Other ethnicity | | -1.994 (0.073)** | -0.881 (0.052)** | -0.504 (0.083)** | | -1.946 (0.073)** | -0.879 (0.051)** | -0.492 (0.082)** | -0.486 (0.084)** |
| Observations | 30746 | 30746 | 30746 | 30746 | 30746 | 30746 | 30746 | 30746 | 30746 |
| R-squared | 0.01 | 0.143 | 0.615 | 0.614 | 0.014 | 0.148 | 0.615 | 0.614 | 0.614 |
| Controls | NO | NO | YES | YES | NO | NO | YES | YES | YES |
| State FE | NO | NO | NO | YES | NO | NO | NO | YES | YES |

Standard errors in parentheses. Controls include child characteristics and household characteristics as in Column (IV) of Table 2.

* significant at 5% level; ** significant at 1% level