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ESSAYS ON INTERGENERATIONAL MOBILITY IN AFRICA

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ABSTRACT

This thesis seeks to provide an in-depth examination of intergenerational mobility in Africa. Examining intergenerational mobility and its underpinnings is of particular importance for Africa which, by 2020, was home to 8 of the 10 most unequal countries globally. We focus on the role of different historical institutional aspects in understanding and explaining trends and patterns in intergenerational mobility within selected African countries. The different institutions and relationships that we examine are (i) colonial administrative institutions and their implication for parental versus ethnic group based persistence (ii) precolonial ethnic group class systems and historical persistence (iii) political systems and human capital accumulation across different stages of development.

The thesis is comprised of six chapters. The first chapter provides a general introduction to the thesis. In the second chapter paper, we provide insight on how colonial administrative institutions and policies may have affected the evolution of intergenerational mobility in different parts of Africa through their effect on ethnicity. We focus on former British and French colonies and compare differences in intergenerational education persistence from parents to children to ethnic group based persistence. We use cross sectional secondary data for eight countries and apply both linear regression and interaction modelling regression techniques. Our results show high levels of parental and ethnic based persistence. We also find that persistence from parents to children is stronger in former French colonies while parental ethnic group-based persistence is stronger in former British colonies. Nevertheless, our birth cohort results show that the importance of ethnicity in the intergenerational mobility process has declined in former British colonies, while remaining comparatively static in former French colonies.

Precolonial characteristics such as ethnic group centralization and agricultural practices have been found to be relevant in explaining different aspects of economic development for Africa. In the third chapter, we explore whether intergenerational transmission of education within African countries also depends on precolonial and early colonial period ethnic group characteristics. In particular, we set out to examine whether differences in class stratification systems that existed within ethnic groups from that era are relevant for explaining social mobility. Estimates from an interaction linear regression model, using cross-sectional household survey data for six African countries, reveals differences in intergenerational persistence based on the historical class stratification system in which the various ethnic groups fall into. We find statistically significant differences in intergenerational persistence in three of the six countries. The findings from this paper challenges the notion of uniformity in institutional

lock in and support arguments that national level estimates mask significant differences in mobility between groups within the country.

The fourth chapter of this thesis examines taxes and intergenerational transmission of human capital when households are faced with a savings threshold that determines the ability to invest in children's education. We study human capital accumulation across different stages of economic development and show that rich households are more likely to invest in children's education than poor households at all stages. We find that the tax rate preferred by the poor is higher than that of the rich households and an application of the median voter theorem suggests that democratic settings may be a mode of accelerating social mobility and movements to higher stages of development through increased redistribution and public investment in education in the early stages. This then increases aggregate human capital and productivity in the economy, leading to a transition to a higher stage of development.

Chapter 5 provides policy implications that arise from the thesis while Chapter 6 concludes by providing a summary of the dissertation and suggesting future areas of research.

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DEDICATION

I thank my husband, Kampamba, and children, Felix and Abigail, for their patience and support during this PhD journey.

I also appreciate the encouragements and prayers from my mother, Patricia Namuchana, who has been a pillar of strength. Her support was immeasurable.

Finally, I dedicate this thesis to the memory of my late father, Wilford Joseph Funjika, and sister, Pumulo Funjika.

DECLARATION

This thesis is entirely my own work an acknowledgements have been made where other sources have been used. I declare that this thesis has not been previously submitted for the award of another degree at any university.

Candidate: Patricia Funjika

Signed: _____

Date: _____

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1

INTRODUCTION

One of the features notable about the current African landscape is the relatively high levels of inequality. The Gini index of income and consumption inequality shows that of the 10 most unequal countries globally, 8 of them are in SSA, with South Africa being the most unequal country in the world (World Bank, 2020). A body of research aimed at identifying drivers of inequality in Africa has since emerged. Amongst the identified determinants in the literature, which include goods market distortion, land distribution, political governance and ethnic horizontal and vertical inequality, inequality of opportunities has been found to play an important role in explaining persistence in inequality (Cornia, 2019; Shimeles and Nabassaga, 2018). Unequal opportunities lead to persistence in status across generations and have significant implications for social mobility levels within the different countries. Persistence of inequality because of unequal opportunities which result from family characteristics, such as race or parental background, necessitates the need for policies aimed at evening out the landscape (Behrman et al., 2001). This thesis focuses on intergenerational mobility in Africa, using education as the measure of mobility, and explores the relationship between institutions and inequality through consideration of precolonial (chapter 3), colonial (chapter 2), and post-colonial/contemporary political institutions (chapter 4).

The thesis focuses on different political institutions and their long term trajectories, adding to the emerging body of research that focuses on developing countries, Africa in particular. Notable recent contributions to this discourse include Acemoglu, Johnson, and Robinson (2001), Alesina, Giuliano, and Nunn (2013), Gennaioli and Rainer (2007), Michalopoulos and Papaioannou (2013), and Nunn (2009) and Alesina et al. (2021).

The first article provides insight on how colonial administrative institutions and policies may have affected the evolution of intergenerational mobility in Africa through their effect on ethnicity. We focus on former British and French colonies and compare differences in intergenerational education persistence from parents to children to ethnic group based persistence. In the second article, we explore the relationship between intergenerational transmission of education within African countries and historical (precolonial and early colonial period) ethnic group characteristics. In particular, we set out to examine whether differences in class stratification systems that existed within ethnic groups are relevant for contemporary social mobility. The third article studies human capital accumulation across different stages of economic development when households are faced with a savings threshold that determines the

ability to invest in children's education and links the discussion to political institutions. Taken together, these papers constitute an original contribution to the discourse on education intergenerational mobility in Africa.

Studies on intergenerational mobility are important as they provide a framework for understanding the association between the socio-economic standing of an individual's family of origin (as assessed when the individual is growing up), and the socio-economic standing of that same individual when she or he is an adult (Blanden, 2009). Strong linkages between parental status and socio-economic outcomes of children indicates that people born in disadvantaged circumstances have limited opportunities. In countries with high poverty levels, children from poor households may be unable to escape their start in life and poverty will be perpetuated across generations. This results in economic inefficiency as children from poor backgrounds are not able to contribute as much as they would if their full potential were realized, irrespective of their personal choices or efforts (Blanden, 2009; Nicoletti and Ermisch, 2007). If the circumstances into which an individual is born into play a role in their labour market outcomes as adults, then equality of opportunity, a key policy concern, has not been attained.

Traditionally, economists have studied intergenerational mobility by analysing incomes or education levels of parents and their children. Intergenerational mobility studies estimate the correlation between socio-economic status of parents and their offspring. A high correlation implies that people born in disadvantaged families have a smaller chance to occupy the highest socio-economic positions than people born in privileged families while a zero correlation implies a high degree of mobility and more equal opportunities (Nicoletti and Ermisch, 2007). Most African studies have focused on education as the measure of mobility for various reasons. Notably, education is more readily accessible and widely available compared to income, is easily comparable across generations, and is a more consistent measure across generations than the occupation. The literature also points to education as an important variable in determining an individual's income, occupation and wealth though the correlation to these variables for Africa is an area for empirical research (Blanden, 2009; Hertz et al., 2007; Solon, 1999).

Various studies on intergenerational mobility have been conducted, mainly focused on developed regions of the world, such as, Europe and North America.[1] Intergenerational mobility studies in developing countries and particularly sub-Saharan African countries, are sparse, with the exception of South Africa. Early contributions to the South African mobility literature was provided by Hertz (2001) who used data on co-resident fathers and sons in the Kwa Zulu Natal Income Dynamics Study (KIDS) to calculate the range of the intergenerational elasticity. Further evidence of education persistence across generations was presented by Finn, Leibbrandt, and Ranchhod (2017), Girdwood and Leibbrandt (2009), and Nimubona and Vencatachellum (2007). Piraino (2015) calculated the intergenerational earnings elasticity and inequality of opportunity index for South Africa and found high levels of earnings persistence between fathers and sons, comparable to other developing countries with high income

1 For surveys on existing studies see Black and Devereux (2010), Onuzo et al. (2013), and Solon (1999)

inequality. Kwenda, Ntuli, and Gwatidzo (2015) investigated trends in intergenerational transmission of education among black South Africans and found decreasing intergenerational transmission of education across the past four decades.

Cross-country comparisons of intergenerational mobility in Africa include the works of Alesina et al. (2021), Azomahou and Yitbarek (2020), Bossuroy and Cogneau (2013), and Hertz et al. (2007). Recent work by Alesina et al. (2021) examined intergenerational mobility in 23 African countries and found that investments in infrastructure during the colonial period and geographic features were strongly correlated to educational mobility. Additionally, they found high levels of heterogeneity in persistence both across and within countries, with rural areas having higher levels of persistence. An earlier study in intergenerational mobility in five African countries, by Cogneau and Mesplé-Somps (2008), found similar country-specific results – the two former British colonies (Ghana and Uganda) shared a much higher intergenerational educational and occupational mobility than the three former French colonies (Ivory Coast, Guinea, and Madagascar). Narayan et al. (2018) provide estimate of mobility for 148 countries globally, including Africa, and argue that higher public investment in education and better policies are crucial in increasing low levels of mobility in African and South Asian countries, host to the poorest people globally. We contribute to this strand of literature by providing an empirical and theoretical exposition of intergenerational mobility in Africa.

1.1 INTERGENERATIONAL MOBILITY IN AFRICA

Income intergenerational persistence in SSA is high though lower than Latin American and Middle Eastern countries. However, when compared to other regions of the world, SSA has the highest level of intergenerational persistence in education (see Table 1.1).

Table 1.1: Average Intergenerational Income and Education persistence rates, by Region

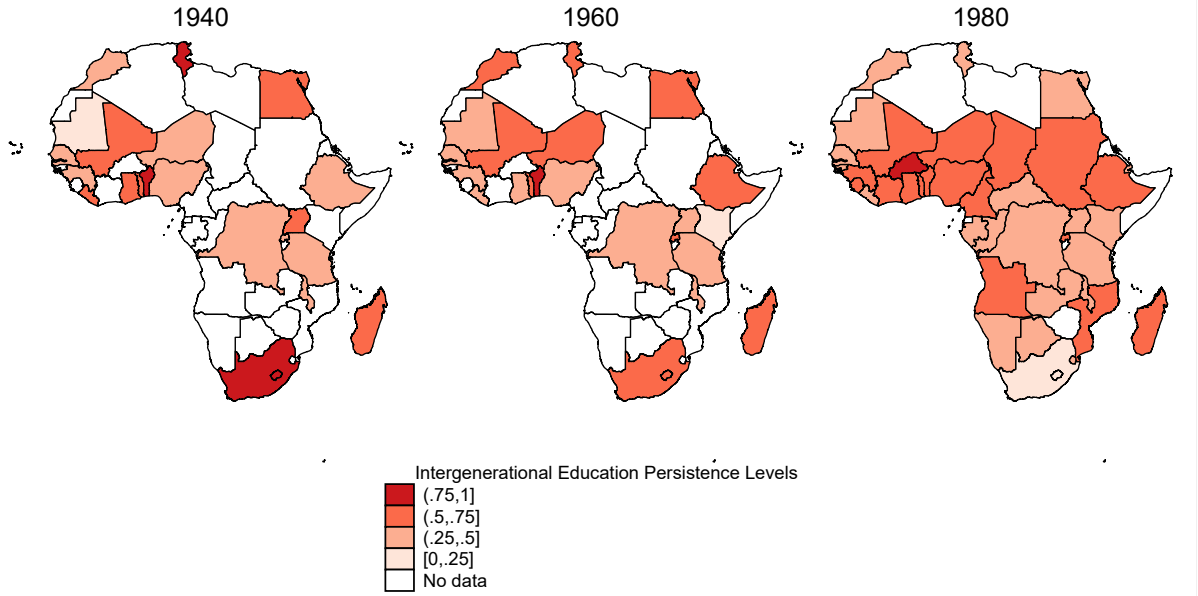
Region	Income IGP	Education IGP
East Asia and Pacific	0.50 (5)	0.37 (16)
Europe and Central Asia	0.47 (9)	0.43 (20)
High income	0.35 (31)	0.32 (36)
Latin America and Caribbean	0.90 (7)	0.43 (16)
Middle East and North Africa	0.82 (4)	0.39 (10)
South Asia	0.51 (4)	0.50 (8)
Sub-Saharan Africa	0.66 (14)	0.50 (41)

Notes: IGP - intergenerational persistence. Authors computation. Sample size in parentheses. MENA - Middle East and North Africa; SSA - Sub Saharan Africa. Source: GDIM (2018)

The average rate of persistence for SSA is marginally higher than South Asia, which also has high levels of persistence. In comparison, high income countries have the lowest rates of intergenerational persistence. Indeed an exploration of the evolution

of mobility in Africa using ten-year birth cohorts for those born in the 1940s, 1960s and 1980s shows differences in evolution in persistence between countries. For countries where there is data, Figure 1.1 shows unchanged persistence levels from the earliest cohort to those born in the latter cohort in most countries in West Africa while other regions have experienced a reduction. In essence, intergenerational education mobility has increased for some countries, such as South Africa and Egypt, while for countries such as Nigeria, Ghana and Togo, low levels of mobility persist.

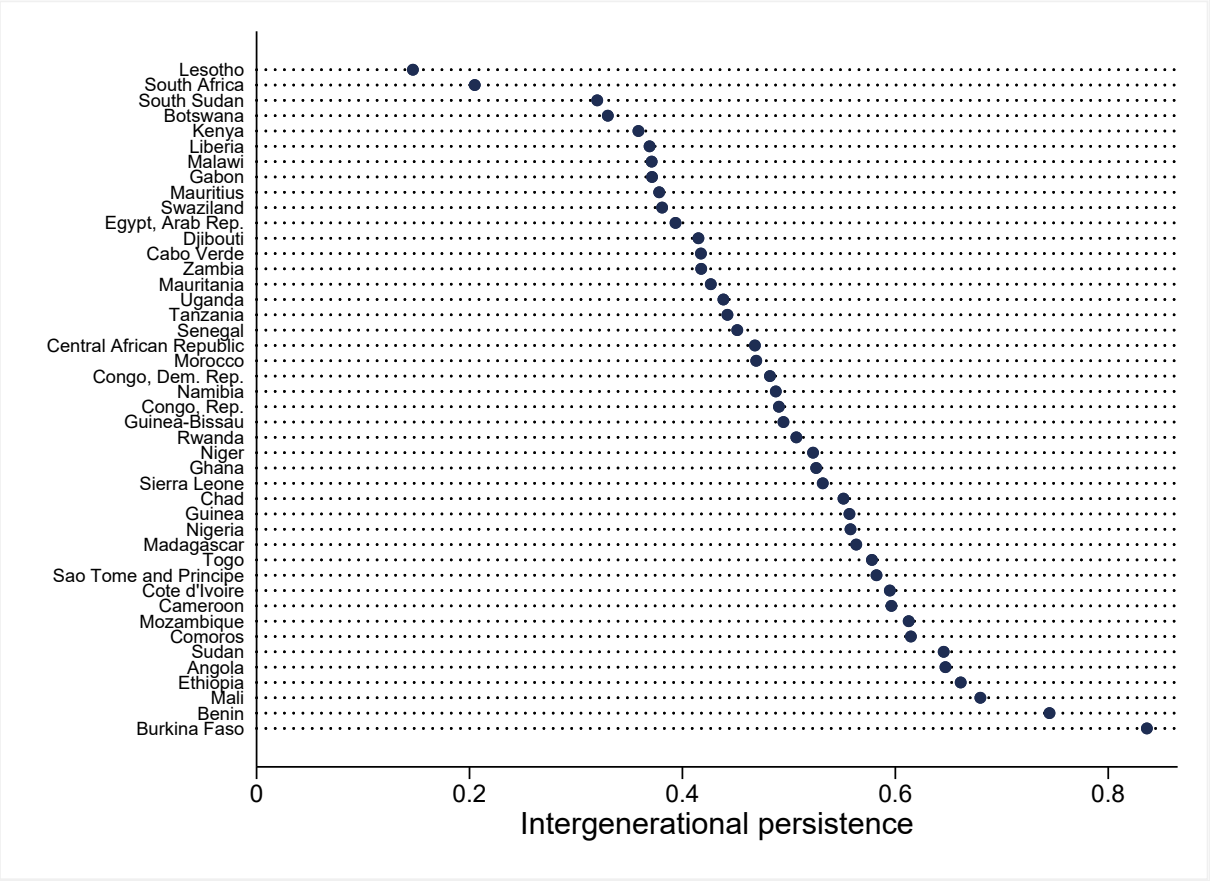
Figure 1.1: Evolution of Intergenerational Mobility in Africa - Birth Cohort Analysis



Notes: The figure illustrates education persistence levels for African countries, arranged in descending order. *Source*: Authors calculation based on data from GDIM (2018).

The observed heterogeneity underscores the need to understand the underlying factors and mechanisms at play which may be driving the differences in persistence between countries. As we can see in Figure 1.2, Lesotho and South Africa have much higher levels of mobility than other countries in Africa. At the tail end of the distribution are countries from West Africa, namely Mali, Benin and Burkina Faso. Over half of the countries in Africa have intergenerational education persistence of over 0.4 implying that unequal opportunities abound for their citizens and reducing poverty and inequality within these countries remains a challenge.

Figure 1.2: Estimates of Intergenerational Persistence of Education in Africa



Notes: The figure illustrates education persistence levels for African countries, arranged in descending order. *Source*: Authors calculation based on data from GDIM (2018).

The few studies that do exist on intergenerational mobility in Africa have put forward different reasons to explain the high levels of persistence. Factors identified include gender, race, credit market constraints, locality (rural versus urban), colonial transport infrastructure as well as weaknesses in the education system, particularly the availability and the quality of schooling (Alesina et al., 2021; Asiedu et al., 2021; Azomahou and Yitbarek, 2020; Burns and Keswell, 2012; Cogneau and Mesplé-Somps, 2008; Finn, Leibbrandt, and Ranchhod, 2017; Kwenda, Ntuli, and Gwatidzo, 2015; Nimubona and Vencatachellum, 2007; Piraino, 2015). There is even less information available on the mechanisms underlying the factors that lead to intergeneration poverty persistence and inequalities. This thesis aims to contribute to the literature in this regard by focusing on the role of historical institutions in explaining mobility in Africa.

Previous studies have identified differences in historically determined political and economic institutions as one of the key sources of development variations between countries. In particular, historical inequality associated with precolonial and colonial institutions have been found to be cardinal factors in understanding differences in economic performance, poverty and inequality between and within countries even long

after these institutions have ceased to exist (Acemoglu, Gallego, and Robinson, 2014; Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013; Mookherjee and Napel, 2007). Historical institutions and their impact on human capital development and growth are therefore an important area of research and must be undertaken for developing countries to understand reasons for persistence of poverty and inequality (Acemoglu, Gallego, and Robinson, 2014).

1.2 OVERVIEW OF CHAPTERS

In the first paper, we provide insight on how colonial administrative institutions and policies may have affected the evolution of intergenerational mobility in Africa through their effect on ethnicity. We focus on former British and French colonies and estimate differences in intergenerational mobility from parents to children and in ethnic group based persistence in education status. We contribute to the literature by estimating the effects of parental ethnicity on an individual's human capital skill level, underscoring the role of colonial origin in understanding intergenerational mobility in African countries. In the empirical analysis, I utilise cross sectional secondary data for eight countries using the Living Standards Measuring study (LSMS) surveys. Both linear regression and interaction modelling techniques are applied. Results obtained from the analysis demonstrate strong intergenerational persistence in human capital skill levels between individuals and the human capital of their parents' ethnic group (ethnic capital). Pool data using colonial identity as the grouping variable shows that persistence from parents to children is stronger in former French colonies while parental ethnic group-based persistence is stronger in former British colonies. Nevertheless, our birth cohort results show that the importance of ethnicity in the intergenerational mobility process has declined in former British colonies, while remaining comparatively static in former French colonies.

In the second paper, we explore whether differences in intergenerational transmission of education in Africa can be linked to precolonial and early colonial period ethnic group class stratification systems. To achieve this, we first use country level intergenerational mobility estimates from the World Bank, Global Database on Intergenerational Mobility (GDIM), to graphically observe patterns between intergenerational education persistence in African countries and historical class systems based on the dominant type of society in each country. Stylized facts from this graphical exploration indicates, amongst other factors, that geographic differences between regional blocs in Africa interplayed with colonial origin may play a role in determining whether historical ethnic characteristics can explain contemporary mobility. We then estimate a structural regression model using cross-sectional LSMS household survey data for Ghana, Guinea, Madagascar, Malawi, Niger and Nigeria. The model is first estimated individually for each country and then pooled and includes various fixed effects. To complement the regression results, standard mobility and transition matrices are also estimated. The regression results reveal differences in intergenerational persistence based on the historical class stratification system in which the various ethnic groups fall into. This difference is statistically significant in three of the six

countries, namely Ghana, Malawi and Madagascar. The results complements studies which have suggested that national level estimates may mask significant differences in mobility for African countries e.g. Alesina et al. (2021). Pooled regression results show that intergenerational persistence is higher in groups which were historically more fluid while there is lower persistence among the Dual (and Foreign) group, and points to the need to understand colonial and post-colonial policies which may have affected the mobility trajectories for different countries.

The third paper of this thesis sets out to examine intergenerational transmission of human capital when households are faced with a fixed educational cost threshold that determines the ability to invest in children's education. The paper develops a two period overlapping generations model with heterogeneous households and altruistic parents, with both public and private education. One of the crucial features of the model is the non-existence of a credit market for households to borrow for investment in offspring education. Hence human capital accumulation depends on only three input: parental altruism, parental investment and government expenditure. We derive the household education investment threshold and use numerical techniques to show that rich households are more likely to invest in children's education than poor households. Our model finds that the tax rate preferred by the poor is higher than that of the rich households and application of the median voter theorem suggests that public expenditure on education will be high if the proportion of poor households is high. This may act as a catalyst for social mobility as it increases access to better quality education for children from poor households, reducing intergenerational persistence in education, and increasing the level of aggregate human capital and productivity in the economy. This eventually leads the economy to move to another stage of development until eventually all households are able to invest in the children's education. We test the model's empirical implications using a constructed sample of 36,987 households from two Ghana Living Standards Surveys (GLSS). Ghana is selected because of comparable data availability over an extended period of time, and also because it is a stable democratic state in SSA with the two periods, 1992 and 2017, taken as representative of a generational change. Consumption expenditure quintiles are used to differentiate rich and poor households, in line with the model specifications. The results from the structural estimations show higher levels of mobility in rich households compared to poor households, indicating that the offspring of rich households are able to access more education opportunities and hence are more likely to invest in their children, in line with the model prediction. The results also show higher education persistence in poor households in the latter survey and increased variation in intergenerational persistence in education between rich and poor households. This may be reflective of the changing characteristics of the median voter and implies that democracy may have a more equalizing effect with regards to social mobility in the short run but more should be done to have long term equality between households.

1.3 THESIS LAYOUT

The remainder of the thesis is arranged as follows: Chapter 2 presents the first paper on colonial origin and intergenerational mobility. This is followed by Chapter 3 which discusses historic ethnic institutions and their relevance for contemporary intergenerational mobility in Africa. Chapter 4 presents a theoretical model on intergenerational transmission of human capital across different stages of development. Chapter 5 discusses policy implications that arise from the Chapters while Chapter 6 concludes the thesis and highlights future areas of research.

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2

COLONIAL ORIGIN, ETHNICITY AND INTERGENERATION MOBILITY IN AFRICA

ABSTRACT

This chapter examines the relationship between an individual's human capital and that of their parents' ethnic group in former British and French colonies in Africa. Using pooled cross-sectional data from eight African countries, four former French colonies (Cote d'Ivoire, Guinea, Madagascar, Niger) and four former British colonies (Ghana, Malawi, Nigeria, Uganda), we find large effects of parental ethnicity on individuals' human capital. Our results show that colonial origin may be important in understanding intergenerational mobility in African countries via its effect on ethnic relations. Ethnic capital has a persistent effect. This effect, which could be attributed to differences in administration styles adopted during the colonial period for the countries considered, is higher in former British than former French colonies. Birth cohort regression analysis further shows that the ethnic effect has declined across cohorts in former British colonies while remaining comparatively static in former French colonies. Our results are robust to the use of different estimation techniques.

Key words: Human Capital, Intergenerational Mobility, Colonial Origin, Africa.
JEL Classification: C21, I24, J62, N37

2.1 INTRODUCTION

Decades after the end of colonial rule in Africa, ethnic identity remains a source of contention within most of its nation-states. It is a salient factor that, particularly for Africa, has historically been linked to bouts of within-country resource competition, conflict, and strife. Ethnicity has also been used as a means of grouping individuals for political and socio-economic advantage, and its importance in understanding the African socio-economic landscape is unquestionable (Bates et al., 1972). Understanding the historical dimensions of the interrelationships between different ethnic groups is pertinent given that some African ethnic groups and the countries they reside in were the results of transformations that took place during episodes of foreign domination, slavery or as a result of specific colonial administrative policies (Stavenhagen, 1996). Colonialism, in particular, transformed the economy, altering the structures of economic opportunities and economic relations, and the implications for the current African economies are still to be fully understood (Horowitz, 1985; Nnoli, 1998).

This paper explores the relationship between colonialism, ethnicity, and intergenerational mobility in post-colonial African states. There has been a long-standing interest in intergenerational mobility studies as they provide a framework for understanding the association between individuals and the socio-economic standing of their family of origin. Strong intergenerational linkages imply that people born in disadvantaged circumstances have limited opportunities for success as adults. This means that in countries with high poverty levels, children from poor households cannot escape their start in life, and poverty perpetuates across generations. In recent years, there has been a shift in the focus of research on intergenerational mobility studies from the traditional child-parent regressions towards group-level analysis to reduce the downward biases associated with these studies (Adermon, Lindahl, and Palme, 2021; Clark, 2014; Clark and Cummins, 2015).

The current work focuses on the relationship between individuals' ethnic belonging and intergenerational mobility, using education as the measure of status in former British and French colonies. In line with Hertz et al. (2007), who argued that long-run differences in education persistence might have been initiated in the colonial past and related to schooling systems operating in the midst of ethnic divisions, we argue that socio-economic outcomes and intergenerational mobility in African states may have been altered by colonialism through its impact on ethnicity.[1] We posit that differences in administration styles adopted by colonialist masters, in particular the use of ranked (hierarchy-based ethnic group stratification) versus unranked (all ethnic groups seen on a horizontal scale) systems with respect to ethnic relations, may have contributed to

1 A body of research, which focuses on understanding how differences in contemporaneous living standards and development between countries, through institutional and historical events, has emerged in recent times (Acemoglu, Johnson, and Robinson, 2001; Bossuroy and Cogneau, 2013; Engerman and Sokoloff, 2005; Michalopoulos and Papaioannou, 2013, 2016; Nunn, 2008, 2009; Nunn and Wantchekon, 2011; Summerhill, 2010). This literature demonstrates the fundamental importance of taking into account past events to understand differences in institutional and long-term economic growth in developing countries.

differences in the intergenerational educational mobility outcomes observed in former British or French African colonies through their effect on ethnicity.[2]

We analyse pooled cross-sectional data from eight African countries, four former French colonies (Cote d'Ivoire, Guinea, Madagascar, Niger) and four former British colonies (Ghana, Malawi, Nigeria, Uganda). We develop a measure of ethnic capital (defined as the average education of the parental ethnic group) using the social and cultural definition of ethnicity and apply the framework to our household survey dataset of 122,374 observations. Using country fixed effects, we interact ethnic capital with colonial origin to determine differences in ethnic-based intergenerational persistence between former British and French colonies.

Results obtained from the analysis demonstrate strong intergenerational persistence in human capital skill levels between individuals and the human capital of their parents' ethnic group in all of the sample countries. We pool our country-level data based on the identity of colonial masters prior to independence, and our results show that persistence from parents to children is stronger in former French colonies while parental ethnic group-based persistence is stronger in former British colonies. Our birth cohort results show that the importance of ethnicity in the intergenerational mobility process has declined in the sampled countries. We find that persistence from parents to children has, in comparison, remained relatively unchanged in all the countries over the successive birth cohorts. Rural/ urban analysis also reveals that ethnic capital is higher in urban areas of former French colonies than British colonies for the countries included. Various robustness checks using alternative definitions of parental and ethnic capital, using only fathers' education as a proxy for parental education, and accounting for low parental education provide similar results.[3]

The intuition behind these results lies in differences in administration styles adopted by the two colonialist masters. The British colonial administrators used a divide-and-rule system with regards to relations with the ethnic groups, whereby the ethnic groups competed against each other for recognition by the colonial masters (Von Albertini and Wirz, 1982). This would have the effect of heightened ethnic consciousness and strengthening unity within the ethnic groups, leading to stronger ethnic ties and between ethnic group persistence. The French fostered a sense of nationalism in their colonies as the overarching goal. Hence, in these countries, a sense of patriotism rather than competition between the ethnic groups was fostered, which may explain why the influence of ethnic capital is relatively lower, though it is still an important factor for mobility there.

Our work closely relates to two strands of literature. Firstly, it relates to the literature that puts forward group-level effects (such as ethnicity, dynasty and surnames) to the centre of intergenerational mobility studies (Adermon, Lindahl, and Palme, 2021; Borjas, 1992, 2006; Borjas and Chiswick, 2019; Clark, 2014; Clark and Cummins, 2015).

2 Section 2.2 provides more discussion on these two systems of ethnic relations and their possible implications for the development trajectory of human capital accumulation.

3 We also check for the consistency of our results using the instrumental variables (IV) technique with religion-based historical and geographic instruments for ethnic capital. Specifically, we use missionary activity per region within a country as measured in 1923 by Roome (1925) and colonial period geographic variables. The discussion is presented in the appendix.

An early contributor to this genre was Borjas (1992). Using data from the United States, he showed that the socio-economic performance of workers depended not only on the human capital of their parents but also on the average skills of the ethnic group in the parents' generation (ethnic capital).[4] Clark (2014), and Clark and Cummins (2015) use rare surnames for studying intergenerational linkages measured by group-average outcomes. They argue that previous estimates of intergenerational persistence that use individual-level variables are substantially biased downward due to attenuation bias. Adermon, Lindahl, and Palme (2021) estimate long-run intergenerational persistence, using human capital information from extended family members of the Swedish data, and claim a very strong intergenerational persistence. We advance the literature by establishing the importance of parental ethnicity in understanding intergenerational persistence in Africa, exploring one of the historical dimensions that may explain why it varies between countries - colonial origin.

Our paper also adds to the emerging literature on African intergenerational mobility. Studies on African countries are scant, with the exception of South Africa for which numerous studies exist (Finn, Leibbrandt, and Ranchhod, 2017; Girdwood and Leibbrandt, 2009; Nimubona and Vencatachellum, 2007; Piraino, 2015).[5] An early contribution to the South African literature on intergenerational mobility came from Hertz (2001), who used data on co-resident fathers and sons in the Kwa Zulu-Natal Income Dynamics Study (KIDS) to calculate the range of intergenerational elasticity. Evidence of education persistence across generations, particularly among black South Africans, is presented by Case and Deaton (1999), Kwenda, Ntuli, and Gwatidzo (2015), Lam (1999), Nimubona and Vencatachellum (2007), and Thomas (1996). Piraino (2015) calculated the intergenerational earnings elasticity and inequality-of-opportunity index for South Africa and found high levels of persistence between the earnings of fathers and sons, with the estimates being comparable to other developing countries with high levels of income inequality.

Cross-country comparisons of intergenerational mobility in Africa include the works of Alesina et al. (2021), Azomahou and Yitbarek (2020), Bossuroy and Cogneau (2013), and Narayan et al. (2018) and Hertz et al. (2007). Notably, Alesina et al. (2021) examined intergenerational mobility in 23 African countries and found that investments in transportation infrastructure, such as railways, and missionary activity during the colonial period as well as geographic features were strongly correlated to educational mobility. An earlier study in intergenerational mobility in five African countries, by Cogneau and Mesplé-Somps (2008), also found comparable country-specific results – the two former British colonies (Ghana and Uganda) shared a much higher intergenerational educational and occupational mobility than the three former French colonies

4 Other studies also demonstrated that ethnic capital is an important determinant and has a lasting effect on intergenerational mobility, mainly using data on children of immigrants in industrialized countries (Aydemir, Chen, and Corak, 2013; Bauer and Riphahn, 2007; Chow, 2004; Leon, 2005; Nielsen et al., 2003; Postepska, 2019). For instance, Bauer and Riphahn (2007) use Swiss census data while Postepska (2019) uses US data; Nielsen et al. (2003) use data from Denmark. Aydemir, Chen, and Corak (2013) study the importance of ethnic capital for earnings mobility among children of immigrants in Canada.

5 For surveys on studies in intergenerational mobility of income and education globally, see Black and Devereux (2010), Onuzo et al. (2013), and Solon (1999).

(Ivory Coast, Guinea, and Madagascar). The study also claimed ethnicity to be a significant factor in explaining inequality of opportunities. Narayan et al. (2018) provide estimates of education and income mobility in 148 countries worldwide in the Global Database on Intergenerational Mobility (GDIM, 2018), and of these, 41 of are in Africa. The estimates show high levels of education persistence in Africa compared to to other regions, similar to findings by Hertz et al., 2007. A common feature of this literature is that they abstract from ethnic-based intergenerational mobility for Africa, which is the main focus and contribution of this paper.

The rest of this paper is structured as follows. Section 2 develops the theoretical framework, based on existing theories, which is used to explain the main results and the mechanism behind intergenerational persistence that have evolved differently in the former British and French colonies. Descriptive analysis of the data provided in Section 3 shows wide disparities in average years of schooling between ethnic groups in the different countries and between former British and French colonies. We also provide the definition and measurement of ethnicity, parental and ethnic capital in this section. Section 4 presents the methodological framework that sets out the econometric models estimated. In Section 5, we discuss the main results from the econometric analysis. Results from the pooled cross-sectional linear analysis and interaction model show that the within-family persistence is higher within families in former French colonies and that ethnic capital, while important in both pools, has a greater impact on the intergenerational mobility process in former British colonies. In Section 6, we check the robustness of our results using different specifications of the structural model, including using only the fathers' education as parental human capital, using parental average education as the measure of parental education and estimating a logistic model. Finally, section 7 concludes and provides policy implications that may arise from our findings. Additional results, data and descriptive statistics are provided in the Online Appendix.

2.2 AFRICAN INSTITUTIONS, ETHNICITY AND COLONIALISM

Institutions in Africa bear the profound and long-lasting effects of European colonialism. Of course, Africa was not the only continent that faced European colonialism (European colonialism spread as far as Asia and North and South America from as early as the fifteenth century). However, by the time the European powers moved to the African coastal regions through which the slave trade was conducted, in the later part of the nineteenth century, Young (1994) argues that the principles of supremacy had matured. This meant there was an accumulated set of concepts of suppression and lessons in colonial science from which to draw. By then, European powers had elaborate notions of how a colonial state should be organized, which led to a set of policies and a texture of relationships with African society that still affects contemporary African states. This does not mean that colonialism did not have lasting effects on other continents; Engerman and Sokoloff (2005), Jimeno et al. (2005), and Summerhill (2010) document the long-term impacts of colonialism on economic performance, inequality, and institutions in South America and the Caribbean. However, we argue

that colonialism in Africa was more systematic due to the earlier experiences on other continents. Hence, the impact in post-colonial African countries and their institutions may have been more significant.

The creation by the European countries of African borders that had little resemblance to the local spatial arrangements of ethnic identity led to post-colonial African states being a collection of numerous ethnic groups (Jenkins, 2008). Thus, the territorial boundaries drawn with little consideration of the actual distribution of indigenous ethnocultural groups within them established a key source of the ethnic struggles in post-colonial Africa (Blanton, Mason, and Athow, 2001; Michalopoulos and Papaioannou, 2016). After the end of colonial rule, former colonies remained with their colonial borders intact and were transformed into ethnically fragmented states. The forms and degree of ethnically induced social, political and economic conflict that has ensued in most of them have differed and may be partially explained by the different colonial styles (Blanton, Mason, and Athow, 2001).

Aside from having the most colonies in Africa, there were inherent differences in the British and French colonial policies adopted to facilitate colony administration. The British practised indirect rule – a mechanism designed explicitly to use traditional ruling/ethnic authorities for the transmission and enforcement of policies. In the process, it sanctioned the notion that an ethnic group was a valid basis for an administrative unit and provided an institutional expression for cultural unity (Horowitz, 1985; Kasfir, 1972). Regarding relationships with the ethnic groups in their colonies, the British system was an unranked or horizontally integrated structure of ethnic stratification that led to 'competitive ethnicity' patterns as groups found themselves competing for the same resources and occupational roles in the society's status hierarchy. The French adopted a more centralized colonial approach and used the vertically integrated or 'ranked' system of inter-ethnic relations based on existing ethnic relations; this led to a social structure characterized by one ethnic group being subordinate to another. As a result of these colonial policies, ethnic contrasts that might otherwise have been only vaguely perceived were seen all too clearly after the colonialists cleared the field for comparison (Horowitz, 1985).

To understand how the different colonialist systems may have affected ethnicity, we focus on the structure of group ethnic relations. Horowitz (1985) notes the distinction in ethnic relations between ranked and unranked ethnic groups. In the ranked system, class stratification and ethnic membership tend to overlap, and mobility opportunities can be restricted by group identity. In such systems, political, economic, and social status tend to be cumulative. Members of the lower-ranked ethnic group are usually simultaneously subordinate in each of these ways to the higher-ranked ethnic group(s). Race relations founded on African slavery in the Western Hemisphere and the Caste system in India are examples of the ranked system; but, closer to Africa, the historical relations between Hutu and Tutsi in Burundi and Rwanda, and the race relations in Aparthied South Africa are examples of the same (Asher, Novosad, and Rafkin, 2018; Gisselquist, 2013; McDoom, 2019). In the unranked system, parallel ethnic groups that are internally stratified co-exist, and socio-economic and political opportunities are available to all. This distinction may be key in understanding ethnic

relations in countries that have experienced these systems. The lower status of the subordinate group in ranked systems is reinforced through restrictions on education and occupation, among others, which limits their opportunities for upward mobility. In contrast, unranked ethnic groups develop elaborate ways of reaffirming the superiority of their own culture and use their ethnicity as a means of accessing resources (and opportunities for mobility) and this reinforces ethnic ties (Caselli and Coleman, 2013; Eifert, Miguel, and Posner, 2010; Horowitz, 1985).

2.3 DATA

The study will focus on four French (Niger, Madagascar, Cote d'Ivoire, and Guinea) and four former British colonies (Nigeria, Uganda, Ghana, and Malawi). Specifically, we use data from Cote d'Ivoire - Côte d'Ivoire Living Standards Survey (1985/1987), Ghana — Ghana Living Standards Survey (GLSS 2012/13), Guinea — Enquête Intégrée de Base pour l'Evaluation de la Pauvreté (EIBEP 2002/03), Madagascar — Enquête permanente auprès des ménages (EPM 2005), Malawi— Malawi Integrated Household Survey (IHS4 2016/17), Niger - Deuxième Enquête National sur les Conditions de Vie des Ménages et Agriculture (ECV-MA 2014), Nigeria—Nigeria General Household Survey (GHS 2010/2011), and Uganda— Uganda National Household Survey (UNHS 2013/14). The surveys for Cote d'Ivoire, Ghana, Malawi, Niger, Nigeria and Uganda are from the Living Standards Measurement Study (LSMS) while Guinea and Madagascar are from the Integral Household Survey, which covers similar multi-topic household surveys conducted by national statistical agencies of each country in collaboration World Bank's Development Data Group. These countries account for over 34 per cent of the total population of Africa (World Bank, 2018b).

We use World Bank survey data for all the countries to ensure the comparability of the findings. The LSMS is a nationally representative household survey aimed at facilitating the use of household survey data for evidence-based policy-making (World Bank, 2018a). It has been conducted in several countries worldwide, and for Africa, early survey data-sets go back as early as the 1980s. Whilst numerous World Bank surveys exist for African countries, our sample size was constricted as some of the African surveys did not collect information on ethnicity, e.g. Ethiopia, Mali, Rwanda and Tanzania do not collect ethnicity of the respondents. For our purposes, in addition to asking respondents questions on parental education and occupation, these surveys collects information that allowed us to identify the ethnic group of household members – or the main language used by the head of the household for some countries. This information allows us to group the individuals into different ethnic groups, which is a key variable for the analysis and informed the choice of countries that were included in the study. Additionally, because of the focus of the paper, countries which were not colonized by Britain or France, or who experienced unique historic experiences, such as Apartheid for South Africa, or Liberia which was founded as a settlement for returning African American slaves were excluded. Though the surveys collected information of all household members, similar to Azomahou

and Yitbarek, 2020, we restricted the analysis in this paper to the adult population and the minimum age of inclusion was taken to be 20 years of age.

As can be seen in Table 2.1, most of the country datasets used are fairly recent, except for Cote d'Ivoire, where the only available information was for the years 1985–86. Despite this, we include it because we can still analyse the impact of colonisation on mobility and ethnicity as there is a period of almost 30 years post-independence. The most recent survey included is for Malawi and was conducted in 2017, while the others fall between 2002 and 2013. The total sample size for analysis is 122,374 households, and the country-specific samples range from 4,139 for Uganda to 34,003 for Ghana. The sample sizes of some of the countries included were reduced because we dropped observations where the respondent's education level was not captured, or both parental education levels were missing. We also did not include observations not directly related to the head of household for countries where ethnicity was observed for only the head of the household. Because we could not assume they were of the same ethnic grouping, and this was done to improve the precision and accuracy of the results. This was the case for Guinea, Cote d'Ivoire, and Malawi.[6]

Table 2.1: Sampled countries: former British and French colonies

Country	Colony	Year of survey	Year of independence	Sample size	EF	Gini Index
Cote d'Ivoire	French	1985/87	1960	8,616	0.820	42
Ghana	British	2013	1957	34,003	0.673	42.9
Guinea	French	2002/03	1958	11,665	0.739	38.7
Madagascar	French	2005	1960	21,517	0.879	42.18
Malawi	British	2017	1964	20,837	0.674	43.37
Niger	French	2014	1960	8,994	0.651	36.88
Nigeria	British	2010	1960	12,603	0.850	41.55
Uganda	British	2013	1962	4,139	0.930	43.18

Notes: EF - ethnic fractionalization index, source:Alesina et al. (2003). Gini index: Average Gini inequality index between 2000 and 2018, source: World Bank (2018b). Source: authors' compilation based on LSMS data.

The degree of ethnic fractionalization within the different countries is obtained from Alesina et al. (2003). The ethnic fractionalization index measures the degree of heterogeneity in terms of ethnic groups within a country.[7] It provides a comprehensive measure on the extent of ethnic fragmentation within the sampled countries and reflects the likelihood that two randomly selected individuals from a population will not belong to the same group. The index lies between 0 and 1, with 1 being the highest measure and implying that each person belongs to a different group.

We see relatively high levels of ethnic fractionalization within the sampled countries, particularly in Uganda at 0.93. It is comparatively lower in Niger and Ghana.

6 The original country sample sizes and sample construction including details of observations not included is presented in Table A.1 of the Online Appendix.

7 Ethnicity is constructed using a combination of racial and linguistic characteristics, and the ethnicity variable is collected for over 650 distinct groups in 190 countries.

The country-specific linguistic fractionalization indices also present similar values to those obtained in the ethnic fractionalization index. Furthermore, average income inequality levels measured using the Gini index between the period 2000 and 2018 show high inequality levels ranging from 36.9 in Niger to 43.4 in Malawi (World Bank, 2018b). It is highest in Malawi, Uganda and Ghana, which also have high levels of ethnic fractionalization. Horizontal inequality, or inequality between groups, measured using the Group Gini (GGini) index by Tetteh-Baah (2019) shows that Nigeria has the highest level of education attainment inequality between ethnic groups, followed by Cote d'Ivoire, Ghana and Guinea, and this underscores the importance of understanding the role of ethnicity in the mobility process.

2.3.1 *Main variable definition and measurement*

There are three main variables of interest in this paper. These are the years of schooling of the respondents (children), the years of schooling of their parents, and parental ethnicity. To measure the years of schooling of the respondents and their parents, in line with previous work (Adermon, Lindahl, and Palme, 2021; Azomahou and Yitbarek, 2020; Hertz et al., 2007), we transform the categorical education levels collected as highest grade completed or highest qualification attained into a continuous variable, years of schooling, using as a guide the country-specific education system layout on the number of years of schooling required to attain the different education levels. We assume no repetition of grades.[8]

The LSMS use of retrospective data for the respondent's education and their parents may lead to measurement error if recall bias is present and sufficiently large. The literature has different findings on the effect of recall bias in African data collected by international organizations. Reliability analysis of African LSMS data by Beegle, Carletto, and Himelein (2012) finds no consistent effect of significant recall length in agricultural surveys from the early 2000s. A more recent analysis by Wollburg, Tiberti, and Zezza (2020) found evidence of non-random measurement error for key agricultural variables in LSMS household surveys from 2012 to 2017 for Malawi and Tanzania and recommended shorter recall periods to reduce the recall bias. However, the bias is significantly reduced for more salient events, and there is no evidence that education statistics are subject to it. Indeed Freedman et al. (1988) found that generally, retrospective education and occupation were recalled as reliably as in concurrent surveys, and this is similar to the finding of Tasciotti and Wagner (2018) for education LSMS data in Malawi.

8 We assume that the respondents do not have increased numbers of years of schooling due to repetition of a grade, and so we count those who spent two years or more in one grade as only having completed one year of schooling overall.

Parental capital

The LSMS collects retrospective parental education data for all respondents.[9] Parental education, also referred to as parental capital, is measured as the highest number of years of schooling of either parent in the household. In the intergenerational mobility literature, parental education is usually measured as the average of both parents' education, the highest education level of either parent or as the father's level of education (due to low levels of women in education historically). To increase our sample size, we include the years of schooling of the mothers in our analysis and use the highest number of years of schooling of either parent, (i.e. the parental maximum) as a measure of parental education, similar to the approach undertaken by Behrman et al. (2001).[10] As argued by Hertz et al. (2007), when used, the correlation coefficients obtained from using parental average or parental maximum are similar, but the coefficients from the regression are lower when the parental maximum is used. We used parental maximum because the low level of education of the mothers in the households in our sampled households may significantly bias downwards the average parental years of schooling/education level if it were used. Therefore, our regression coefficient can be interpreted as being the lower bound of education persistence across generations.

Ethnicity

Ethnicity is measured using social and cultural criteria. This is in reference to individually identified common descent and common language and is similar to the criteria used to define 'tribes' in the colonial framework, as discussed by Jerman (2003). Respondent ethnicity was collected directly as a variable for each respondent in the country surveys for Ghana, Madagascar, Niger, and Uganda, and hence did not have to be imputed. For Cote d'Ivoire, only the ethnicity of the head of the household was collected, and for Malawi and Guinea, it was derived from the language used by the head of the household, which was taken to be a sufficient proxy. Ethnicity in Africa is inherited mainly through the patrilineal system (i.e. through the father's lineage), but in some ethnic groups, it is matrilineal (through the mother's lineage). In Guinea, where there were no matrilineal ethnic groups, only immediate relations to the male head of the household (parents and children) were included in the analysis. The spouse and relations whom we could not ascertain to be in the same ethnic group as the head of the household were excluded from the sample. For Cote d'Ivoire and Malawi, some of the ethnic groups were identified to be matrilineal,[11], and for

9 For Uganda, there was no parental education data collected if the parent was deceased, and hence these households were excluded from the analysis.

10 There was no significant difference in terms of reporting of education levels of either parent: 94 per cent of respondents in the sample reported their mother's education level while 93 per cent reported their father's education level.

11 Malawi matrilineal ethnic groups were the Chewa, Yao, and Lomwe (Berge et al., 2014); for Cote d'Ivoire, the matrilineal ethnic group was Akan or the Ashanti as they are known in Ghana (De Witte et al., 2001). More information on ethnic group organization structures is available from Murdock (1967)

these groups, we included the spouse in the analysis. For Nigeria, ethnicity was not collected directly, but the ethnic regional distribution countrywide was used to derive ethnicity. The country is dominated by four main ethnic groups (75% of the population), and we used the Afro-barometer survey (2008) to identify the main ethnic group in each state.[12] This is similar to the approach adopted by Archibong (2018) in determining ethnic group distributions for the regions in Nigeria.

Ethnic capital

Ethnic capital is derived from the years of schooling of the parents' ethnic group and is measured in two ways. First, we measure it as the average human capital of the parents' ethnic group in each country as defined by Borjas (1992). We then extend the definition to include region-specific human capital levels, redefining ethnic capital as the average years of schooling of the parents' ethnic group per region. In the second case, we modify the original definition of ethnic capital and incorporate the effects of living in specific neighbourhoods, taken as the district/region of residence. We assume that the respondents reside in the same region as their parents and are raised in those areas. That is, we assume little movement across geographic areas. This modification is generally acceptable, and in his later work Borjas and Chiswick (2019) contends that ethnic groups tend to cluster in particular regions, and hence a study of ethnic effects should incorporate neighbourhood or regional effects. Leon (2005) also states that ethnic capital operates mainly in geographic clusters of ethnic groups. This is especially relevant for studies done on mobility in Africa, where there are wide disparities in wealth and socio-economic opportunities between regions, usually dependent on whether one resides in an urban or rural area. Arguably, these disparities in within-country development resulted from colonialism in the sense that areas where colonial administrative institutions were set up are more developed today than other areas, and ethnic groups who lived in and around these areas had more opportunities for upward mobility (Horowitz, 1985). We do not consider ethnic endogamy in this paper.

2.3.2 *Descriptive statistics*

The descriptive statistics presented in Tables 2.2 and 2.3 provide insight into the human capital accumulation of the respondents in comparison to their parents and between ethnic groups. An initial examination of the sampled countries descriptive

12 The Afro-barometer survey is a nationally representative cross-sectional survey undertaken periodically for various countries, including Nigeria. To be considered the main ethnic group, over 50% of respondents must belong to the group in each state. In our survey, Hausa were the main ethnic group in Adamawa, Bauchi, Jigawa, Kaduna, Kano, Kastina, Kebbi, Sokoto, and Zamfara states; Igbo were the main group in Abia, Anambra, Delta, Ebonyi, Enugu, and Imo states; Yoruba were the main group in Kwara, Lagos, Ogun, Onyo, Osun, Ekiti, and Ondo states; Ijaw are the main ethnicity in Bayelsa, and Rivers states while Fulani were the main group in Gombe; Tiv in Benue; Ibibio in Akwa and Ibom;, and Edo in Edo .

statistics by ethnic group shows wide variation in education attainment (Tables A.2–A.9 of the Appendix).[13] In Madagascar, the years of schooling on average for all the ethnic groups was low, and the largest sampled group was Merina (23 per cent), who had an average number of years of schooling of 3.07 for the respondent, 3.08 years for the fathers, and 2.40 years for the mothers. In Nigeria, the most populous group were the Hausa (26 per cent), and they had the lowest average education levels at 4.70 years for the respondents, 4.01 years for the fathers, and 3.28 years for the mothers. The ethnic group with the highest average years of schooling were the Ijaw, who had 10.16 years of education for the respondent, 5.79 years for the fathers, and 3.95 years for the mothers. For Guinea, individuals who identified as having French as the main language of use in the household and who composed 17% of the sample had the highest average years of schooling at almost 7 years for the respondents, 3 years for the fathers, and 2.5 years for the mothers.[14] The Fulani (Pular) were the most populous at 29 per cent, and the respondents from this ethnic group had on average 1.74 years of schooling, the fathers had 0.64 years, and the mothers had 0.37 years of schooling respectively. In Ghana, average years of schooling across the numerous ethnic groups was high, and the largest sampled ethnic group, the Ewe (12 per cent), had 8 years of schooling for the respondents, 5 years for the fathers, and 3 years for the mothers. The country-level ethnic group statistics show low levels of education among the ethnic groups in former French colonies with small variations between groups. For former British colonies, though ethnic groups generally have much higher levels of education, there are sizeable disparities in years of schooling between ethnic groups who are highly educated and those who have lagged behind.

At the national level, as expected, the average education levels of the respondents is higher than that of their parents in all the countries. This is in line with the general observed upward trend in education levels globally as perceived returns have increased. Overall, as shown in Table 2.2, for the whole sample, the mean education level is 6.30 years for children, which approximately equals the number of years required to complete primary education (six years in former French and seven years in former British colonies). Uganda and Ghana had the highest average years of schooling for respondents, while the fewest years of schooling were for those from Madagascar, Cote d'Ivoire and Guinea. Despite having low levels of education across the board in Madagascar, the disparities between children and their parents were low. The average years of education for children was 2.06 years, while for mothers and fathers, the average education years were 1.57 and 2.22 years, respectively. This may be indicative of an absence of historical gender-based discrimination in terms of access, or lack thereof, to education, which has been a major impediment to other areas within Africa. Table 2.2 shows that former British colonies had higher education attainment than French

13 Given the large number of ethnic groups that exist within any given African country, for countries for which we had identified large numbers of ethnic groups, the descriptive statistics were limited to those groups that had respondents numbering more than 100 sampled households, while the smaller groups were recorded as other ethnic groups. However, for the regression analysis, the ethnic groups were maintained as collected in the surveys to ensure the results were not biased by this manipulation.

14 French is the official language of Guinea and the lack of identification with an ethnic language may be considered as part of the colonial legacy.

colonies, as was also shown by Cogneau and Mesplé-Somps (2008). On average, in the former British colonies, the children had 6.79 years of education compared to 2.31 years in former French colonies.[15]

Table 2.2: Descriptive statistics

Country	Children (education)			Father(education)			Mother(education)			Age(years)		Hhld size(no.)	
	Mean	S.D.	*n*	Mean	S.D.	*n*	Mean	S.D.	*n*	Mean	S.D.	Mean	S.D.
Cote d'Ivoire	2.17	4.58	11,616	0.51	2.41	11,591	0.08	0.97	11,602	43.1	16.26	8.59	6.05
Ghana	6.91	5.16	34,003	4.33	5.39	32,457	2.46	4.26	33,501	40.3	16.18	5.08	3.12
Guinea	2.57	4.70	13,016	1.17	3.61	12,908	0.93	3.26	10,948	45.1	18.54	11.7	7.02
Madagascar	2.06	3.61	21,517	2.22	2.97	20,733	1.57	2.43	20,963	37.5	13.7	6.58	2.66
Malawi	5.92	4.32	21,066	1.38	3.37	21,064	0.77	2.43	21,064	39.6	15.95	4.67	1.99
Niger	2.90	3.80	8,994	0.57	2.22	8,864	0.30	1.50	8,969	40.4	15.12	8.87	4.48
Nigeria	6.80	5.60	11,999	3.94	4.66	11,920	2.82	4.05	11,890	39.5	15.51	7.11	3.49
Uganda	7.65	4.02	4,139	5.80	4.21	2,468	3.43	3.73	3,683	29.0	8.66	7.12	3.18
French Colonies	2.31	7.80	50,792	1.81	6.38	49,773	1.28	5.17	48,484	39.5	30.08	8.07	9.43
British Colonies	6.79	4.49	70,978	3.92	3.76	67,680	2.78	3.28	69,909	39.4	12.50	7.04	2.82
All	6.30	5.58	121,770	3.70	4.59	117,453	2.62	3.94	118,393	39.4	15.45	7.16	3.66

Notes: Education measured in years of schooling. Hhld size (no.) = household size measured in terms of number of household members. Source: authors' compilation based on LSMS data (World Bank).

We divided the country samples into 10-year birth cohorts, as shown in Table 2.3, and the results show that there has been an upward trend in terms of school attainment across successive cohorts. One finding that stands out from the cohort analysis is that the average years of schooling of children in the latest birth cohort in Madagascar (1977–86) is lower than that seen in Nigeria, Uganda, and Ghana in the 1937–46 birth cohort, a difference of 40 years.

The ages of respondents in the sampled countries is balanced across colonies, but we do find significant differences in children and parental education suggesting impediments to educational attainments in former French when compared to the British colonies, which necessitates an examination of the source of this disparity (see Table A.10 in the Appendix). The descriptive data indicates wide dispersion in education attainment across ethnic groups within and across sampled countries for parents and children. It is, therefore, of interest to examine the role that ethnicity plays in the intergenerational transmission of skills. We explore this further in the results section.

15 Applying the Kitagawa-Oaxaca-Blinder decomposition shows the observed covariates explain most of the differences in educational outcomes between the two colonial blocs. We used the twofold pooled method (inclusive of control variables) and results, shown in Table A.11 of the Appendix, reveal from the difference of 4.48 years between the two groups, differences in covariate endowments explain the majority (80 %) of the disparity (3.55 years) between the two groups while 1.13 years was unexplained. The unexplained part subsumes the effects of group differences in unobserved predictors and we posit that part of this unexplained variation may be as a result of externalities resulting from other historical differences.

Table 2.3: Descriptive statistics: birth cohort analysis

Birth Cohort	Sample size	Years of schooling			Sample size	Years of schooling		
		Children	Father	Mother		Children	Father	Mother
		French colonies				**British colonies**		
	Cote d'Ivoire				**Ghana**			
1937–46	1,804	1.31	0.21	0.02	1,884	3.57	1.24	0.26
1947–56	2,267	3.64	0.54	0.06	2,825	5.85	1.96	0.69
1957–66	3,996	3.67	1.04	0.16	4,828	6.50	2.97	1.18
1967–76	147	3.64	1.60	0.62	6,888	6.54	4.25	2.05
1977–86					8,700	7.45	5.31	3.24
1987–96					7,730	8.95	6.30	4.11
	Guinea				**Malawi**			
1937–46	1,584	1.03	0.38	0.04	834	2.22	0.14	0.06
1947–56	2,028	3.12	0.56	0.15	1,466	3.30	0.27	0.09
1957–66	2,354	2.83	0.90	0.29	2,048	4.39	0.68	0.24
1967–76	3,996	3.27	1.83	1.28	3,359	5.15	0.89	0.33
1977–86	2,725	4.32	2.95	2.61	5,388	6.36	1.28	0.60
1987–96					6,764	7.51	2.22	1.38
	Madagascar				**Nigeria**			
1937–46	1,209	1.13	1.41	0.90	760	3.41	1.39	0.86
1947–56	2,677	1.74	1.84	1.27	1,280	4.77	2.30	1.33
1957–66	4,221	2.35	2.17	1.59	1,931	6.03	2.68	1.74
1967–76	5,682	2.14	2.38	1.71	2,580	6.25	3.54	2.45
1977–86	6,869	2.16	2.52	1.77	3,302	8.14	5.12	3.76
1987–96					1,654	9.51	6.30	4.88
	Niger				**Uganda**			
1937–46	422	1.38	0.05	0.01	26	5.27	1.01	0.51
1947–56	866	2.17	0.10	0.04	97	4.79	1.88	0.34
1957–66	1,347	2.46	0.12	0.04	385	5.94	4.23	1.44
1967–76	1,656	2.95	0.36	0.13	779	5.98	4.67	2.03
1977–86	2,490	3.02	0.56	0.31	1,180	6.91	5.44	3.04
1987–96	2,053	3.96	1.43	0.83	1,672	8.40	6.74	4.05

Notes: Countries arranged alphabetically based on colonial origin. Source: authors' compilation based on LSMS data (World Bank).

2.4 METHODOLOGY

2.4.1 *Modeling intergenerational mobility and ethnic capital*

The methodological framework is based on the literature in intergenerational mobility and ethnic capital as first espoused by Becker and Tomes (1986) and adapted by Borjas (1992). The traditional child-parent regression equation has the following form:

$$y_{ij,t} = \delta_0 + \delta_1 y_{ij,t-1} + \xi_{ij,t} \tag{2.1}$$

where $\xi_{ij,t}$ represents the disturbance term and is assumed to be independent and identically distributed (i.i.d.) with mean zero and constant variance. $y_{ij,t}$ denotes the level of education for child i in ethnic group j in generation t; $y_{ij,t-1}$ refers to the education level of the parents. The estimate of δ_1 is reported as one of the measures of

intergenerational education persistence. Alternatively, $1 - \delta_1$ is a measure of intergenerational mobility.

Adermon, Lindahl, and Palme (2021) argue that estimates of intergenerational persistence of human capital of Equation 2.1 are underestimated for two reasons. The first is due to measurement errors. For instance, an individual's formal education attainment (even measured precisely) may not necessarily reflect the individual's human capital. The second is because Equation (2.1) rules out the human capital of important members of the dynasty, except that of the parents. Adermon, Lindahl, and Palme (2021) prove that downward bias decreases when these factors are included in the regressions (see Proposition 3 on their online appendix). Their finding is supported by Clark (2014) who argues that individual-level variables (such as education and income) are noisy indicators of "social status" and emphasizes the importance of group-average outcomes in studying intergenerational linkages.

According to Borjas (1992) and Güell, Rodríguez Mora, and Solon (2018), Equation (2.1) could be modified to include group effects such as ethnic capital:

$$y_{ij,t} = \beta_0 + \beta_1 y_{ij,t-1} + \beta_2 \overline{y}_{j,t-1} + \varepsilon_{ij,t} \tag{2.2}$$

where $\varepsilon_{ij,t}$ is the error term; $\bar{y}_{j,t-1}$refers to the average education level of parental ethnic group and β_2 measures group effects.[16] Borjas (1992) and Güell, Rodríguez Mora, and Solon (2018) warn the estimations of Equation (2.1) may greatly underestimate the intergenerational mobility persistence if the true model for intergenerational transmission of human capital includes group effects (or if $\beta_2 \neq 0$). Borjas (1992) posits the least-square estimator of δ_1 as

$$\delta_1 = \beta_1 + (1 - \pi)\,\beta_2 < \beta_1 + \beta_2 \tag{2.3}$$

where $\pi \equiv 1 - \rho$; and, $\rho \equiv \frac{Var\left(\bar{y}_{j,t-1}\right)}{Var\left(y_{ij,t-1}\right)}$ is the fraction of the between-group variance over the population variance ($Var\left(y_{ij,t-1}\right)$). Thus, π is the proportion of the within-group variance – the fraction of the population variance explained by the within ethnic group variations. Borjas (1992) argues that π could be large, as most variations comes from the within ethnic group variations. But if β_2 is sufficiently large, estimation results from Equation (2.1) could substantially underestimate the the intergenerational linkages in the society.

The above discussion clearly shows, regardless of whether the true model for intergenerational transmission of human capital is Equation (2.1) or Equation (2.2), estimates from Equation (2.2) could be informative, as they can be used to reduce the downward bias from the child-parent estimate of Equation (2.1). Notably, the intergenerational mobility process will be misspecified if group effect such as ethnic capital plays an important role in determining the educational outcome of the children and are not taken into account.

The transmission parameter that describes how skills of the ethnic group evolve across generations is given by the sum of the coefficients $\beta_1 + \beta_2$. If the sum of the

16 As shown below, one also could control for other important variables to intergenerational mobility.

coefficients is less than 1, this implies that the average human capital of the different ethnic groups will converge across generations and vice versa. If the sum of the coefficients is equal to or greater than 1, then the relative dispersion that exists between the ethnic groups will continue indefinitely (Borjas, 1992; Borjas and Chiswick, 2019).

2.4.2 *Incorporating colonial origin*

Equation (2.2) presents the estimates for intergenerational persistence across generations and ethnic capital effect for the African states. To incorporate the effect of the British or French colonial identity on intergenerational mobility across the different countries in the analysis, we estimate Equation (2.2) using a pooled data-set of the countries by colonial origin, defined as the last colonial ruler before the independence of the country. We adapt the model to include interaction effects, and the main interaction is between a dummy variable of the identity of the colonizer and the ethnic capital variable. Interaction effects in our case capture the difference in the importance of ethnic capital for intergenerational mobility in former British and French colonies. Our second econometric model is then specified as follows:

$$y^k_{ij,t} = \beta_0 + \beta_1 y^k_{ij,t-1} + \beta_2 \overline{y}^k_{j,t-1} + \mathbf{fi}_3 \mathbf{x}^k_{ij,t} + \beta_4 C_i + \beta_5 C^k_i * y^k_{ij,t-1} + \beta_6 C^k_i * \overline{y}^k_{j,t-1} + \eta^k_{ij,t} \tag{2.4}$$

where C^k_i is a binary (dummy) variable, which takes the value of 1 if the person i resides in country k is a former British colony, and 0 otherwise. Again, we control for variables that may affect individual i's mobility in the conditioning set, $\mathbf{x}^k_{ij,t}$, which is composed of the variables age, age squared, sex, and household size. $\eta^k_{ij,t}$ is the error term, which is assumed to have zero mean and constant variance. In this case, the partial effect of being a British colony will be given by

$$\frac{\partial y^k_{ij,t}}{\partial \overline{y}^k_{j,t-1}} = \beta_2 + \beta_6 C^k_i \tag{2.5}$$

where $C^k_i = 1$. If β_6 is greater than zero, this means that being a former British colony increases the education attainment levels of successive generations given the average years of education of the parents' ethnic group. In other words, persistence between the parental ethnic group and child outcome as measured by years of schooling is higher in the former British colonies. If β_6 is less than zero, this implies that being a former British colony decreases the education attainment levels of successive generations given the average years of education of the parents' ethnic group. β_2 would then be the slope of ethnic capital for the French colonies. We also include an interaction term between parental capital, as measured by parents' years of schooling, and the colonial identity and the interpretation with respect to β_5 is the same.

2.5 RESULTS

2.5.1 *Ethnic capital and intergenerational mobility*

Country level analysis

In Table 2.4, we estimate Equation (2), with and without control variables, for each country in the sample. We estimate the intergenerational transmission coefficients from parents to children without ethnic capital (columns 1 and 4) and with ethnic capital (columns 2, 3, 5, and 6). We present results from the two measurements of ethnic capital and also include the vector of control variables in columns 4 to 6. In our analysis, we refer to the intergenerational elasticity measure from parents to children as parental capital.

Column 1 shows that the intergenerational transmission coefficients from parents to children in the sampled countries is within the range 0.4–0.7, which is similar to findings by Hertz et al. (2007) and Azomahou and Yitbarek (2020) for African countries, and are comparable to those in the global mobility database, GDIM (2018), for the specified countries.[17] Our findings are also akin to those of Behrman et al. (2001) for previously colonized countries by Spain in Latin America (Brazil and Colombia had a parental capital coefficient of around 0.7, while Mexico and Peru had coefficients of 0.5). Niger has the highest coefficient at 0.63, with Cote d'Ivoire second with a coefficient of 0.61, which indicates that intergenerational education persistence between parents and children is higher in these countries. The lowest coefficient was in Uganda, at 0.455.

In line with Borjas (1992) and Azomahou and Yitbarek (2020), we introduce a minimal number of controls: age, age-squared (to control for cohort effect), sex, and size of the household. When we include the vector of control variables, as can be seen in column (4), the coefficients decrease across all countries, with Nigeria having the lowest coefficient at 0.387; but overall the difference is modest. The explanatory power of the model increases when the control vector is introduced and is evidenced by the increased value of R^2.

When ethnic capital is introduced to the model (columns 2, 3, 5, and 6), it has a positive and significant impact on children's educational attainment in all of the countries. The highest ethnic capital results, as measured using the average of the ethnic group of the parents only, and shown in column 2, are seen in Nigeria (1.22), Malawi (0.93), and Guinea (0.93). When we also control for the region of the parental ethnic group, as shown in column 3, then ethnic capital is seen to be highest in Cote d'Ivoire (1.21), Guinea (1.18), Malawi (0.96), and Niger (0.95), of which three of the four are former French colonies. When the control vector is introduced (column 6),

17 GDIM estimates are cohort based and when we focus on the 1980 cohort, and use the parental maximum measure as applied in the Chapter, the estimates are as follows: Cote d'Ivoire:0.595; Ghana:0.526; Guinea: 0.557; Madagascar:0.563; Malawi: 0.371; Nigeria:0.523; Niger:0.558; and Uganda: 0.438. These are all between 0.4 and 0.6 and are similar to the estimates for parental capital found in our models, though our estimates are slightly higher as they include earlier birth cohorts.

both parental and ethnic capital effects reduce in the former French colonies. The coefficients that we obtain for ethnic capital are much higher than those obtained by Borjas (1992) and Borjas and Chiswick (2019) and Leon (2005), which suggests that ethnic capital, as we measure it, is a more important variable for mobility in Africa than in the United States, where the other studies are conducted.

When comparing the magnitudes of the two estimation coefficients, those associated with the average human capital of the parental ethnic group seem to be larger than those associated with the human capital of parents. In all the countries, the ethnic capital coefficient is almost twice as large or more than that of the parental human capital. This suggests that parental ethnicity (and their skill level) and region of residence are important for mobility across generations in African countries. However, direct comparisons of the two coefficients, in terms of how they impact children's education, may not be possible. Parental education is a direct input in the human capital accumulation process of the children's outcome through parental time and investment. In contrast, in unpacking how ethnic capital affects children's education outcome, Borjas (1992) and Borjas and Chiswick (2019), and Coleman (1988) note that the effects operate as a form of social capital mainly and can be considered as an externality in the human capital accumulation process. Therefore, in interpreting the coefficients, parental capital can be interpreted directly – an increase of one year in the parents' education leads to an increase of a particular amount in the children's outcome. For ethnic capital, an increase in the average education of the parental ethnic group can be interpreted as an improvement in the ethnic environment faced by the child, and this has an additional effect on their outcome as measured in the analysis.

The finding that ethnic group plays an important role in children's human capital accumulation is important as it may explain the persistence of poverty across subsequent generations of families in Africa and presents an opportunity for interventions to correct for this. It is also in line with arguments by Asher, Novosad, and Rafkin (2018) that group identity, albeit caste groups in their case for India, is a strong predictor of the level and change in mobility for individuals. When we only take into account parental capital, since the coefficients for this variable in all the countries is less than one, we anticipate that the differences between children in successive generations will reduce and eventually revert to the mean. However, our results show that the combined effect of the coefficients for ethnic and parental capital is greater than one, meaning that the dispersion in human capital in future generations may not revert to the mean but will instead grow larger, as explained by Borjas (1992). In essence, ethnic inequality may persist, with the differences in attainment among the ethnic groups increasing over time.

Table 2.4: Intergenerational transmission coefficients: country-level analysis

Dependent variable: respondent education level y_t						
Variable	(1)	(2)§	(3)†	(4)	(5)§	(6)†
Cote d'Ivoire						
Parental capital	0.608	0.557	0.372	0.518	0.465	0.323
	(0.033)	(0.032)	(0.030)	(0.036)	(0.035)	(0.031)
Ethnic capital		0.876	1.214		0.953	1.132
		(0.130)	(0.090)		(0.121)	(0.085)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.108	0.137	0.275	0.209	0.242	0.348
Guinea						
Parental capital	0.466	0.396	0.299	0.418	0.351	0.265
	(0.019)	(0.020)	(0.019)	(0.023)	(0.022)	(0.020)
Ethnic capital		0.931	1.176		0.919	1.151
		(0.084)	(0.051)		(0.080)	(0.052)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.147	0.207	0.285	0.196	0.254	0.327
Madagascar						
Parental capital	0.584	0.559	0.521	0.575	0.551	0.512
	(0.033)	(0.032)	(0.029)	(0.035)	(0.034)	(0.030)
Ethnic capital		0.434	0.555		0.419	0.550
		(0.073)	(0.059)		(0.072)	(0.059)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.246	0.253	0.269	0.254	0.260	0.276
Niger						
Parental capital	0.625	0.620	0.536	0.553	0.547	0.460
	(0.028)	(0.028)	(0.027)	(0.029)	(0.029)	(0.028)
Ethnic capital		0.654	0.948		0.725	0.943
		(0.185)	(0.088)		(0.189)	(0.088)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.151	0.154	0.202	0.224	0.227	0.274
Ghana						
Parental capital	0.485	0.395	0.365	0.424	0.308	0.277
	(0.009)	(0.008)	(0.008)	(0.010)	(0.009)	(0.009)
Ethnic capital		0.538	0.588		0.630	0.665
		(0.026)	(0.021)		(0.025)	(0.021)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.265	0.309	0.330	0.339	0.395	0.416
Malawi						
Parental capital	0.576	0.545	0.533	0.485	0.453	0.442
	(0.015)	(0.014)	(0.014)	(0.017)	(0.017)	(0.016)
Ethnic capital		0.925	0.957		0.877	0.908
		(0.063)	(0.052)		(0.056)	(0.047)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.221	0.242	0.249	0.337	0.356	0.363
Nigeria						
Parental capital	0.489	0.444	0.418	0.387	0.333	0.295
	(0.019)	(0.020)	(0.019)	(0.023)	(0.023)	(0.023)
Ethnic capital		1.223	0.756		1.344	0.896
		(0.136)	(0.114)		(0.139)	(0.113)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.176	0.212	0.208	0.259	0.301	0.302
Uganda						
Parental capital	0.455	0.440	0.379	0.421	0.409	0.344
	(0.020)	(0.019)	(0.020)	(0.023)	(0.021)	(0.022)
Ethnic capital		0.212	0.597		0.169	0.588
		(0.155)	(0.065)		(0.156)	(0.066)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.224	0.226	0.263	0.277	0.278	0.314

Notes: Standard errors in parentheses; sample size: Cote d'Ivoire = 11,615; Guinea = 13,016; Madagascar = 21,517; Niger = 8,990; Ghana = 32,546; Malawi = 20,034; Nigeria = 11,977; Uganda=3,799.
§ = Ethnic capital calculated as average human capital of parental ethnic group.
† = Ethnic capital calculated as average human capital of parental ethnic group per region.
Source: authors' compilation based on LSMS data (World Bank).

2.5.2 *Colonial origin and ethnic capital: estimates from the interaction model*

To examine the effect of colonial origin on ethnic capital differentials, we pooled the cross-sectional data into two, former British colonies and former French colonies. We then estimated Equation (2.4), an interaction model, as set out in the methodology section. Our results show that ethnic capital has a substantial impact in terms of magnitude on the educational outcome of the next generation. From the results presented in Table 2.5, we can see that the coefficients for the interactive effect between ethnic capital and the colonial identity dummy with controls and country fixed effects show a positive and significant relationship. The significant and positive interaction term suggests that ethnic capital has a higher impact on the years of schooling of children in successive generations in former British colonies than former French colonies. On the contrary, parental capital is lower in terms of impact in former British colonies than in French colonies. This is seen in the negative coefficient of the interaction between parental capital and colonial identity, and our results are significant in the full control and fixed effects model.[18] This is in line with our hypothesis that the use of the ranked system in former French colonies may have led to stronger within-family persistence.[19]

The result for the colonial identity dummy is significant, and together with the coefficients for the interactive terms and the mean years of schooling for former British colonies, represents the predicted difference in years of schooling between those in former British and French colonies. It confirms the previous results that there is a significant mean education gap between former British and French colonies. Recall the mean years of schooling in former British colonies is 6.79, while it is 2.31 in the former French colonies (see Table 2.2). While the coefficient for the dummy variable (British) is -1.587, in the last column, the coefficients for the interaction terms for parental and ethnic capital are -0.088 and 0.497, respectively. Therefore, the average estimated difference in years of schooling between individuals in former British colonies and former French colonies is about 1.19 years.[20]

18 Instrumenting for ethnic capital with missionary activity per region within a country as measured in 1923 by Roome (1925) and colonial period geographic variables yields similar estimates though the coefficients are larger in magnitude. Appendix C sets out the instrumental variable approach in detail.

19 Results from estimations using different pooled country specifications as part of the robustness checks are presented in Table A.17 of the Appendix. We explore specifications excluding Uganda, or Nigeria, or countries where language was used to identify ethnicity, and parental capital results are unchanged though the exclusion of Nigeria reduced the effect of ethnic capital. We also introduce urban-rural fixed effects in our estimations to control for locality differences in infrastructural and labour market conditions that could play a role in the mobility process, particularly for Africa, as argued by Alesina et al. (2021). The results, presented in Tables A.18 and A.19 of the Appendix, are unchanged in terms of effect.

20 The predicted difference in years of schooling between the British and French colonies considers both the estimated slope difference and the estimates for parental and ethnic capital. Following Wooldridge (2016), Section 7.4, the slope estimated difference in average years of schooling between the two colonies is the coefficient estimate for Colony (British) in Table 2.5, which is less by 1.578 for the British than the French colonies. But when considering the estimates of the interaction terms for parental and ethnic capital (British) (-0.088 and 0.497 respectively), for 6.79 mean years of schooling in former

Table 2.5: Interaction estimation: ethnic capital and intergenerational transmission coefficients in British and French colonies

	Dependent variable: respondent education level y_t		
	(1)	(2)	(3)
Parental capital	0.464	0.506	0.432
	(0.021)	(0.021)	(0.024)
Ethnic capital	0.695	0.710	0.720
	(0.057)	(0.056)	(0.057)
Colony (British)	0.094	-1.520	-1.587
	(0.577)	(0.589)	(0.606)
Parental capital*colony (British)	-0.019	-0.063	-0.088
	(0.028)	(0.028)	(0.029)
Ethnic capital*colony (British)	0.318	0.401	0.497
	(0.118)	(0.128)	(0.128)
Constant	-0.259	0.827	2.439
	(0.117)	(0.173)	(0.573)
Country FE	No	Yes	Yes
Controls for x	No	No	Yes
R^2	0.257	0.262	0.337
N	121769	121769	121738

Notes: Ethnic capital calculated as average human capital of parental ethnic group. Source: authors' compilation based on LSMS data (World Bank).

2.5.3 *Ethnic capital and intergenerational mobility: birth cohort analysis*

The empirical analysis done thus far does not show how ethnic capital and mobility have changed since the sampled countries attained independence. In this section, we discuss the results from our birth cohort analysis, which highlight how these two variables have evolved over time. In line with previous studies, we separated respondents into 10-year birth cohorts, the oldest of which precede independence for all the countries included in this study. As noted by Hertz et al. (2007), aggregation into cohorts may introduce a bias in terms of reasons for selection of size, but the estimates remain unbiased as long as the same cohort size is applied across surveys.

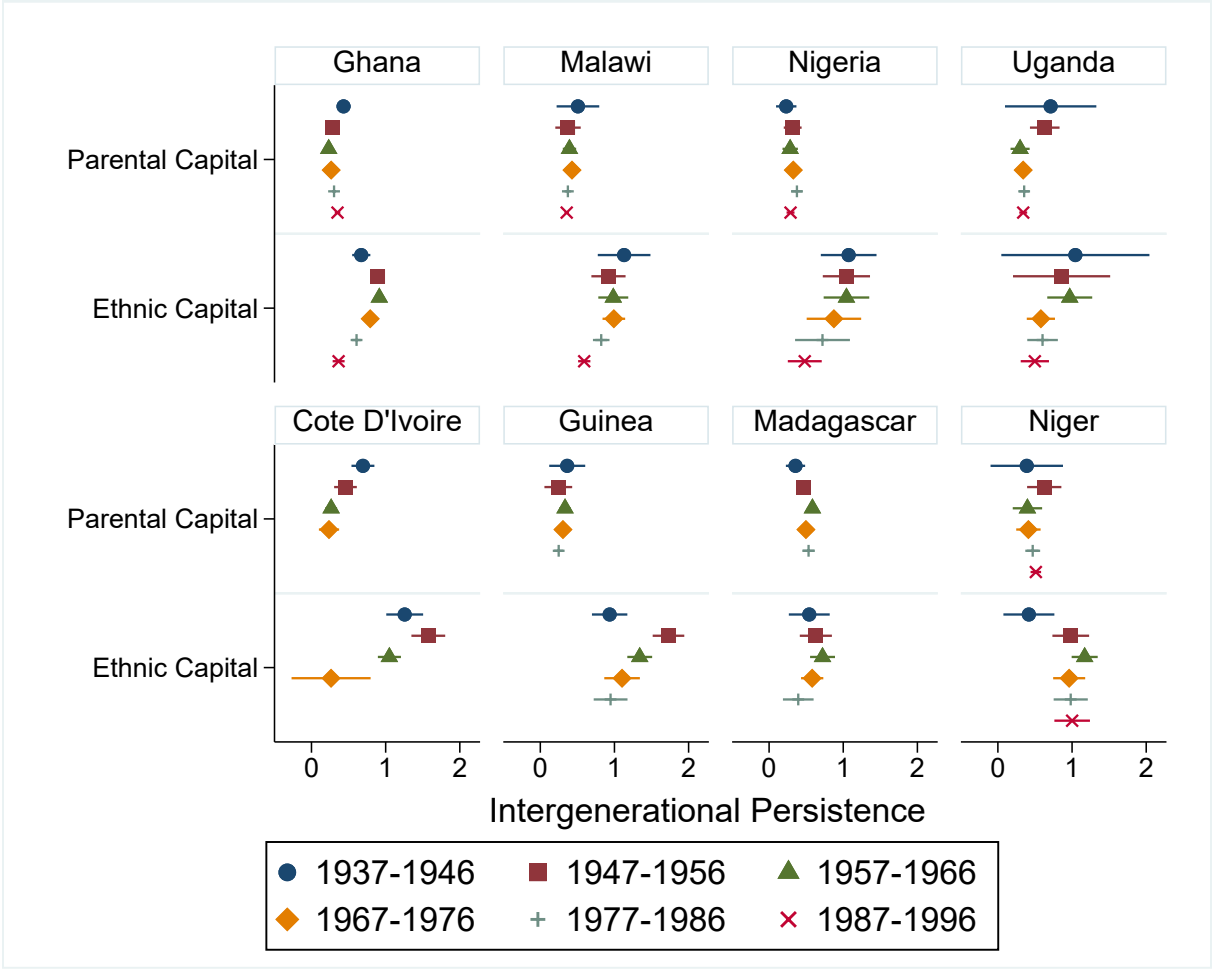
We have shown in our descriptive analysis that average years of schooling has increased over time in our birth cohorts (see Table 2.3). Results from the birth cohort analysis, shown in Figure 2.1 show that the effect of ethnic capital on children's education outcomes has also diminished across cohorts. Ethnic capital is highest in terms of point estimates in the oldest birth cohort (those born between 1937 and 1946) in Nigeria (1.372) and Niger (1.259), while it is lowest in Madagascar (0.387). There is an observed increase in the importance of ethnic capital as measured using the point estimates in the second and third 10-year birth cohorts (1947–66) before declining in

British colonies, we get the predicted difference in years of schooling between the two former colonies: $-1.587 + (-0.088 + 0.497) \times 6.79 \approx 1.19$, in favour of British colonies.

the successive cohorts. Interestingly, parental capital in the sampled countries, except for Cote d'Ivoire, is more or less unchanged comparatively over the last three cohorts, indicating that the role of within-family inequalities across generations has remained relatively unaltered post-independence, though similar to Azomahou and Yitbarek (2020), we do observe some decline in persistence.

Ethnic capital is also relatively unchanged when we compare the earliest to last birth cohort in the former French colonies, with the exception of Niger, and this may point to unchanged ethnic societal rigidities. In contrast, on aggregate, the former British colonies have experienced diminished effects of ethnic capital in terms of magnitude while parental capital has only marginally reduced. What we may be able to infer is that colonial origin is important in explaining the evolution of ethnic capital in African countries, and in particular, understanding why the role of ethnic capital in the intergenerational mobility process seems relatively unchanged in French colonies.

Figure 2.1: Intergenerational transmission coefficients and ethnic capital: birth cohort analysis



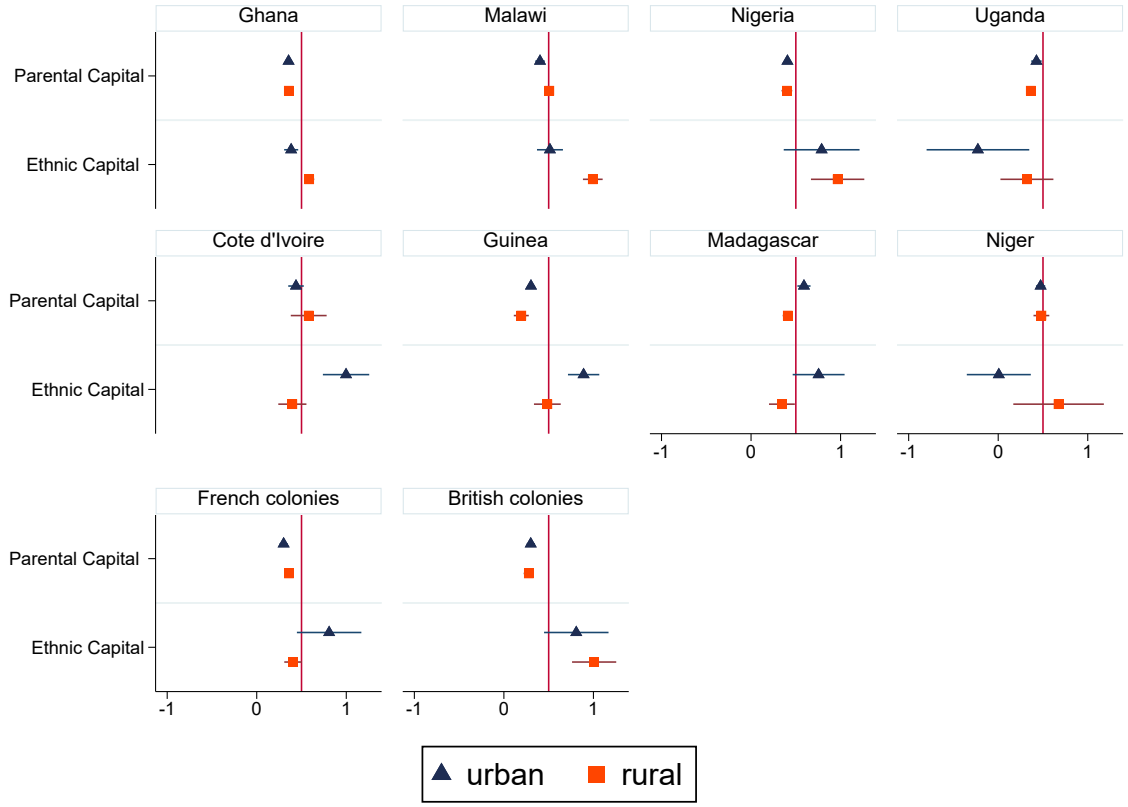
Notes: The upper panel shows parental and ethnic capital coefficient estimates across 10 year birth cohorts in former British colonies, while the bottom panel shows the estimates in former French colonies. Source: authors' creation using LSMS data.

2.5.4 *Intergenerational mobility and ethnic capital - Does rural/ urban locality matter?*

In this section, we examine the extent to which differences in intergenerational mobility and ethnic capital can be explained by the rural-urban differential. Whether or not ethnic capital is more important for rural rather than urban areas is difficult to ascertain a priori as intuitive arguments can be put forth for both scenarios. On one hand, for most African countries, ethnic groups within a region could assimilate over time due to various factors including intermarriages and this may diminish the relevance of the concept of 'ethnicity', from a primordial point of view, and lower the importance of ethnic capital. From an instrumentalist perspective, ethnic capital may be higher in the rural than urban areas because of the underlying importance of ethnicity as a tool to gain access to power and resources, as argued by Bayart (1993), Caselli and Coleman (2013), and Posner (2005). The notion of ethnicity and importance of belonging to a major ethnic tribe is usually used as a political tool to garner votes during elections and being more populous, ethnic identity is reinforced in the rural areas, making ethnic capital likely to be higher in these areas. In the urban areas, while it is more than likely that there would be what Borjas (1992) refers to as social, cultural and economic assimilation which would reduce the importance of ethnic capital in the intergenerational transmission mechanism, we also posit that the presence of different ethnic groups may lead to a more apparent role for ethnic capital in terms of competition in education attainment and for employment opportunities, and hence it may have a larger effect on education outcomes.

Overall, our results show that ethnic capital has an important role in intergenerational mobility in both urban and rural areas (2.2). For the urban areas, changes in ethnic capital had the largest impact as measured by the point estimates on children education outcomes in Cote D'Ivoire and Guinea. It was lowest in urban areas in Uganda. We also found that in three out of the four former French colonies included in our study, with the exception of Niger, the point estimates for ethnic capital was higher in urban areas than in rural areas meaning that changes in average years of education of a respondents parent ethnic group caused larger changes in their education status if they resided in the urban areas than in the rural areas. For the former British colonies, ethnic capital was more important in the rural areas than in the urban areas, irrespective of the inclusion of control variables. The effect of parental capital in the intergenerational transmission process was generally lower in rural areas than urban areas for the majority of the sampled countries especially for Guinea, indicating higher levels of mobility when the role of ethnic capital is taken into account. Our pooled results, presented in the lower panel of Figure 2.2 suggest that colonial origin may explain distinct locality based results for the countries included - namely that in the former British colonies, ethnic capital in rural areas is higher than in the urban areas while the opposite is true for former French colonies.

Figure 2.2: Intergenerational transmission coefficients and ethnic capital: rural/urban analysis



Notes: The upper panel shows parental and ethnic capital coefficient estimates comparing urban and rural areas in former British colonies, while the middle panel shows the estimates in former French colonies. The bottom panel presents the pooled results. Source: authors' creation using LSMS data.

2.6 ROBUSTNESS CHECK

To check the robustness of the results, we explore three different specifications of our structural model. Firstly, we estimate a model that includes only fathers' education where ethnic capital refers to the average years of schooling of the fathers' ethnic group. In the second specification, we use the parental average, which is the average years of schooling of the parents, as the measure of analysis for parental capital. In this respect, ethnic capital is also computed as the average of both parents' ethnic capital. Finally, we take into account low parental education and estimate a binary model to compare outcomes in the two colonial blocs. Result tables for the additional specification tests are presented in the Appendix.

2.6.1 *Results from fathers and children estimations*

When we use fathers' education rather than the parental maximum as the explanatory variable for parental capital, there is little change in the country-level results when compared to those in Section 2.5. This may be the result of generally low levels of maternal education in the sampled countries, implying that measuring using parental maximum in most cases took on the father's education level. The results show that coefficient estimates from the father's ethnic group to the children are often higher than those of within-family measurement (Table A.14). We find that the persistence from the ethnic group is highest in Cote d'Ivoire and Guinea, similar to earlier country-level results presented in Table 2.4. Persistence within the family is highest in Madagascar, and Niger, while it is lowest in Nigeria, Ghana, and Guinea, similar to the earlier observed patterns. Pooled results presented in Table A.12 show higher persistence in parental capital in French than British colonies. We also find higher ethnic group persistence in former British than French colonies. Overall, our results support the argument that ethnic externalities play a significant role in the mobility process in African countries, particularly in former British colonies.

2.6.2 *Alternative measurement of parental capital*

When we use the parental average as our measure of analysis, our results show much higher estimates of parental and ethnic variables (Tables A.13 and A.15). This is in line with the findings by Hertz et al. (2007) who argue that using parental average provides higher estimates of mobility and may be considered as the upper-bound values. Our results are unchanged in terms of our main findings as we still see that ethnic capital plays an important role in the mobility process. Country-level results are similar to those from the fathers' and children's human capital estimation, while pooled country analysis findings confirm that persistence within families (parental capital) is higher in former French colonies than former British colonies. We also see that ethnic capital is higher in terms of correlation with the educational outcomes of children in successive generations in former British colonies than former French colonies, in line with the previous results.

2.6.3 *Accounting for low parental education*

To methods are applied to consider the effect of low/no parental education in some of the sampled countries on ethnic capital. Firstly, we constructed two binary indicator variables, one for the respondents and one for their parents. The first is coded as zero if the respondents have no education and one if they have some form of education. We do the same for the parents with the second binary indicator. We then estimate a logistic model to assess the likelihood of children being more mobile given their parents' education status (no-education or education) in the two colonial blocs and how this affects the coefficient estimates of ethnic capital. The results, in Table A.16, show higher levels of persistence from educated parents to children in former French

colonies than British colonies. This suggests a wider variation in persistence within the family in the former French colonies. Regarding ethnic capital, we see higher estimates of persistence in former British colonies, though the coefficient is lower than that of within-family persistence. Secondly, we removed Cote d'Ivoire and Uganda from the pooled sample because the parental average years of education were exceptionally small, suggesting that many parents may have no education, whereas a few individuals had high levels of education. Though our point estimates are relatively lower, the results (presented in the appendix) are consistent and confirm the results obtained in the previous sections.

Overall, when the different specifications of the pooled model are used, we see a clear pattern showing that colonial origin has differing implications for how parental or ethnic capital affects the mobility process. This has policy relevance in terms of the respective policymakers' approach to increasing equality of opportunity concerning education. Furthermore, it highlights the importance of considering historical factors when understanding contemporary African intergenerational mobility patterns.

2.7 CONCLUSION

This paper looked into the relationship between an individual's ethnic belonging – a circumstantial factor – and their intergenerational mobility, using education as the measure of status in former British and French colonies. Among the findings, colonial origin via its effects on ethnic relations could be important to intergenerational mobility in Africa. In particular, the different administrative styles adopted by the French and British during the colonial period could have led to differences in opportunities for mobility. This inequality operates along ethnic lines, implying that ethnicity may be an important variable influencing intergenerational mobility in Africa. To that effect, we have shown that ethnic capital as measured by the average educational attainment of the parents' ethnic group is an important determinant of the educational attainment of successive generations. Our results, which are robust to using different estimation techniques, show that changes in ethnic capital have a large effect on children's educational attainment.

Compared to former British colonies, the French colonies, which had the ranked-based ethnic system, were found to have relatively high levels of within-group intergenerational education persistence. For the former British colonies who had the unranked system, ethnic capital effects were comparatively higher and played a prominent role in the intergenerational transmission of skills. This finding can be understood if we examine it from the point of view that indirect rule, used by the British for colonial administration, fostered competition for recognition between ethnic groups, which acted as an impetus for each group to have an added interest in opening up opportunities for kinsmen – in essence, an individual's ethnic group becomes a form of social capital that avails them opportunities for upward mobility or may act as a factor limiting their economic outcome in life. As has been argued by Bayart (1993) and Bates et al. (1972), ethnicity or tribalism should not be looked at in isolation but as a channel through which self-serving groups can accumulate wealth and mobilize

votes so they can access political power and resources. In this sense, there would be a self-satisfying interest to ensure that members of one's ethnic group are more educated and have easier access to better jobs, so they maintain a higher social class and hence have more opportunities to be in control of the resources. Because of the tribal competition fostered during colonialism in British colonies, ethnic capital is understandably higher in these countries. The French fostered a sense of nationalism as the overarching goal, and hence in these countries a sense of patriotism rather than competition between the ethnic groups was fostered. This may explain why ethnic capital is lower, though it is still an important factor for mobility there.

Based on our findings, policymakers may have a clear role in ensuring upward mobility opportunities to individuals irrespective of their ethnicity. This is more so for former British colonies, for which ethnicity is an important circumstantial determinant of the socio-economic outcome of children. Interventions on an ethnic group level could seem a short-term measure to correct the lack of opportunities for particular ethnic groups. However, in the long term, reducing perceived ethnic differences in terms of opportunities will reduce the importance of ethnic capital in the intergenerational mobility process.

Another key factor that policymakers in Africa may need to consider when dealing with intergenerational persistence is horizontal inequality. Though generally horizontal inequality in Africa has fallen over time, compared to non-African countries, there has only been a marginal reduction in education inequality between groups. This reduction is a result of overall growth in living standards, and not changes in the gaps in sub-national regional, ethnic, gender, or religious outcomes (Tetteh-Baah, 2019). In some African countries, group inequalities, particularly inequality between ethnic and religion-based groups, remain the most significant barriers to attaining horizontal equality in educational attainment. In particular, Tetteh-Baah (2019) finds that ethnicity remains a vital identity cleavage in Ivory Coast, Mozambique, and Nigeria. While religion is most important in Nigeria, other cleavages such as gender are important in Guinea.

Some of the solutions involve what Stewart and Langer (2008) refers to as targeted government interventions aimed at the vulnerable groups with regards to both human capital accumulation and economic disadvantage. Chetty et al. (2020) further suggests that interventions are not only aimed at resolving horizontal inequality but also in changing the intergenerational mobility process. Such interventions should be aimed at children and include mentoring programs for disadvantaged groups, levelling the schooling environment to ensure similar standards between poorer and more affluent regions, and integrating neighbourhoods/regions to reduce the importance of ethnicity. Careful domestication of such interventions is vital for African countries to attain equality of opportunities for all.

Our study can be extended in various ways. Firstly, future work could examine the theoretical and empirical mechanisms through which historical rank/unranked ethnic systems may be linked to current micro and macro country developmental features. Another possible avenue could be to explore gender, ethnicity and mobility in Africa, in line with the work of Alesina et al. (2021), Asiedu et al. (2021) and Azomahou and

Yitbarek (2020), and focus on how historical, ethnic gender-specific traits from the precolonial and colonial period can be linked to social mobility today. Finally, another possible line of work would be to relate political leaders' ethnicity and social mobility, examining how ethnic favouritism perpetuates horizontal inequality through its effect on the mobility process within countries over time.

Appendices

A

APPENDIX

A.1 DATA DESCRIPTION AND SELECTED DESCRIPTIVE STATISTICS

Table A.1: Construction of the Country Sample Size

Country	Sample	< 20 years of age		Missing education		Non-relative		Final Sample
	n	n	%	n	%	n	%	n
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cote D'Ivoire	36993	23190	63%	1449	4%	3738	10%	8616
Ghana	72512	36750	51%	953	1%	806*	1%	34003
Guinea	52579	30126	57%	326	1%	10462	20%	11665
Madagascar	54994	30511	55%	2966	5%	-	-	21517
Malawi	53531	24967	47%	2	0%	7725	14%	20837
Niger	22668	13537	60%	137	1%	-	-	8994
Nigeria	27591	14803	54%	185	1%	-	-	12603
Uganda	17241	10215	59%	2887	17%	-	-	4139

Notes:Columns (1) presents the full sample size of the survey. (2) and (3) show the proportion of individuals less than 20 years who are excluded from the final sample. Column (4) and (5) is the number of respondents missing their education information as well as those where both parental education information and education is missing. Column (6) and (7) presents the number of non-relative individuals that are excluded from the analysis in countries where language of the head of household was used to as an identifier of ethnicity. For Ghana*, it includes those whose ethnicity was not collected in the survey. Column 8 presents the final sample size used.

Table A.2: Descriptive statistics: Cote d'Ivoire (1985–87)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	Percentage of sample
Abron	3.85	0.34	0.02	102	0.88
Krou	0	1.2	0	5	0.04
We	2.74	0.81	0	146	1.26
Other Krou	2.16	1.05	0	70	0.6
Dioula	2.04	0.46	0.02	420	3.62
Malinke	2.82	0.76	0.1	484	4.17
Other Mande North	0.85	0.1	0	317	2.73
Dan/Yacouba	2.14	0.25	0.02	488	4.2
Gouro	1.28	0.09	0	469	4.04
Toura	3.93	0	0	10	0.09
Other Mande South	1.72	0.37	0.05	499	4.3
Agni	2.39	0.7	0.08	1,508	12.98
Senoufo	1.22	0.13	0.02	824	7.09
Koulango	1.97	0.13	0	84	0.72
Lobi	2.03	1.25	0	22	0.19
Other Voltanic	2.03	0.54	0.09	121	1.04
Burkina Faso	0.75	0.05	0	572	4.92
Mali	1.39	0.27	0.08	343	2.95
Guinea	1.46	0.48	0	135	1.16
Ghana	2.33	2.68	0	42	0.36
Senegal	1.88	0.68	0	39	0.34
Liberia	0	0	0	2	0.02
Baoule	2	0.34	0.08	2,117	18.22
Other African country	3.22	0.92	0.23	221	1.9
Laguinaires	7.1	2.22	0.39	322	2.77
Other African country	6	0	0	1	0.01
Other Akan	2.58	0.67	0.13	1,242	10.69
Bakwe	0	0	0	2	0.02
Bete	3.77	0.85	0.13	737	6.34
Dida	2.4	0.27	0.02	264	2.27
Godie	10.51	5.19	3.84	8	0.07

Source: authors' compilation based on LSMS data (World Bank).

Table A.3: Descriptive statistics: Ghana (2013)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	Percentage of sample
Akuapem	9.03	6.99	4.64	829	2.44
Akyem	9.14	6.57	4.36	887	2.61
Asante	8.68	5.92	3.51	3,312	9.74
Asen (Assin)	8.88	6.52	3.4	207	0.61
Boron (Brong) (including Banda)	7.68	4.27	2.22	1,635	4.81
Denkyira/Twifo	8.55	6.85	3.42	164	0.48
Fante	7.85	5.64	3.11	3,247	9.55
Kwahu	8.83	6.29	3.65	565	1.66
Nzema	8.12	6.01	3	399	1.17
Sefwi	7.93	4.86	2.24	428	1.26
Wasa	7.74	5.93	2.67	386	1.14
Ga-Dangme	6.46	3.02	1.38	219	0.64
Dangme (Ada, Shai, Krobo, Osudoku)	7.26	4.9	2.44	1,075	3.16
Ga	10.07	8.4	5.61	736	2.16
Ewe	7.88	5.39	2.87	4,132	12.15
Avatime, Nyongbo, Tafi, Logba	5.71	3.07	1.84	208	0.61
Gonja	4.36	1.65	0.42	522	1.54
Yeji, Nchumuru, Krachi, Nawuri, Bass	6.78	3.04	1.46	250	0.74
Bimoba	4.62	1.46	0.14	348	1.02
Kokomba	1.67	0.29	0.11	1,201	3.53
Basare(Kyamba)	4.73	2.12	0.52	239	0.7
Kotokoli	4.93	1.63	0.82	157	0.46
Builsa (Kangyaga or Kanjaga)	4.98	1.99	0.95	458	1.35
Dagarte (Dagaba), Lobi , Wali (Wala)	3.88	1.13	0.58	3,175	9.34
Dagomba	3.14	0.71	0.21	1,814	5.33
Kusasi	3.24	0.95	0.3	1,183	3.48
Mamprusi	3.6	1.49	0.47	407	1.2
Nankansi, Talensi and Gurense (Frafra)	4.92	1.39	0.5	1,324	3.89
Mosi	4.5	1.45	1.14	247	0.73
Kasena (Paga)	4.88	1.85	1.2	370	1.09
Sisala	3.79	1.25	0.82	882	2.59
Other Grusi (e.g. Lela, Templensi)	4.16	0.5	0.67	381	1.12
Busanga	3.81	1.03	0.55	296	0.87
Other groups	6.23	3.49	2.02	2,320	6.82

Source: authors' compilation based on LSMS data (World Bank).

Table A.4: Descriptive statistics: Guinea (2002)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	Percentage of sample
Fulani (Pular)	1.74	0.64	0.37	3,733	28.7
Soussou	3.51	1.84	1.14	2,935	22.5
Maninka	1.49	0.7	0.51	3,243	24.9
Toma/Lomagouwe	0.93	0.36	0.2	120	0.9
Kpelewo/Guerze	2.09	1.29	0.66	461	3.5
Kissi	2.27	0.53	0.4	253	1.9
French	6.32	3.36	2.47	2,177	16.7
Other	1.53	0.77	0.53	94	0.7

Source: authors' compilation based on LSMS data (World Bank).

Table A.5: Descriptive statistics: Madagascar (2005)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	percentage of sample
Antakarana	2.07	1.6	1.42	219	1.02
Antambahoaka	3.77	4.01	2.81	78	0.36
Antandroy	0.81	0.67	0.49	1,720	7.99
Antanosy	1.23	1.09	0.59	650	3.02
Antefasy	2.13	2.59	0.92	310	1.44
Antemoro	2.61	2.72	1.67	615	2.86
Antesaka	1.7	1.63	1.1	941	4.37
Arabo	3.62	3.17	3.17	14	0.07
Bara	0.48	0.79	0.45	852	3.96
Betsileo	2.1	2.59	1.79	3,480	16.17
Betsimisaraka	1.33	2.12	1.37	2,807	13.05
Bezanozano	2.75	1.89	1.67	85	0.4
Frantsay	3.28	5.6	2.99	4	0.02
Karana	3.92	4.05	3.15	22	0.1
Komoriana	3.23	2.36	2.65	64	0.3
Mahafaly	0.74	0.77	0.43	317	1.47
Merina	3.07	3.08	2.4	4,869	22.63
Sakalava	1.65	1.69	1.27	1,532	7.12
Sihanaka	2	1.76	1.19	774	3.6
Sinoa	4.75	7.21	5.68	9	0.04
Tanala	0.63	1.31	0.69	503	2.34
Tsimehety	1.79	1.36	0.85	1,289	5.99
Vezo	3.8	2.26	2.39	168	0.78
Other ethnic groups	1.48	2	1.29	195	0.91

Source: authors' compilation based on LSMS data (World Bank).

Table A.6: Descriptive statistics: Malawi (2017)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	Percentage of sample
Chewa	6.08	1.45	0.82	14,040	66.65
Nyanja	5.73	1.33	0.6	1,235	5.86
Yao	3.65	0.38	0.15	1,279	6.07
Tumbuka	8.28	2.54	1.44	1,771	8.41
Lomwe	4.59	0.7	0.35	364	1.73
Nkhonde	8.05	1.68	0.88	171	0.81
Ngoni	5	0.62	0.39	512	2.43
Sena	5.02	0.75	0.28	533	2.53
Nyakusa	4.86	1.05	0.4	51	0.24
Tonga	7.69	2.82	1.9	548	2.6
Lambya	7.54	1.6	0.88	121	0.57
Senga	6.75	2.34	0.91	8	0.04
Sukwa	6.94	1.14	0.98	81	0.38
English	15.51	12.19	9.97	41	0.19
Other ethnic group	6.43	1.64	0.71	311	1.48

Source: authors' compilation based on LSMS data (World Bank).

Table A.7: Descriptive statistics: Niger (2014)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	Percentage of sample
Arab	6.5	0.03	0.06	42	0.47
Djema/Songhai	2.84	0.72	0.37	2,452	27.26
Gourmantche	6.16	1.91	1.3	41	0.46
Haoussa	3.05	0.49	0.29	3,538	39.34
Kanouri-Manga	2.86	0.44	0.22	658	7.32
Peul	2.91	0.79	0.32	576	6.4
Touareg	2.23	0.44	0.22	1,334	14.83
Toubou	3.55	1.07	0.23	187	2.08
Other ethnic group	5.7	0.1	0.92	9	0.1
Foreign	7.36	3.36	1.79	157	1.75

Source: authors' compilation based on LSMS data (World Bank).

Table A.8: Descriptive statistics: Nigeria (2010)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	Percentage of sample
Hausa	4.69	4.01	3.28	3,222	25.57
Igbo	8.56	3.51	2.57	2,273	18.04
Yoruba	9.02	4.73	3.12	2,287	18.15
Ibibio	8.84	5.02	4.02	458	3.63
Ijaw	10.16	5.79	3.95	700	5.55
Fulani	5.22	5.52	5.16	186	1.48
Tiv	4.98	1.49	0.46	390	3.09
Edo	8.40	4.50	2.77	247	1.96
Others ethnic groups	5.89	2.84	1.53	2,840	22.53

Source: authors' compilation based on LSMS data (World Bank).

Table A.9: Descriptive statistics: Uganda (2013)

	Education (mean years of schooling)				
Ethnic group	Respondent	Father	Mother	Sample size	Percentage of sample
Baganda	9.36	7.87	5.95	618	14.93
Banyakole	7.04	4.9	2.36	520	12.56
Langi	6.74	6.14	2.04	434	10.49
Bagisu	7.27	5.69	3.17	232	5.61
Bakiga	5.84	4.57	2.04	200	4.83
Lugbara	5.9	4.89	2.09	183	4.42
Basoga	7.68	6.7	3.88	320	7.73
Banyoro	7.05	6.13	4.24	136	3.29
Iteso	7.08	5.98	2.66	334	8.07
Karimojong	1.97	1.59	0.19	80	1.93
Acholi	8.06	6.91	2.96	147	3.55
Alur	6.44	5.51	2.1	108	2.61
Batoro	7	5.43	3.01	172	4.16
Other ethnic groups	6.43	5.02	2.1	655	15.83

Source: authors' compilation based on LSMS data (World Bank).

A.2 ADDITIONAL ESTIMATION RESULTS AND SENSITIVITY ANALYSIS

Table A.10: Balance Table - French Vs. British Colonies

Variable	(1) Mean French	(2) Mean British	(3) French Vs. British
Education	2.313	6.786	4.472
	(3.963)	(5.551)	(0.069)
Parental Education	1.973	4.189	2.215
	(3.288)	(4.809)	(0.060)
Age	39.477	39.364	-0.113
	(15.278)	(15.466)	(0.205)
Household Size	8.074	7.043	-1.031
	(4.789)	(3.484)	(0.065)
Observations	50,792	70,978	121,770

Notes: Education is measured in years of schooling for respondents and their parents. Hhld size (no.) = household size measured in terms of number of household members. Source: authors' compilation based on LSMS data (World Bank).

Table A.11: Results from the Kitagawa-Blinder-Oaxaca Decomposition

	British Colonies	French Colonies	Difference
Years of schooling (Mean)	6.79	2.31	4.48
	(0.17)	(0.08)	(0.19)
Decomposition	Explained	Unexplained	
	3.37	1.1	
	(0.30)	(0.26)	

Note: Standard errors are in parentheses. Source: authors' compilation based on LSMS data.

Table A.12: Pooled country analysis: fathers and children - interaction model estimated

	Dependent variable: respondent education level y_t		
	(1)	(2)	(3)
Fathers education	0.467	0.504	0.426
	(0.020)	(0.020)	(0.022)
Ethnic capital	0.720	0.745	0.752
	(0.058)	(0.058)	(0.059)
Colony (British)	-0.534	-2.128	-2.126
	(0.613)	(0.616)	(0.638)
Fathers education*colony (British)	-0.037	-0.073	-0.095
	(0.028)	(0.028)	(0.029)
Ethnic capital*colony (British)	0.446	0.503	0.582
	(0.123)	(0.132)	(0.133)
Constant	-0.256	0.758	2.757
	(0.120)	(0.179)	(0.583)
Country FE	No	Yes	Yes
Controls for x	No	No	Yes
R^2	0.246	0.251	0.331
N	117452	117452	117422

Notes:Ethnic capital calculated as average human capital of parental ethnic group. Source: authors' compilation based on LSMS data (World Bank).

Table A.13: Pooled country analysis: parental average human capital - interaction model estimates

	Dependent variable: respondent education level y_t		
	(1)	(2)	(3)
Parental capital	0.553	0.594	0.505
	(0.026)	(0.027)	(0.030)
Ethnic capital	0.692	0.705	0.715
	(0.056)	(0.055)	(0.057)
Colony (British)	-0.209	-1.763	-1.798
	(0.597)	(0.609)	(0.623)
Parental capital*colony (British)	-0.065	-0.106	-0.137
	(0.036)	(0.037)	(0.038)
Ethnic capital*colony (British)	0.416	0.504	0.585
	(0.120)	(0.131)	(0.131)
Constant	-0.205	0.919	2.773
	(0.115)	(0.172)	(0.584)
Country FE	No	Yes	Yes
Controls for x	No	No	Yes
R^2	0.239	0.244	0.324
N	121769	121769	121738

Notes:Ethnic capital calculated as average human capital of parental ethnic group. Source: authors' compilation based on LSMS data (World Bank).

Table A.14: Country level estimations: Intergenerational transmission coefficients from fathers to children

Dependent variable: respondents' education level, y_t						
Variable	(1)	(2)§	(3)†	(4)	(5)§	(6)†
Cote d'Ivoire						
Parental capital	0.655	0.599	0.403	0.560	0.501	0.341
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Ethnic capital		0.853	1.258		0.952	1.208
		(0.10)	(0.07)		(0.09)	(0.07)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.118	0.145	0.291	0.210	0.242	0.363
Guinea						
Parental capital	0.484	0.416	0.311	0.428	0.361	0.269
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Ethnic capital		0.936	1.200		0.925	1.171
		(0.09)	(0.06)		(0.09)	(0.06)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.155	0.215	0.296	0.204	0.263	0.337
Madagascar						
Parental capital	0.584	0.555	0.514	0.571	0.544	0.503
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ethnic capital		0.500	0.608		0.486	0.604
		(0.08)	(0.07)		(0.08)	(0.07)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.230	0.238	0.256	0.237	0.245	0.263
Niger						
Parental capital	0.655	0.646	0.534	0.582	0.573	0.461
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)
Ethnic capital		0.977	0.994		1.016	0.976
		(0.18)	(0.07)		(0.19)	(0.07)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.147	0.154	0.237	0.221	0.228	0.308
Ghana						
Parental capital	0.488	0.391	0.362	0.425	0.305	0.275
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ethnic capital		0.577	0.616		0.669	0.693
		(0.03)	(0.02)		(0.02)	(0.02)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.262	0.315	0.335	0.339	0.405	0.426
Malawi						
Parental capital	0.577	0.544	0.434	0.487	0.455	0.348
	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
Ethnic capital		0.946	0.813		0.893	0.783
		(0.07)	(0.04)		(0.06)	(0.04)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.203	0.225	0.269	0.328	0.347	0.388
Nigeria						
Parental capital	0.474	0.431	0.399	0.369	0.321	0.278
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Ethnic capital		1.367	0.839		1.458	0.958
		(0.14)	(0.12)		(0.14)	(0.11)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.156	0.200	0.195	0.246	0.295	0.295
Uganda						
Parental capital	0.456	0.438	0.396	0.420	0.399	0.358
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Ethnic capital		0.873	0.712		0.909	0.713
		(0.22)	(0.09)		(0.22)	(0.09)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.226	0.236	0.273	0.284	0.295	0.330

Notes: Standard errors in parentheses; sample size: Cote d'Ivoire = 8,599; Guinea = 11,572; Madagascar = 20,712; Niger = 8,837; Ghana = 32,359; Malawi = 20,821; Nigeria = 11,899; Uganda = 2,453. § = Ethnic capital calculated as average human capital of parental ethnic group. † = Ethnic capital calculated as average human capital of parental ethnic group per region. Source: authors' compilation based on data.

Table A.15: Country level analysis: intergenerational transmission using parental average human capital

Dependent Variable: respondents' education level, y_t						
Variable	(1)	(2) §	(3)†	(4)	(5)§	(6) †
Cote d'Ivoire						
Parental Capital	1.063	0.975	0.658	0.910	0.819	0.561
	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Ethnic Capital		0.860	1.264		0.953	1.210
		(0.10)	(0.07)		(0.09)	(0.07)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.113	0.140	0.288	0.207	0.240	0.360
Guinea						
Parental Capital	0.510	0.438	0.327	0.451	0.380	0.280
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Ethnic Capital		0.948	1.207		0.936	1.180
		(0.09)	(0.06)		(0.09)	(0.06)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.152	0.214	0.294	0.199	0.259	0.334
Madagascar						
Parental Capital	0.739	0.709	0.663	0.727	0.698	0.651
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Ethnic Capital		0.403	0.536		0.396	0.535
		(0.07)	(0.06)		(0.07)	(0.06)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.258	0.264	0.279	0.265	0.270	0.285
Niger						
Parental Capital	0.897	0.891	0.741	0.795	0.787	0.636
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ethnic Capital		0.678	0.979		0.747	0.967
		(0.19)	(0.07)		(0.19)	(0.07)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.152	0.155	0.238	0.225	0.229	0.309
Ghana						
Parental Capital	0.605	0.496	0.460	0.531	0.390	0.353
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ethnic Capital		0.540	0.587		0.629	0.662
		(0.03)	(0.02)		(0.02)	(0.02)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.270	0.316	0.336	0.342	0.399	0.420
Malawi						
Parental Capital	0.762	0.719	0.584	0.646	0.603	0.467
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Ethnic Capital		0.890	0.788		0.844	0.764
		(0.07)	(0.04)		(0.06)	(0.04)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.217	0.236	0.279	0.335	0.353	0.393
Nigeria						
Parental Capital	0.536	0.487	0.446	0.410	0.352	0.297
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ethnic Capital		1.330	0.821		1.432	0.956
		(0.14)	(0.12)		(0.14)	(0.12)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.147	0.190	0.185	0.239	0.287	0.288
Uganda						
Parental Capital	0.527	0.503	0.444	0.490	0.472	0.410
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Ethnic Capital		0.340	0.610		0.267	0.590
		(0.14)	(0.06)		(0.15)	(0.06)
Controls for x	No	No	No	Yes	Yes	Yes
R^2	0.236	0.239	0.277	0.294	0.296	0.331

Notes: Standard errors in parentheses; sample size: Cote d'Ivoire=8,612; Guinea=11,664; Madagascar = 21,494; Niger = 8,967; Ghana = 33,899; Malawi = 20,823; Nigeria = 11,977; Uganda = 4,109. § = Ethnic capital calculated as average human capital of parental ethnic group. † = Ethnic capital calculated as average human capital of parental ethnic group per region. Source: authors' compilation based on data.

Table A.16: Logistic regression results - categorical education and parental education measures

Categorical dependent variable: respondent education y_t, (0, no education; 1, some education)						
	French			**British**		
	(1)	(2)§	(3)†	(4)	(5)§	(6)†
Parental Schooling						
No	1	1	1	1	1	1
Yes	1.554	1.375	1.232	0.983	0.887	0.522
	(0.083)	(0.079)	(0.076)	(0.140)	(0.139)	(0.141)
Ethnic Capital		0.446	0.572		0.676	0.595
		(0.039)	(0.028)		(0.068)	(0.064)
Controls for x	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
F	152.124	145.567	173.567	109.475	108.905	100.345
N	50783	50782	50737	70956	70956	70808

Notes: Standard errors in parentheses; § = Ethnic capital calculated as average human capital of parental ethnic group. † = Ethnic capital calculated as average human capital of parental ethnic group per region. Source: authors' compilation based on data.

Table A.17: Sensitivity Analysis - Pooled data results

	Dependent Variable: Respondent Education					
	French			British		
	(1)	(2)§	(3)†	(4)	(5)§	(6)†
Excluding Uganda						
Parental Capital	0.532	0.489	0.424	0.389	0.333	0.295
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Ethnic capital		0.709	0.869		1.242	0.877
		(0.05)	(0.04)		(0.12)	(0.10)
R-squared	0.226	0.248	0.288	0.261	0.302	0.305
N	50783	50782	50737	66817	66817	66699
Excluding Nigeria						
Parental Capital	0.532	0.489	0.424	0.433	0.352	0.304
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Ethnic capital		0.709	0.869		0.587	0.665
		(0.05)	(0.04)		(0.02)	(0.02)
R-squared	0.226	0.248	0.288	0.324	0.356	0.388
N	50783	50782	50737	58979	58979	58831
Excluding Uganda and Cote d'Ivoire						
Parental Capital	0.532	0.489	0.424	0.389	0.333	0.295
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Ethnic capital		0.709	0.869		1.242	0.877
		(0.05)	(0.04)		(0.12)	(0.10)
R-squared	0.226	0.248	0.288	0.261	0.302	0.305
N	42167	42167	42125	66817	66817	66699
Excluding Guinea, Malawi and Cote d'Ivoire						
Parental Capital	0.529	0.483	0.422	0.429	0.339	0.301
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Ethnic capital		0.714	0.855		1.232	0.873
		(0.06)	(0.04)		(0.12)	(0.10)
R-squared	0.227	0.252	0.287	0.260	0.301	0.304
N	33182	33182	33158	50119	50119	49985
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls for x	Yes	Yes	Yes	Yes	Yes	Yes

Notes: § = Ethnic capital calculated as average human capital of parental ethnic group.
† = Ethnic capital calculated as average human capital of parental ethnic group per region.
Source: authors' compilation based on data.

Table A.18: Country level analysis with urban-rural fixed effects: intergenerational transmission using parental average human capital

Dependent Variable: respondents' education level, y_t						
Variable	(1)	(2) §	(3)†	(4)	(5)§	(6) †
Cote d'Ivoire						
Parental Capital	0.608	0.557	0.372	0.428	0.381	0.322
	(0.029)	(0.031)	(0.030)	(0.031)	(0.033)	(0.030)
Ethnic Capital		0.876	1.214		0.886	0.995
		(0.107)	(0.065)		(0.098)	(0.058)
Guinea						
Parental Capital	0.466	0.396	0.299	0.287	0.253	0.229
	(0.019)	(0.020)	(0.019)	(0.017)	(0.017)	(0.017)
Ethnic Capital		0.931	1.176		0.658	0.778
		(0.084)	(0.051)		(0.055)	(0.048)
Madagascar						
Parental Capital	0.584	0.559	0.521	0.512	0.488	0.459
	(0.033)	(0.032)	(0.029)	(0.028)	(0.027)	(0.025)
Ethnic Capital		0.434	0.555		0.422	0.495
		(0.073)	(0.059)		(0.067)	(0.054)
Niger						
Parental Capital	0.625	0.620	0.516	0.399	0.397	0.366
	(0.028)	(0.028)	(0.026)	(0.023)	(0.023)	(0.024)
Ethnic Capital		0.654	0.981		0.503	0.724
		(0.185)	(0.067)		(0.175)	(0.093)
Ghana						
Parental Capital	0.485	0.395	0.366	0.375	0.268	0.257
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)
Ethnic Capital		0.538	0.612		0.600	0.618
		(0.026)	(0.022)		(0.023)	(0.022)
Malawi						
Parental Capital	0.576	0.545	0.443	0.383	0.360	0.346
	(0.015)	(0.014)	(0.013)	(0.015)	(0.015)	(0.014)
Ethnic Capital		0.925	0.797		0.773	0.649
		(0.063)	(0.037)		(0.051)	(0.046)
Nigeria						
Parental Capital	0.489	0.444	0.418	0.318	0.287	0.257
	(0.019)	(0.020)	(0.019)	(0.020)	(0.020)	(0.020)
Ethnic Capital		1.223	0.756		1.023	0.688
		(0.136)	(0.114)		(0.127)	(0.106)
Uganda						
Parental Capital	0.455	0.440	0.379	0.358	0.348	0.309
	(0.020)	(0.019)	(0.020)	(0.021)	(0.020)	(0.020)
Ethnic Capital		0.212	0.597		0.146	0.446
		(0.155)	(0.065)		(0.141)	(0.065)
Controls	No	No	No	Yes	Yes	Yes
Urban-Rural Fixed Effects	No	No	No	Yes	Yes	Yes

Notes: § = Ethnic capital calculated as average human capital of parental ethnic group. † = Ethnic capital calculated as average human capital of parental ethnic group per region. Source: authors' compilation based on LSMS data.

Table A.19: Interaction estimation with urban-rural effects: ethnic capital and intergenerational transmission coefficients in British and French colonies

	Dependent variable: respondent education level y_t		
	(1)	(2)	(3)
Parental capital	0.464	0.414	0.333
	(0.021)	(0.020)	(0.022)
Ethnic capital	0.695	0.608	0.620
	(0.057)	(0.047)	(0.050)
Colony (British)	0.094	-1.047	-1.072
	(0.577)	(0.525)	(0.533)
Parental capital*colony (British)	-0.019	-0.013	-0.035
	(0.028)	(0.026)	(0.026)
Ethnic capital*colony (British)	0.318	0.217	0.318
	(0.118)	(0.114)	(0.113)
Constant	-0.259	3.151	4.812
	(0.117)	(0.283)	(0.597)
Country Fixed Effects	No	Yes	Yes
Urban-Rural Fixed effects	No	Yes	Yes
Controls for x	No	No	Yes

Notes: Ethnic capital calculated as average human capital of parental ethnic group. Source: authors' compilation based on LSMS data (World Bank).

A.3 COLONIAL INSTITUTIONS AND ETHNIC CAPITAL: INSTRUMENTAL VARIABLE APPROACH

We checked for consistency of our results using the instrumental variables (IV) technique with religion-based historical and geographic instruments for ethnic capital. Specifically, we instrument for ethnic capital using missionary activity per region within a country as measured in 1923 by Roome (1925) and colonial period geographic variables as instruments.

The first instrument is country - and region-specific missionary activity, which was dependent on the colonial identity and was an important determinant of the spread of education in Africa, during the 19th and early 20th century, and subsequent differences in human capital skill development. Historically, the church has facilitated mass education in areas where it has established itself, and its operations can be viewed as a natural experiment. In effect, one of the key determinants of long-run differences in human capital in colonized countries has been the work of missionaries. Especially for African countries, the work of Protestant missionaries was cardinal in the spread of education within the colonies (Nunn, 2009; Woodberry, 2012, 2004). They were instrumental to the spread of mass education because of their motivation that the native population be able to read the scriptures and took particular interest in educating indigenous leaders and religious teachers (Gallego and Woodberry, 2010; Woodberry, 2004). They were also key in the creation of native languages and have been cited as the originators of the ethnic group classifications in Africa (Chimhundu, 1992; Ranger, 1985; Vail, 1989). In addition, they translated the Bible into the local dialects to increase conversions of the native populace, and this helped to foster mass education in the colonies. Such missionary activities are believed to have long-lasting impacts on education in modern Africa through human and social capital externalities.

We also use historical colonial period geographic variables such as distance from the coast, mean precipitation and elevation from sea level, and natural resources as additional instruments. Such geography variables have been identified among the factors that increased the probability of having European settlers and/or mission location being established and hence may be considered to have indirectly influenced current human capital outcomes, without being directly influenced by unobserved variables that are important for current individual human capital accumulation (Alesina et al., 2021; Nunn, 2009; Waldinger, 2017). Their *indirect* effects on current economic outcomes through past interactions is well acknowledged in economic development literature. Acemoglu, Johnson, and Robinson (2001), for instance, argue disease-prone environment may have a role on economic growth through the effect on mortality rate and the subsequent impact on colonial settlement, which in turn determines the type of institutions colonizers implemented. In estimating the influence of economic diversification on financial development, Ramcharan (2013) instruments economic diversification with geography variables, which, he argues, has a vital influence on transaction and transportation costs within a country. The instruments are obtained from the mid-1930s and include the distance from the coast, elevation and precipita-

tion of the area, and presence of natural resources within a region (see below for a detailed discussion on the geographic instruments).

The IV model

In estimating the IV model, we apply the two-stage least squares estimation technique on the following:

$$y^k_{ij,t} = \beta_0 + \beta_1 y^k_{ij,t-1} + \beta_2 \bar{y}^k_{j,t-1} + \mathbf{fi}_3 \mathbf{x}^k_{ij,t} + \varepsilon^k_{ij,t} \tag{A.1}$$

$$\bar{y}^k_{j,t-1} = \gamma_0 + \gamma_1 ML^k_{j,t} + \gamma_2\ GEOG^k_{j,t} + \nu^k_{j,t} \tag{A.2}$$

The variables for Equation (A.1) are as defined in Equation (2.2). The variable ML in Equation (A.2) represents the presence of a mission station per locality within a country as captured by Roome (1925), while $GEOG$ are the historic regional geographic control variables.[1] The error terms, $\nu^k_{j,t}$ and $\varepsilon^k_{ij,t}$, are assumed to be uncorrelated with mean zero and constant variance. We check for instrument relevance using correlation analysis and from the first-stage results. While instrument validity is more difficult to measure than relevance, we apply below different approaches to deal with that.

Relevance of the instruments

We check for the relevance of the instruments using both correlation analysis and first-stage results. Correlation analysis shows that our instruments are sufficiently relevant (see Table A.20). When we look at the first-stage results presented in Table A.21, regression of ethnic capital on the instruments and covariates shows that our instruments are strong based on their F-statistics.[2] We find, for former British and French colonies, locations where both Catholic and Protestant missions was recorded in 1923 show a significant and positive association with human capital levels of different individuals. The results show that the effect is higher in locations where both protestant and catholic mission stations were located than where only one was located or where there was no mission station, in line with the extant literature on the subject (see for example Woodberry (2012, 2004)). A positive and significant association is also found between the geographic instruments and the endogenous variable in the former colonies, with the exception of distance to the coast, which is negatively related. In line with Alesina et al. (2021) who posits that distance to the coast can be linked to educational outcomes through European presence and associated investments, we expect that the more distant to the coast an ethnic group resides, the lower the educational outcomes and hence ethnic capital. For the French colonies, we obtain an insignificant result, possibly reflecting less European presence/economic activity and weak linkages between distance to the coast and human capital outcomes.

1 We use the logged form of distance to the coast to stabilize the variance within the variable.
2 Survey weights and survey designs are taken into account in the IV estimation.

Table A.20: Pairwise correlation coefficients.

	Ethnic Capital	Elevation	Precipitation	Distance to coast	Mission location
French colonies					
Ethnic Capital	1.0000				
Elevation	0.1965	1.0000			
Precipitation	0.0843	-0.2057	1.0000		
Distance to coast	-0.0628	0.0845	-0.5437	1.0000	
Mission location.	0.1599	0.2964	0.3102	-0.7535	1.0000
British colonies					
Ethnic Capital	1.0000				
Elevation	-0.2740	1.0000			
Precipitation	0.4669	-0.4801	1.0000		
Distance to coast	-0.5601	0.6255	-0.5134	1.0000	
Mission location	0.2913	0.2986	-0.1065	-0.2888	1.0000

Notes: Ethnic capital calculated as average human capital of parental ethnic group. Source: authors' compilation based on LSMS data.

Results from the IV estimation

The IV results show that in former British colonies, ethnic capital has a significantly higher effect than in former French colonies when we use control variables and country fixed effects (columns 3 and 6 of Table A.21).[3] These estimates are higher than the previous estimations but consistent with the findings. This is in line with expectations as estimates from an instrumental variable regression tend to be higher than those from a least-squares estimation and is indicative of measurement error in the least-squares estimation.[4] It also implies that the least square estimation method may underestimate the persistence between the parental ethnic group and respondents, though the standard errors are much larger, which infers some loss in precision in the IV estimation. They do not change in effect when ethnic capital is defined as the average human capital of the parental ethnic group in each region. There is also higher persistence in education from parents to children in former French colonies than in former British colonies, just as we found from the least square estimations with marginal differences in the point estimates.

3 We also explore different specifications excluding Uganda, or Nigeria, or countries where language was used to identify ethnicity, and results are unchanged though the exclusion of Nigeria reduced the effect of ethnic capital.

4 Solon (1992) and Blanden (2009) find large coefficients from IV estimation compared to OLS and argue that for intergenerational mobility, under plausible assumptions, this may reflect the upper bounds of the true extent of intergenerational transmission.

Table A.21: Instrumental variables estimation: intergenerational transmission coefficients in British and French colonies.

	Dependent Variable: Respondent Education					
	French			British		
	(1)	(2)	(3)	(4)	(5)	(6)
Ethnic Capital	-0.462	0.725	0.735	3.032	3.227	3.512
	(0.260)	(0.151)	(0.154)	(0.244)	(0.249)	(0.265)
Parental education	0.535	0.505	0.487	0.405	0.407	0.290
	(0.019)	(0.019)	(0.020)	(0.021)	(0.021)	(0.024)
First Stage Results						
	Dependent Variable: Ethnic Capital					
Land elevation	0.617	0.951	0.947	-0.574	0.925	0.923
	(0.074)	(0.087)	(0.087)	(0.135)	(0.240)	(0.239)
Precipitation	0.773	3.852	3.891	0.861	3.728	3.801
	(0.402)	(1.540)	(1.534)	(1.268)	(1.378)	(1.367)
Distance to the Coast	-0.035	-0.104	-0.098	-0.253	-0.343	-0.346
	(0.033)	(0.058)	(0.057)	(0.046)	(0.050)	(0.050)
No mission location	0.111	0.102	0.109	-0.379	-0.403	-0.404
	(0.118)	(0.140)	(0.141)	(0.112)	(0.105)	(0.103)
Prot. miss. loc.	-0.823	-0.498	-0.499	-0.362	-0.580	-0.593
	(0.065)	(0.103)	(0.103)	(0.084)	(0.079)	(0.077)
Cath. miss. loc.	-0.016	0.061	0.062			
	(0.125)	(0.126)	(0.125)			
Controls	No	No	Yes	No	No	Yes
Country Fixed Effects	No	Yes	Yes	No	Yes	Yes
F-stat	148.226	226.505	164.277	101.527	491.098	336.720
N	50791	50791	50782	69845	69845	69823

Notes: Standard errors in parentheses.
Endogenous variables: respondent education level, ethnic capital. Exogenous variables: parental capital, ML, geographic variables, control variables. Ethnic capital calculated as average human capital of parental ethnic group. Base of the mission location variable in the first stage regression is the locations with both protestant and catholic mission stations. In the British colonies, we did not find any catholic mission stations without protestant mission stations in the region for the sampled countries.
Source: authors' compilation based on LSMS data.

Validity of instruments

As Cameron and Trivedi (2010) noted, the exclusion restriction that underlies instrument validity often relies more on theory from economics and precedent/norms set up in previously related empirical studies. We base the validity of our instrument on established norms, mainly following the work of Acemoglu, Gallego, and Robinson (2014), Woodberry (2012, 2004), and Woodberry et al. (2010), who trace the indirect effects of religious activity on current human capital accumulation. However, the va-

lidity of the instruments may remain suspect, given that the endogenous variables measure the same things as the dependent variable. Although missionary activities may have had long-lasting effects on Africa's education systems and have influenced parental education, those education systems may have also impacted children's education. We thus apply the method proposed by Conley, Hansen, and Rossi (2012) that allows us to relax the exclusion restriction and identify inferences that are consistent with "plausibly exogenous" instruments.[5]

Notably, following Conley, Hansen, and Rossi (2012), we estimate two complementary inference strategies using prior information about the instruments to check for the plausible exogeneity of the instruments by relaxing the exclusion restriction.[6] We first apply the UCI estimation technique and identify interval estimates for the endogenous variable for British and French colonies. We then use prior information about the distribution of potential values of the instruments and apply the LTZ estimation technique.

Union of confidence interval: γ prior support

The application of UCI requires specifying lower and upper bounds on the parameter γ based on prior information that consists of knowledge of the support of γ. Table A.22 below provides the lower and upper bounds, gmin and gmax, using prior information on the values of the parameter and expected direction of the bias. The lower bounds for missionary activity, elevation, and precipitation are all set to zero, whereas the upper bounds for the instruments are 0.94, 0.32, and 0.05, respectively. These variables are, in general, expected to have a positive influence on education, given existing estimation results in the literature. However, we expect distance to the coast to negatively influence education. The upper bound is thus set to zero, whilst the lower bound becomes -1.233.

Table A.22: Values of the lower and upper bounds - UCI

Instrument	Gmin	Gmax	Expected direction (education)
Missionary activity	0	0.94	Positive
Elevation	0	0.32	Positive
Precipitation	0	0.05	Positive
Distance to the Coast	-1.233	0	Negative

5 We thank one of the referees for pointing out these to us.

6 Relaxation of the exclusion restriction assumption means that the classical IV system could be rewritten as a system of $y = x\beta + z\gamma + \epsilon$ and $x = z\omega + v$ where y, x and z represent the outcome, interest endogenous and instrumental variables respectively. Imposing a strong prior that $\gamma = 0$ implies the exclusion restriction precisely holds and results in point estimates for the interest parameter β. One procedure implemented by Conley, Hansen, and Rossi (2012) is to relax the exclusion restriction with minimum and maximum bound, $[\gamma_{\min}, \gamma_{\max}]$, and produce confidence intervals on β for models within the range, which they name the union of confidence interval (UCI). An alternative is to make a distributional assumption about γ and then calculate bound on the parameter β using the assumed distribution, which they refer to as the local to zero (LTZ) approach.

Concerning the rationale and sources of the bounds, for missionary activity, we used the coefficient estimate of the effect of protestant missionary activities in the early twentieth century (during the colonial period) on the schooling of individuals in 2005 from Acemoglu, Gallego, and Robinson (2014) as the upper bound (gmax). The coefficient, 0.94, was obtained from the first stage regression model of the cross country sample and controlled for the continent dummies (Africa, Asia or America), colonial origin (British or French) and different sources of the missionary data. We expect the general direction of the bias to be positive, as found in existing studies. For instance, Alesina et al. (2021) found a positive relation with estimates of between 0.2 and 0.4 for the effect of distance to a protestant or catholic mission on mobility, and Wantchekon, Klašnja, and Novta (2015) found that the presence of a colonial school in villages in Benin was correlated positively to second generation education attainment (coefficient estimate of 0.38 higher than villages with no colonial schools present). The size of the gamma may be less than or greater than the estimated bounds; we explore this variation in the sensitivity analysis.

The coefficient estimate of elevation was obtained from Nunn and Puga (2012) who examined the effect of terrain ruggedness, of which elevation is one of the measures, on African economic development. An estimated size of 0.32 was identified between elevation and development after controlling for other geographic variables. Alesina et al. (2021) also identifies a positive relationship between ruggedness and mobility, with an estimate of approximately 0.1. Hence, we expect the bias to be positive in our estimations.

We also expect a positive bias on the effect of precipitation on education. The estimate 0.05 for precipitation is obtained from the first stage regression results in Acemoglu, Gallego, and Robinson (2014), which capture the effect of the average temperature on years of schooling and is across region sample. Country fixed effects are used in the estimations and the coefficient represents the value of the upper bound (gmax).

We use the estimate of the effect of distance to the coast on development in Africa obtained from (Nunn and Puga, 2012) as the lower bound for gmin. Nunn and Puga (2012) identify a negative relationship between distance to the coast and economic development for Africa, with a coefficient estimates at -1.233. A negative bias is thus expected, and hence the value is used as the representation of the lower bound (gmin). Alesina et al. (2021) also identify a negative relationship between distance to the coast and education mobility (estimate of between -0.1 and -0.3).

Local to zero: γ prior distribution

Table A.23 provides the mean and variance of γ in the LTZ case, separately for French and British colonies. Whilst we centred γ prior at zero, N(0, σ^2), following Conley, Hansen, and Rossi (2012), we used information from the instruments to obtain the values for the variance as proxy values in the estimation. The prior information about the distribution of the potential values for the variance is colony specific, which is

identified from the covariance matrices. Later on, we consider uniform priors for γ with support $[0,+\sigma]$, $[0,+\frac{1}{2}\sigma]$ and $[0,+2\sigma]$ are assumed.[7]

Table A.23: Values of the mean and variance - LTZ

Instrument	French colonies		British colonies	
	Mean	Variance	Mean	Variance
Elevation	0	0.008	0	0.057
Precipitation	0	2.353	0	1.869
Distance to the Coast	0	0.003	0	0.003
Missionary activity	0	0.011	0	0.006

Results from the UCI and LTZ

The results are presented in Table A.24. We find that the UCI confidence interval for the true estimates of the endogenous parameter, in our case, the coefficient for ethnic capital, for French colonies is lower than that of British colonies, in line with our main results. Similarly, the LTZ results are much higher in the British colonies than in the French colonies, providing support with the assertion that ethnic capital may play a more important role in the mobility process in the former. Hence while our instruments are "plausibly exogenous", they may provide useful information.

Table A.24: Plausible Exogenous Test Results - Interval Estimates using UCI and LTZ methods

Dependent variable: respondent education level y_t					
	UCI		LTZ		
	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
French	-0.756	1.040	0.797	0.433	1.161
British	-0.888	3.610	3.303	3.051	3.555

Notes: The results show the estimates of the lower and upper bounds using Conley, Hansen, and Rossi (2012) union of confidence interval (UCI) and local to zero (LTZ) methods, following the implementation technique further developed by Clarke and Matta (2018). For the LTZ, Gaussian γ prior N(0, σ^2) is assumed.

Sensitivity analysis

We run more estimations varying the magnitudes of γ in both the UCI and the LTZ. In the first estimation, we double the values whereas, in the second, we halved them. Lastly, we run LTZ estimates using the prior that γ is uniformly distributed. The results for the former are presented in Tables A.25 and A.26, respectively. Our results are consistent in terms of the estimates for ethnic capital expectations for either British or French colonies. The estimates of the endogenous parameter for both the UCI and LTZ, in our case, the coefficient for ethnic capital, for French colonies are lower than

7 The qualitative results will not change with further variation of the priors.

that of British colonies, in line with our main results, though the confidence intervals are larger in size when we double the coefficients and smaller when the coefficients are halved. As shown in Tables A.27, similar qualitative results with the Gaussian priors are obtained using uniform priors for γ with support [0,+σ], [0,+$\frac{1}{2}\sigma$] and [0,+2σ].

Table A.25: Plausible Exogenous Test Results - Interval Estimates using UCI and LTZ methods, doubling the the coefficients

	Dependent variable: respondent education level y_t				
	UCI		LTZ		
	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
French	-2.198	1.172	0.797	0.297	1.297
British	-4.937	3.718	3.303	3.007	3.599

Notes: The results show the estimates of the lower and upper bounds using Conley, Hansen, and Rossi (2012) union of confidence interval (UCI) and local to zero (LTZ) methods, following the implementation technique further developed by Clarke and Matta (2018). For the LTZ, Gaussian γ prior N(0, σ^2) is assumed.

Table A.26: Plausible Exogenous Test Results - Interval Estimates using UCI and LTZ methods, halving the coefficients

	Dependent variable: respondent education level y_t				
	UCI		LTZ		
	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
French	-0.039	0.978	0.797	0.525	1.068
British	1.116	3.556	3.303	3.076	3.530

Notes: The results show the estimates of the lower and upper bounds using Conley, Hansen, and Rossi (2012) union of confidence interval (UCI) and local to zero (LTZ) methods, following the implementation technique further developed by Clarke and Matta (2018). For the LTZ, Gaussian γ prior N(0, σ^2) is assumed.

Table A.27: Plausible Exogenous Test Results - Interval Estimates using LTZ method, assuming the distribution of γ is uniform

Dependent variable: respondent education level y_t						
	σ		2σ		$\frac{1}{2}\sigma$	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
French	0.729	1.521	0.707	2.195	0.725	1.194
British	3.141	4.377	3.609	5.372	3.290	3.906

Notes: The results show the estimates of the lower and upper bounds using Conley, Hansen, and Rossi (2012) local to zero (LTZ) methods, following the implementation technique further developed by Clarke and Matta (2018). Uniform priors for γ with support [0,+σ], [0,+$\frac{1}{2}\sigma$] and [0,+2σ].

GEOGRAPHIC DATA SOURCES AND VARIABLE DEFINITIONS

1. *Geographic control variables*: the geographic variables were obtained from the AidData website (Goodman, S and BenYishay, A and Runfola, D, 2016). The specific variables are as follows:

   Elevation: average value of elevation above sea level in meters; data are sourced from Jarvis A. and Reuter,H.I. and Nelson, A. and Guevara,E. (2008).

   Precipitation levels: measured as the average precipitation in millimetres for the year 1930, which is during the colonial period for all the countries included in this study; data are sourced from Willmott, C.J. and Matsuura, K. (2001).

   Distance to the coast: refers to the mean distance from the coast for the country, measured in metres; data are sourced from Wessel, P. and Smith, W. H. F. (1996).

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Table A.28: Plausible Exogenous Test Results - Interval Estimates using UCI and LTZ methods

Dependent variable: respondent education level y_t					
	UCI		LTZ		
	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
French	1.157	1.415	1.286	-20.346	22.918
British	2.836	3.219	3.027	-20.660	26.715

Notes: The results show the estimates of the lower and upper bounds using Conley, Hansen, and Rossi (2012) union of confidence interval (UCI) and local to zero (LTZ) methods, following the implementation technique further developed by Clarke and Matta (2018). Confidence intervals for the "plausibly exogenous" UCI case are based on a support assumption implying that the true value of the endogenous variable is on average equal to zero. In the LTZ case, the distribution is assumed to be normal, with a mean equal to zero, and the gamma covariance, obtained from the covariance matrix, set between 0 and 71.972 to fulfill the matrix positive requirement.

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3

HISTORICAL AFRICAN ETHNIC STRATIFICATION SYSTEMS AND INTERGENERATIONAL TRANSMISSION OF EDUCATION

ABSTRACT

This chapter compares intergenerational persistence in education between ethnic groups in Africa based on historical class inequality systems that existed within the ethnic groups. The paper provides stylized facts on the correlations between intergenerational mobility within African countries and precolonial class systems. Results from a structural regression model based on individual-level survey data from six African countries reveals variation in intergenerational education persistence between groups based on the type of historical class system that existed. The study suggests that understanding intergenerational mobility within African countries should take into account historical ethnic inequality though we find that the pattern in persistence is not uniform across countries. Country specific colonial and immediate post-independence education policies are critical factors in understanding the evolution of intergenerational persistence of education from the precolonial to the contemporary period.

Keywords: Intergenerational Mobility, Education, Ethnicity, Precolonial period, Africa

JEL Classification: C21, I24, J62, N37

3.1 INTRODUCTION

There is a rich body of literature on social and economic inequality and its implications for economic development and conflict. At a micro level, social and economic inequality can result from differences in life chances and opportunities between individuals. Inequality can occur along various lines including age, gender, ethnicity and class. For Africa, evidence shows that contemporary inequality along class lines exhibits attributes of what pertained during the precolonial and colonial period (Diamond, 1987; Iliffe, 1981; Nafziger, 1988; Thomson, 2010).

That some characteristics of precolonial African culture and way of living have persisted over time and are relevant in understanding various aspects of modern African society has been demonstrated in the literature (Gakou, 1987; Michalopoulos and Papaioannou, 2013, 2020). In particular, Englebert (2000) and Gennaioli and Rainer (2007) and Michalopoulos and Papaioannou, 2013 found an association between precolonial centralization of ethnic institutions and contemporary development in Africa, with precolonial traits transmitted through already existing traditional systems. Therefore, the nature of the existing precolonial ethnic institution was important and it was easier to set up colonial administrative units for centralized tribes as opposed to the fragmented or decentralized groups. When applied to intergenerational mobility, Alesina et al. (2021) found no differences in persistence between successive generations when precolonial centralisation is taken into account. We build on this literature by focusing on the precolonial and early colonial ethnic class stratification systems captured for the African societies by Murdock (1967).[1] The class inequality measure indicates the extent to which opportunities for upward mobility may have existed within these societies, and we examine whether there are linkages to patterns in transmission of education status across generations in contemporary Africa. This builds upon the work done in Chapter 2 where we examined the role of colonial origin and ethnic capital in understanding intergenerational mobility for African countries. We found that ethnic capital played an important role in the mobility process but we did not examine whether specific ethnic group characteristics from the precolonial period may explain the persistence and how this affects within country estimates of mobility, the focus of this Chapter.

To conduct the analysis, we use the ethnographic data to categorize the ethnic groups into five main groups. They are classified as either Elite, Dual, Complex, Wealth Distinct or Absence amongst Freemen. Elite refers to societies where an elite class was in existence and controlled land and property while Dual societies were those stratified into a hereditary aristocracy and a lower class. Complex societies were societies with clear social classes derived from the different occupational statuses while Wealth Distinct had class distinctions which were non-hereditary but based on

1 The updated and digitalized version of the ethnographic atlas is available at Murdock, Blier, and Nunn (2010). Cross-validation of class stratification systems captured in the ethnographic atlas was done by cross-checking the Human Resource Area Files database housed at Yale university for the cultural set up and stratification systems for selected ethnic groups. More information on this is provided under the ethnographic data description (section 3.3).

property. No significant class differences characterized the Absence amongst Freemen society (Murdock, 1967; Murdock, Blier, and Nunn, 2010).[2] we group these further into two types of societies based on my interpretation of the classifications: Those in which personal efforts could lead to movements between the social classes, fluid societies (Absence among freemen, Wealth Distinct and Complex societies), and those where hereditary factors may have played a major role in status, rigid societies (Elite and Dual societies).[3] Because there are more ethnic groups identified in the contemporary household surveys in Africa than are recorded in the ethnographic data, we include these in a separate category, labelled other ethnic groups, and also differentiate them from those of European origin.[4] We differentiate those of European descent because previous work has shown that human capital developments are different for the settler populations in the colonized states.[5]

To achieve the objectives, we first utilize country level intergenerational mobility estimates from the World Bank, Global Database on Intergenerational Mobility (GDIM), to graphically observe patterns between intergenerational education persistence in African countries and historical class systems based on the dominant type of society in each country. We then estimate a structural regression model using cross-sectional household survey data for six African countries, Ghana, Guinea, Madagascar, Malawi, Niger and Nigeria, with a combined sample of 110,184 individuals. These countries are selected because they provide relatively comparable data, from the Living Standards Measurement Study (LSMS) surveys, and we are able to identify parental education and individual ethnicity. The regression results are complemented with standard mobility and transition matrices.

Stylized facts from the graphical exploration suggest that geographic differences between regional blocs in Africa, combined with colonial origin may play a role in determining whether countries dominated by rigid societies have high levels of persistence and vice versa for fluid societies. The regression results reveal differences in intergenerational persistence based on the historical class stratification system in which the various ethnic groups fall into. This difference is statistically significant in three of the six countries, namely Ghana, Malawi and Madagascar. While there are differences in persistence amongst all ethnic classifications in the sampled countries, intergenerational persistence in education between groups is not significantly different in Guinea, Nigeria and Niger. Pooled regression results show that intergenerational persistence is higher in groups which were historically more fluid while there is lower persistence among the Dual (and Foreign) group. These results are robust to the different controls introduced in the model and different specifications.

2 A detailed discussion of the class stratification's as reported by Murdock (1967) is presented in section 3.3

3 Complex societies are categorized as fluid because based on their definition in the ethnographic atlas, class membership was not hereditary and it is inferred that it was possible to move between classes given sufficient personal effort.

4 Ranger (1985) and Thomson (2010) discuss the creation of new ethnic groups in African society during the colonial period which did not exist in the precolonial period.

5 Summerhill (2010) and Engerman and Sokoloff (2005) discuss the long term human capital differences between colonialists and the colonised population.

Historical class systems can be linked to intergenerational mobility in contemporary Africa through uneven distribution of opportunities for progression during the colonial period. These opportunities, which were through higher prospects of getting Western education or employment positions in colonial administrative offices were largely determined by social status. This mechanism is identified from existing literature which shows that during the colonial period, predominantly, the main beneficiaries of opportunities were those with higher status in the society as opposed to the peasantry (Nafziger, 1988). A description of various mechanisms through which status may persist is provided by Mare (2011) and Piketty (2000) and include credit market constraints, genetic transmission of characteristics, neighbourhood effects and government policies. In this paper, we apply the theory of social capital proposed by Bourdieu (1986) and extended to social networks by Lin (2008) to explain how status may carry on across generations from precolonial Africa and highlight the extent of historical persistence.

The main contribution of the paper is the demonstration that precolonial and early colonial period African class societal traits may be an important feature in understanding intergenerational mobility evolution between ethnic groups for the countries included. This is a relatively unexplored area of the literature and we are not aware of any studies that attempt to study precolonial class societies and mobility. This study adds to two main strands of existing literature. Firstly, by discussing historical African class societies and linking it to modern societal traits, the paper relates to literature which examines the effect of past significant episodes and institutions, such as slavery, precolonial and colonialist institutions, on contemporary societies (Acemoglu, Johnson, and Robinson, 2001; Archibong, 2018; Englebert, 2000; Funjika and Getachew, 2022; Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013, 2016, 2020; Nunn and Wantchekon, 2011). Englebert (2000) argues that state capacity and growth in Africa can be explained by the interaction of postcolonial state institutions and pre-existing traditional institutions. Acemoglu, Johnson, and Robinson (2001), in their seminal work, link colonization policies to differences in institutional development and growth while Gennaioli and Rainer (2007) and Michalopoulos and Papaioannou (2013) and Michalopoulos and Papaioannou (2016) studied how precolonial centralization and the scramble for Africa relates to economic development in Africa. Nunn and Wantchekon (2011) provided a causal framework through which the slave trade led to the origin of mistrust in Africa while Archibong (2018) argued that the interaction between traditional leaders and colonial officers during the colonial period is key to understanding persistent inequality in Nigeria. A survey of recent literature on the colonial and precolonial institutional legacies for African economy and polity is provided in Michalopoulos and Papaioannou (2020).

The contribution of this paper is also in line with similar work which show persistence of historical privileges across multiple family generations (Adermon, Lindahl, and Palme, 2016; Clark, 2012; Lindahl et al., 2015). By focusing on intra group mobility and historical persistence, this study is related to work done in India by various researchers on different mobility levels for the different caste and religious groups whose existence pre-dates the colonial period of the nation (Asher, Novosad, and

Rafkin, 2018; Azam and Bhatt, 2015; Hnatkovska, Lahiri, and Paul, 2013; Jalan and Murgai, 2008). Intergenerational mobility studies which use phenotypic characteristics as a measure of ethnic grouping are the focus of research done in the United States by Chetty et al. (2020) and for South Africa by Nimubona and Vencatachellum (2007) and Kwenda, Ntuli, and Gwatidzo (2015). This literature abstracts from group based mobility on the basis of ethnic groups identified using the social and cultural criteria and we add to this literature in this respect. The discourse on class and intergenerational mobility also relates to existing studies by Savage et al. (2013) for Britain and Dalle (2018) for Argentina.

The rest of this paper is organized as follows: Section 3.2 provides a discussion of African social groups and changes in the class structure from the precolonial period to date. The objective is to highlight the mechanisms through which linkages from the pre to post colonial Africa which are relevant for intergenerational mobility can be understood. The ethnographic data and graphical exploration is provided in section 3.3 while the empirical methodology and survey data are presented in section 3.4. Section 3.5 presents and discusses the study results while section 3.6 provides a summary of the findings and concludes.

3.2 AFRICAN STRATIFICATION SYSTEMS, ETHNICITY AND INTERGENERATIONAL MOBILITY

3.2.1 *Evolution of African Societies and Social Class Structures*

Social stratification systems are a mainstay around which societies have developed over time. They are usually discussed in the context of class and in this regard, Karl Marx is considered as the pioneer of its development. A key aspect of Marx's work is that he ignores the issue of how other variables such as gender, ethnicity and social status interact with issues of class and his theoretical set up has been criticized as not being readily applicable to African society by, amongst others, Gakou (1987) and Thomson (2010). The work of Max Weber provides a more suitable framework of understanding social stratification in Africa. Weber conceptualises political power, social status and class power as the basic dimensions of social stratification. Weber recognises that these dimensions are not necessarily synonymous and hence an individual may have a significant level of social status based on ethnic group belonging but may not necessarily be wealthy (class power). Weberian stratification theory is therefore multi-dimensional, unlike Marxist theory, and this enables it to analyse both class and non-class bases of inequality (Saunders, 2006; Scott, 2014).[6] We employ the Weberian framework in understanding how class differences may be perpetuated within ethnic groups over successive generations through persistence of status across generations.

The discussion that follows provides an overview of the social stratification systems in Africa and advancement opportunities over three periods: precolonial, colonial and postcolonial periods.

6 Saunders (2006) provides a comprehensive review of Marx versus Weber theories of social stratification

Precolonial Africa - Post 1850

A body of work has developed on the type of society that existed in precolonial Africa. This work developed across several decades, from as early as the 1950s, and is driven by the notion that by understanding the history of the African society, we can contextualize the current challenges and suggest appropriate remedies for the future. A summary of some of the literature in this field is provided by Gakou (1987). Using the village community as the basic organisation unit, the general agreement is that African societies had progressed beyond primitive communism and moved into a class society, with factors such as slavery, payment of tributes to chiefs and intercontinental trade playing various roles. Some researchers, such as Suret-Canale (1970), cited in Gakou (1987), situate the analysis following the Asiatic mode of production outlined by Marx and Engels and stress the importance of geographic conditions in the development of class societies, with savanna regions which were agricultural in nature lending themselves more to social conflict than other areas. Other authors argue against the use of the Asiatic mode of production and define an African mode of production that takes into account factors specific to Africa, for example the communal ownership of land (Coquery-Vidrovitch, 2010; Gakou, 1987; Thomson, 2010).[7] A distinction arises when discussing precolonial ethnic groups which were centralized or territorial organizations from those which were more or less tribal and lineage structures based on families. The so called 'state societies' were more organised and the trade network was more advanced and this would lead to development of social classes which were more apparent as opposed to stateless societies (Coquery-Vidrovitch, 2010; Gakou, 1987). Englebert (2000) and Gennaioli and Rainer (2007) and Michalopoulos and Papaioannou (2013) provide a discussion on precolonial African centralization versus decentralization and outline a basic structure of how the society operated under those conditions.

Discussions on the mode of production leads us to focus on the question of what type of social stratification existed in precolonial Africa. Nafziger (1988) positions that class and major wealth and power inequalities existed in Africa before colonial rule. For example, in precolonial Rwanda, the Twa were ranked lower than the Tutsi or Hutu, and the powerful and wealthy elites in the society frequently used oppression and terror in their dealings with them. Others point to the ownership of land communally as key to understanding precolonial Africa. Iliffe and John (1987) highlights the role of occupation as a determinant of status in precolonial African society, and identifies social stratification in existence even amongst slaves. This is in line with work of Murdock (1967), Nafziger (1988), and Wright (1999) and Thomson (2010) who show that different class structures were in existence during this period. These class structures were closely related to the social status an individual was accorded, and

7 A discussion of the African mode of production which is based on a patriarchal-communal economy and exclusive dominance of one group in long distance trade, as opposed to Asiatic mode of production which supposes villages based on collective production and bound to a state/ despot who exploits the community can be found in the work of (Coquery-Vidrovitch, 2010)

sometimes linked to occupation.[8] The class structures also included the beneficiaries from the slave and intercontinental trade that existed then. Indeed, it was easier for the elites in the precolonial days to transmit their wealth, opportunity, power and privilege to their children and the class system captured via the ethnic classifications by Murdock (1967) supports this line of thought.

The colonial period

The colonial period radically transformed African society. Nnoli (1998) notes the major changes in Africa which included the setting up of new institutions and the formal introduction of capitalism. The introduction of education and formal jobs in the colonial administration also led to the emergence of new social classes in Africa during this period. However, a level of continuity in terms of the social stratification system from the precolonial period exists when we look at which Africans were able to access new opportunities that emerged. The literature shows that the main beneficiaries during the colonial administration were those who were within the periphery of power, or in the 'upper' classes during precolonial times. Nafziger (1988) notes that the main recipients of the Western education and training essential for positions in the administrations, commerce and foreign firms came from the families that had higher status or incomes, with some exceptions from poorer backgrounds. In this way, the colonial period amplified existing inequalities and class divisions which originated in the precolonial period. These inequalities would then continue into the postcolonial period.

Western education opportunities during the colonial period were mainly meant for the provision of skills needed for the colonial administration and some parts of the society, for example women, were excluded from accessing it. Class comes into play as the British and French provided excellent education for children of elites (especially chiefs and aristocrats). For example, in 1953, almost all of the families accessing education in Ghana had an annual household income of over 250 pounds in a country where the average annual income was below 100 pounds (Nafziger, 1988). This implies that education opportunities were mainly the reserve of those from wealthier families and peasant families may have been disadvantaged in perpetuity had missionaries not been allowed to undertake mass education. Generally, by collaborating and cooperating with the colonial administration system, traditional rulers and the ruling classes were able to maintain their higher class status and provide their children with more advancement opportunities. However, their ability to monopolize advancement opportunities was affected by the activities of missionaries.

Missionaries played a key role in the development of human capital and education system across the globe and in Africa during this period (Acemoglu, Gallego, and

8 Longman (2009) discusses traditional occupation distribution amongst the Ruanda and Rundi in precolonial times. Traditionally, there was strict division of labour along ethnic lines. The Tutsi raised livestock which was considered to be more prestigious, the Hutu were farmers and the Twa were the hunter gathers. In practice, the allocation of occupation was varied with some Tutsi farming and some Hutu raising livestock but attached status to the role remained with cattle ownership being an important element defining social class.

Robinson, 2014). Woodberry (2004) and Gallego and Woodberry (2010) give the main reason for mass education as the desire for natives to read the Bible and show how access to education differed between Protestant Missionaries and Catholics and also between British (mass education available for all) and French colonies (limited to the elite class). In Nigeria, by 1942, almost all students were enrolled in Mission schools and this included those from underprivileged backgrounds. In this way, missionary activity contributed to the emergence of the educated class and played a significant role in upward mobility. Kitching, cited in Iliffe (1981), postulates that in Kenya, differential access to western education and the resulting better-paid jobs enabled a small minority, the nascent petite bourgeoisie, to emerge during the colonial period.

The Post colonial period

Post colonial Africa has been integrated into the capitalist system though it still maintains some unique characteristics, mainly to do with land ownership which in some cases is still communally owned. African society are characterized by a fragmented class structures with new classes emerging after colonialism. Close inter-linkages exist among the ruling class with those who hold political power frequently able to increase their wealth and economic power. Indeed, Markovitz (1977) and Curtin et. al (1978) cited in Nafziger (1988), showed close ties between Nigerian military rulers and the Northern traditional aristocracy.

The interaction with the colonial administration is key to understanding the emergence of new classes in Africa and how the class system was maintained in the post-colonial era. Archibong (2018) documents how development in Nigeria differs based on how cooperative the traditional leaders were with the colonial administrators. She finds that in areas where there was resistance from the traditional rulers, there is poorer infrastructure than in those which were more cooperative. In the period leading to independence, policies were relaxed by the colonial administrators which enabled the African ruling elite to live in privilege similar to the colonialists and settlers. This elite, which included the newly educated groups, led the independence movement and occupied top position in the new states that were formed. The African ruling class in both rural and urban areas used their accumulated advantages of wealth and power to reproduce the class standing in subsequent generations through human and physical capital investments (Nafziger, 1988). Gore (1994) provides a review of literature on social exclusion in the post colonial period and discusses upward mobility after independence, with a recurring theme that it was biased in favor of selected groups and their succeeding generations emerging. He also discusses the finding of Hazelwood (1989) that family background was an important variable affecting probability of attaining education qualification, even when access to education was provided in postcolonial Africa.

Social groups from the precolonial period: linkages to contemporary Africa

In the preceding section, an overview is provided of the ways in which opportunities between individuals within Africa may have differed based on status across the different time periods. In this section, linkages in social classes across the three periods are explored to highlight commonalities. We mainly base the classification on the work of Thomson (2010) who provides a clear exposition of this topic. Three social classes can be identified from the precolonial period. These are peasants, commercial bourgeoisie (those who benefited from intercontinental trade), and the traditional rulers. More prestigious occupations during this period such as cattle ownership and farming may be located with the commercial bourgeoisie, but certainly above the peasant class. In the colonial period, additional social groups emerged due to new opportunities that became available including a proletariat (those in civil service occupations within the colonial administration), and the petite (minor owners of productive property) and bureaucratic (educated individuals) bourgeoisies.[9] During this period, the commercial bourgeoisie reduced in size due to the redistribution of land and trading activities to the colonial settlers and the importation of Indians to perform the role of trading (Nafziger, 1988). In Postcolonial Africa, peasant and traditional classes persist alongside new social groups such as informal sector and national bourgeoisies (this includes the military and academic groups). What is evident is that some precolonial groups in Africa have persisted to modern day with the addition of new classes as each 'shock' to the African society has occurred. Ethnicities from the precolonial period have also persisted and hence analysing social class stratification systems from the precolonial period may provide insights relevant for understanding African mobility.

A Congruence of Ethnicity and Class

One of the earliest works on ethnicity and class was from Gordon (1961). He develops a theory of the 'ethclass' which refers to societal stratification based on the intersection of the horizontal stratification of class and vertical stratification of ethnicity. In this case, Gordon discusses how belonging to a different class within an ethnic group influences the lifestyle, behaviour and as can be extended for this paper, the opportunity set available to an individual. While individuals still identify with other member of similar ethnic heritage, they associate more closely to individuals who share the same class and background, in this way affecting their network based opportunities. He argues that this is the best unit of analysis for understanding participation of individuals in American society, and we postulate that this can be extended to Africa where ethnicity remains a salient feature. As noted by Bates (1970), ethnic membership in Africa is one of the basic structures around which social and political activity

9 Kitching (1980) provides a good analysis of how the savings from those working in the colonial administrations were used to purchase property in rural areas in Kenya leading to the emergence of a new class, the petite

are organized, though ethnicity needs an intervening variable such as class (or region of residence/ organizational power) to become a significant variable.

This work is complemented by Horowitz (1985) who in his formative work on ethnicity develops a framework showing how ethnic groups and class coincide. In societies where ethnic group belonging and class coincide, he refers to these as ranked society and extends his analysis to the type of conflict that results from this as opposed to unranked society where social class cuts across ethnic groups. In particular, he notes that parallel ethnic groups usually originate from incipient whole societies and may have been autonomous whole states, which is a pivotal assumption we use for precolonial Africa. Ranked and unranked societies also have different implications for mobility as discussed by Blanton, Mason, and Athow (2001), and is a key distinguishing factor for British and French colonial administrations.

It is important to underscore reasons for analysis from an ethnic group perspective, rather than purely class, for Africa. Ethnicity in Africa has evolved from being considered as an objective phenomena (implying differences in culture) in precolonial days to being based on consciousness and forming a base for ethnic processes in colonial and postcolonial Africa (Jerman, 2003). In precolonial days, ethnic identity was more fluid and could change based on marriage, change of language or change in social status (Salamone, 1975; Wright, 1999).[10] That the colonial period led to increased ethnic conscious and the consolidation of ethnic group membership as an important means of identity has been agreed on by numerous scholars (Iliffe, 1979; Jerman, 2003; Ranger, 1985; Thomson, 2010). During the colonial period, ethnicity became a tool to access resources from the colonial state and this has continued in present day. This instrumentalist perspective is one of the main reason for the salience of ethnicity for Africa and has been identified as a key barrier to 'nation' building and development (Bates, 1970; Bayart, 1993; Easterly and Levine, 1997; Welsh, 1996). With reference to the constructivist proposition of fluidity of group boundaries, it can be argued that ethnic identity is stable over time and has been solidified in the postcolonial period. Ethnic groups have found ways of distinguishing between groups through the use of physical traits or names which are unique to the ethnicity and it has been institutionalized in some African countries by the inclusion of ethnic origin on identification documents. Caselli and Coleman (2013) further provide a formal theory of why ethnicity is a rational basis for coalition building (as a boundary enforcement device to limit access to or control of resources) especially in multi-ethnic societies, which is applicable for almost all African countries.

Esteban and Ray (2011) and Esteban and Ray (2008) develop a model which examines the relationship between within and across ethnic group inequality and conflict. A key aspect is the composition of ethnic societies along class lines. They use internal ethnic group class stratifications as the basis for explaining the synergies of ethnic conflict. Horowitz (1985) also notes that unranked societies are usually also internally stratified, with differing degrees of internal group mobility. This is the underlying

10 Wright (1999) finds evidence of individual class identification among the Gambian people in precolonial times. He discusses how an upward change of class led to a change in ethnicity from Mandinka to Soninke.

basis of this research. We examine whether precolonial ethnic stratification have implications for intra group mobility in contemporary Africa utilising the concept of the 'ethclass'. From the literature, various mechanisms can be used to understand how class and parental socio-economic status affects intergenerational mobility. These include credit constraints/market imperfections, differences in public good provision among social classes, the quality of the childhood environment, relative risk aversion and social capital (Becker and Tomes, 1986; Breen and Goldthorpe, 1997; Breen and Yaish, 2006; Chetty and Hendren, 2018; Corak, 2013; Lin, 2008; Stanton-Salazar and Dornbusch, 1995). Of these, we explore the role of social capital in understanding African persistence. Social capital is selected as it provides a well-defined mechanism through which privileges from the ethnic traditional structures from the precolonial period could have persisted.

Social capital refers to social connections from which an individual can potentially access support for education or job advancement. The mechanism proposes that children's education attainment is influenced through intergenerational transmission of social capital by the class level to which their parents belong to within their ethnic group. Accordingly, differences in networks and their embedded resources leads to disparities in quantity and quality of social capital, and people from lower class families tend to have less of it than those from middle or upper class (Lin, 2008; Stanton-Salazar and Dornbusch, 1995).[11] The use of parental social connections to affect life chances of their children is therefore arguably one of the main channels through which inequality if opportunity is maintained in the labour market (Dardanoni, Fields, and Roemer, 2006). This implies that even within ethnic groups which are considered to be dominant in a society, inequalities may persist if the individual primarily interacts with and has socially binding ties with those with similar levels of embedded resources.

3.3 ETHNOGRAPHIC DATA - HISTORICAL AFRICAN STRATIFICATION SYSTEMS

Information from Murdock (1967)'s Ethnographic Atlas is used to identify the class systems that existed from the precolonial to colonial period in Africa. Because there were no nation states in existence during that period, the ethnographic atlas captures the class systems within the ethnic groups which were representative of African states in that period. Murdock collected information from 1270 ethnicities worldwide, of which 834 were in Africa (Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013; Murdock, 1967). Using a wide variety of sources, he recorded the class stratification systems in 571 African societies and measured it as the type and level of class differentiation in existence within the ethnic group, excluding the purely political and religious statuses. He categorised them into five classes, namely, Elite, Dual, Complex, Wealth Distinct, and Absence among Freemen. Elite refers to societies where an elite class existed, who were differentiated from property less lower class, and controlled scarce resources and land. They had some similarities in terms of stratification

11 The criteria under which social capital is important for mobility is discussed further in Stanton-Salazar and Dornbusch (1995), Lin (2008) also proposes a social resource theory

to those classified as Dual which were societies stratified into a hereditary aristocracy and a lower class. Complex refers to societies with a complex stratification into social classes associated with significant differences in occupational status. Wealth Distinct refers to societies with status distinctions based on property owned but this had not materialized into distinguishable or hereditary social classes. Finally, in the Absence among Freemen societies, no significant class distinctions existed except for variations in individual repute based on skill or wisdom (Murdock, 1962, 1967). The distribution of the ethnic groups across Africa is shown in panel A of Figure 3.1.[12] There is a clear mix of the different types of societies though Dual and Elite societies were found predominantly in the desert areas of Mali, Niger and Algeria, as well as parts of Central and Western Africa while those classified as absence among freemen are spread across Eastern and Central Africa.

Table 3.1: Distribution of Ethnic Classification Systems in precolonial Africa

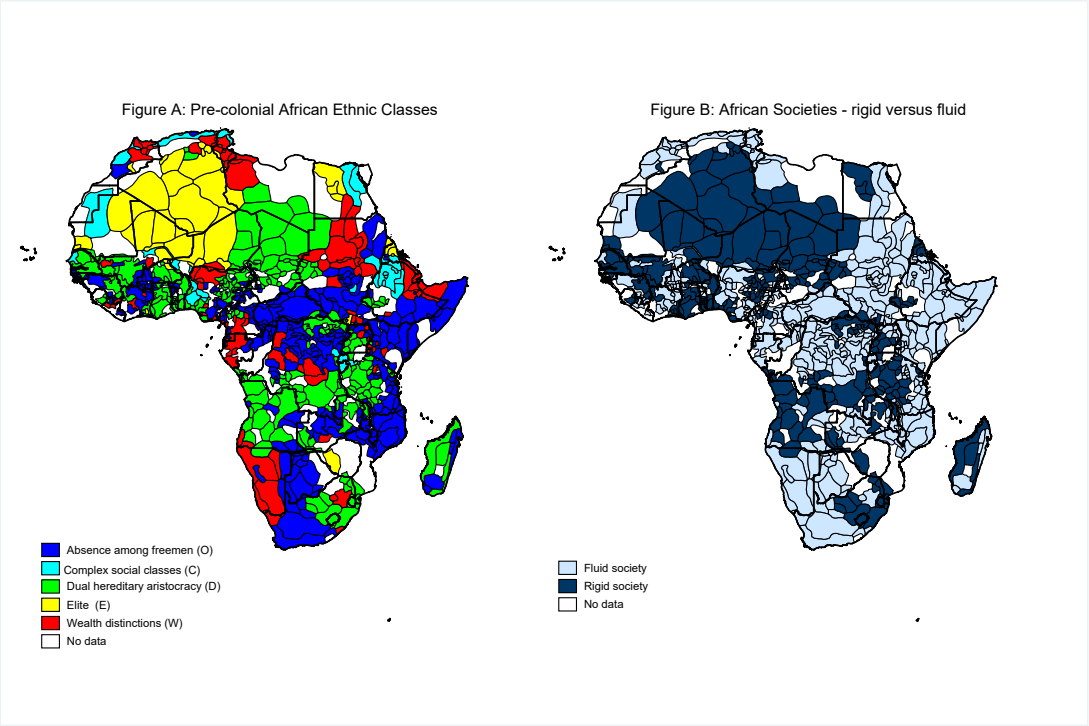
Class Stratification System	Type	Number of Groups	%
Class systems - Disaggregated			
	Absence among freemen	246	43
	Wealth distinctions	77	13
	Elite	48	8
	Dual	170	30
	Complex	28	5
Category of Society			
	Fluid Societies	353	62
	Rigid Societies	218	38
Observed societies			
	Recorded Societies (with class data)	571	68
	Missing Class Data	263	32

Fluid Societies: Absence among freemen, Wealth distinctions, Complex; Rigid Societies: Elite, Dual
Source: Authors computation from Murdock (1959, 1962, 1967)

As can be seen in Table 3.1, the majority of historical African societies were classified as absence among freemen at 43 percent while rigid societies with regards to social status progression (Dual and Elite) made up 38 percent. We further assigned the ethnic groups into two groups based on the stratification system that was present in the society. We assigned as fluid (equal) societies those which were classified as Absence among Freemen, Complex and Wealth Distinct. This is because the societal definitions indicate the absence of hereditary classes, with personal effort leading to changes in social status. We also categorized those in Elite and Dual groups as rigid (unequal) societies where circumstantial factors such as birth played a role in determining their eventual status. To develop the index of society type assigned to the country, we take into consideration the mean sizes of the local community for that period which was computed from census data or other evidence present during the time or recording and use the classification of the dominant group within the country

12 Distribution of the ethnic classification by country is provided in Table B.2 of the appendix.

Figure 3.1: Historical African Ethnic Class Stratification Systems



Source: Authors computation from Murdock, Blier, and Nunn (2010)

to classify it as rigid or fluid.[13] In some cases, there was no clear majority of the pre-colonial population, and these were assigned into a third category, mixed. To identify the country where the ethnic groups resided, we utilized the dataset of Michalopoulos and Papaioannou (2013) which links the ethnic tribes to the ethnographic atlas classification of Murdock (1959) and Murdock (1967) to their respective countries. As shown in panel B of Figure 3.1, the majority of African countries were dominated by fluid precolonial societies (62 percent), with the rest classified as either rigid or mixed.

Use of any historical database requires validation of the accuracy of the data collected. To that end, we cross validated Murdock's dataset with regard to the class systems by checking select ethnic groups against the Human Resource Area Files database housed at Yale university for the cultural set up and stratification systems.[14] In addition, previous researchers who utilized the Atlas cross-validated Murdock's database and found it to be a reliable source particularly for Africa where most of

13 For example, in Angola the Dual society were more in absolute numbers and had the largest recorded density of 200-399 per group when compared to the other classifications. Similarly, for Botswana, the more fluid classified societies were smaller (fewer than 50) than those with Dual societies who had 5000 to 50,000 members. Burkina Faso has numerous small equal societies but the majority were Dual (between 5000 to 50,000 members). This was also the case for Ghana and Nigeria. See the appendix for detailed country information

14 In particular, we examined the Yoruba, Songhai, Amhara and Nupe for their social organisation and to validate the classification system. For example, amongst the Yoruba, social status was determined by sex, age, descent group and wealth though emerging class distinction are along the lines of wealth, education and occupation (Barnes, 2009).

the ethnographic studies were conducted (Rijpma and Carmichael, 2016). Archibong (2018) found a 0.70 correlation between ethnicities identified on the Murdock's map and their location in 2008-2012 using the Afrobarometer surveys. Michalopoulos and Papaioannou (2013) also validated the database as correctly identifying jurisdictional hierarchies in precolonial African ethnic groups and argued that any inherent subjectivity would not weaken justification of using the data given that the bias was not systematic. In terms of the spatial distribution, Nunn and Wantchekon (2011), also using the Afrobarometer survey shows that ethnic groups are still occupying the same regions as in precolonial days and found a correlation of 0.55 between the location of precolonial ethnic groups as recorded by Murdock and where they are residing and also notes that there is a move towards returning to the homeland amongst Africans. It is important to note that though this dataset provides ethnographic data of African societies and has been used as a snapshot of precolonial Africa, it contains observations collected over a period of time ranging from 1830 to 1960, with around half from before 1920. Therefore, It may not be completely accurate to use it as a representation of only the precolonial period Henderson and Whatley (2014). However, to the extent that the number of Europeans involved in administration of the colonies was limited, we argue that it still correctly portrays the different traditional systems that were historically in existence (Herbst, 2014).[15]

3.3.1 *A graphical exploration - intergenerational Education Persistence in Africa and precolonial Society: Some Stylized facts*

We use data from the Global Database for Intergenerational Mobility (GDIM) collected by the World Bank for 148 countries worldwide and standardized for regional comparison, to provide a general representation of the linkage between the type of society that existed in the precolonial periods and intergenerational persistence in Africa. The GDIM collects information for 41 of the 52 Sub-Saharan African countries, and uses both retrospective and co-resident information to compute the intergenerational persistence (GDIM, 2018). [16] Education attainment is measured in terms of years of schooling. For the analysis, the focus is mainly on those in the 1980 birth cohort, though mobility patterns are also provided for those in the 1940 and 1960 birth cohorts. Based on the above categorization of the countries as fluid or rigid, we develop the following assertions:

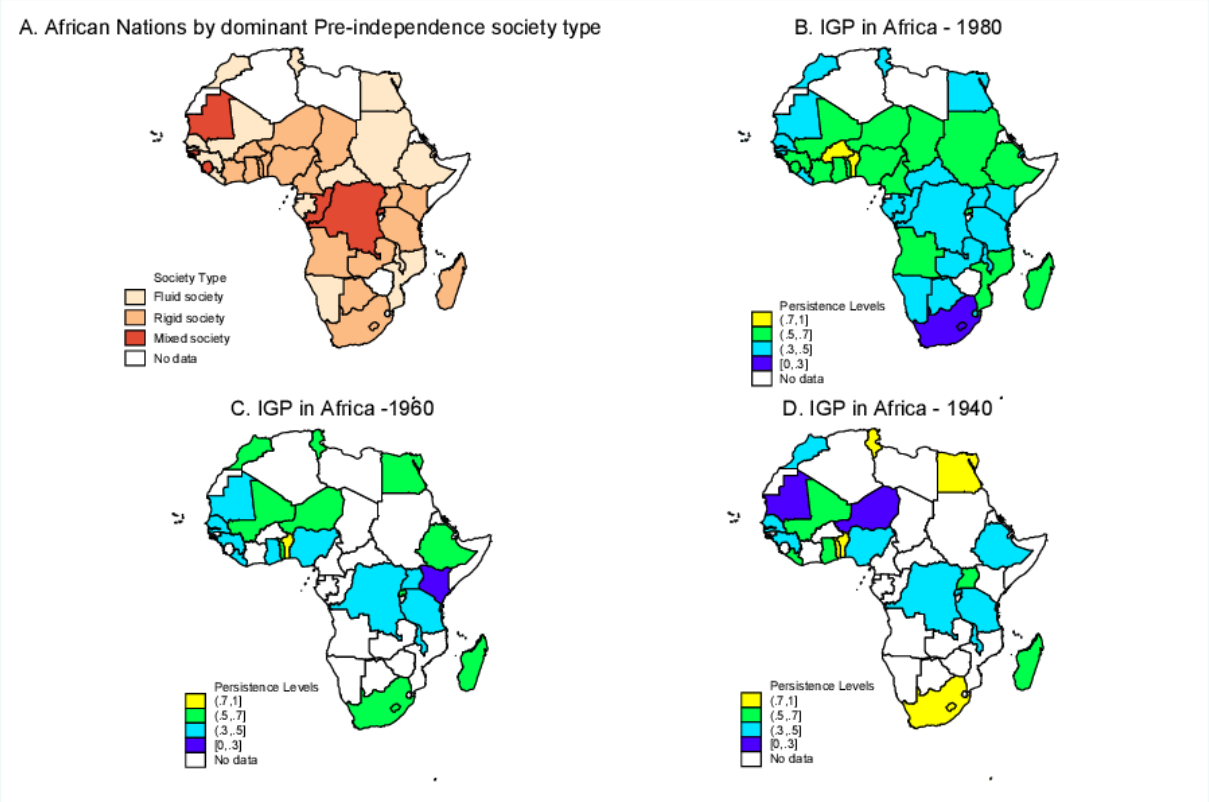
Fact 1: East and Southern African countries previously colonised by Britain have lower intergenerational persistence in education irrespective of precolonial society characteristics; West African societies which were rigid have high persistence irrespective of colonial origin.

15 Henderson and Whatley (2014) provide a discussion on the time duration of the ethnographic atlas and its possible implications.

16 Though the focus of this article is on Sub-Saharan African, Egypt, Djibouti, Morocco and Tunisia are included which are from North Africa because some of the ethnic groups for which information was collected by Murdock (1967) and linked to countries by Michalopoulos and Papaioannou (2013) are split into these countries

From Figure 3.2, it can be seen that in East and Southern Africa, intergenerational persistence in the 1980 birth cohort is lower than in Western Africa. This is with the exception of the two former Portuguese colonies, Angola and Mozambique. This observation is in tandem with arguments that geographic location of African countries have implications for development, as argued by Gallup, Sachs, and Mellinger (1999), albeit in this case through persistence in education. It also points to an association between colonial origin and intergenerational mobility for African countries as Angola and Mozambique were previous colonies of Portugal while the rest were British colonies. For West African countries, those dominated by rigid precolonial societies have high intergenerational persistence. This is the case even for former British colonies like Ghana and Nigeria. This shows that in these countries, precolonial African rigidities have resurfaced despite high mobility levels observed among the 1940 and 1960 birth cohort. It also indicates that factors driving mobility may be different for the geographic blocs on the continent.

Figure 3.2: Intergenerational education persistence in Africa and historic society type



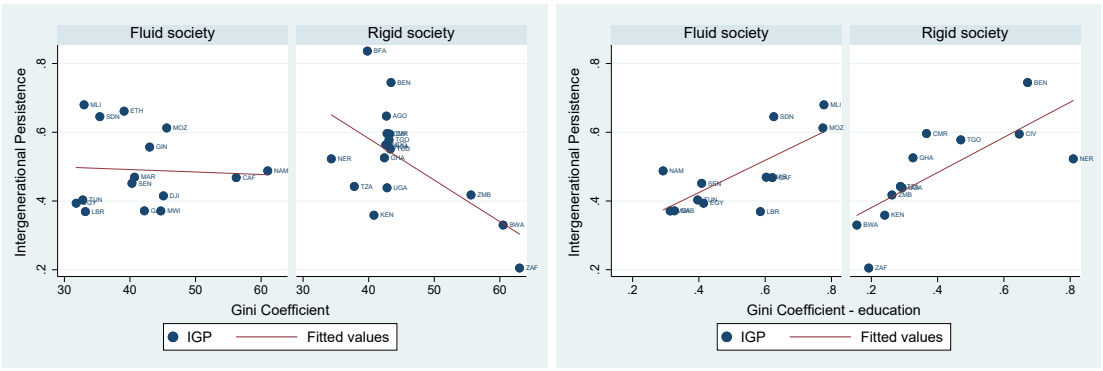
Notes: The figure potrays intergenerational education persistence for 1980 (B), 1960 (C) and 1940 (D) birth cohorts compared against the dominant historic type of society for the country (A). *Source*: Authors computation from GDIM (2018) and Murdock, Blier, and Nunn (2010)

Fact 2: There is a negative relationship between income inequality and intergenerational persistence in countries that were characterised by rigid societies, there is no relationship in those dominated by fluid societies. Education inequality shows a positive relationship to inter-

generational persistence irrespective of type of precolonial society

We plotted the mobility measure against education and income inequality for the countries based on their dominant precolonial societies to obtain the Great Gatsby curve. The Great Gatsby curve, coined by Krueger (2012) and which illustrates the relationship between intergenerational social mobility and a measure of inequality. As can be seen in Figure 3.3, there is a difference in the relationship between income inequality and intergenerational persistence in education for countries based on historical class systems. When mapped against education inequality using the Ziesemer (2016) education gini coefficient, there is a positive relation between persistence and inequality and no apparent differences in relation based on precolonial society type. This finding can be understood as a variation of the Kuznet curve which postulates that during the process of economic development, income inequality first rises before decreasing, in the shape of an inverted u-curve (Barro, 2000; Kuznets, 1955). This finding is supported by Gregorio and Lee (2002) who finds that relationship between increased education attainment, measured as reduced persistence levels in this study, and income inequality is ambiguous and depends on the returns to and initial levels of education present in the country. We interpret my findings as suggesting that the initial dispersion in terms of education levels between individuals in rigid precolonial societies was much higher than in fluid societies.

Figure 3.3: The Great Gatsby Curve Revisited: Intergenerational Education Persistence in Africa and Inequality



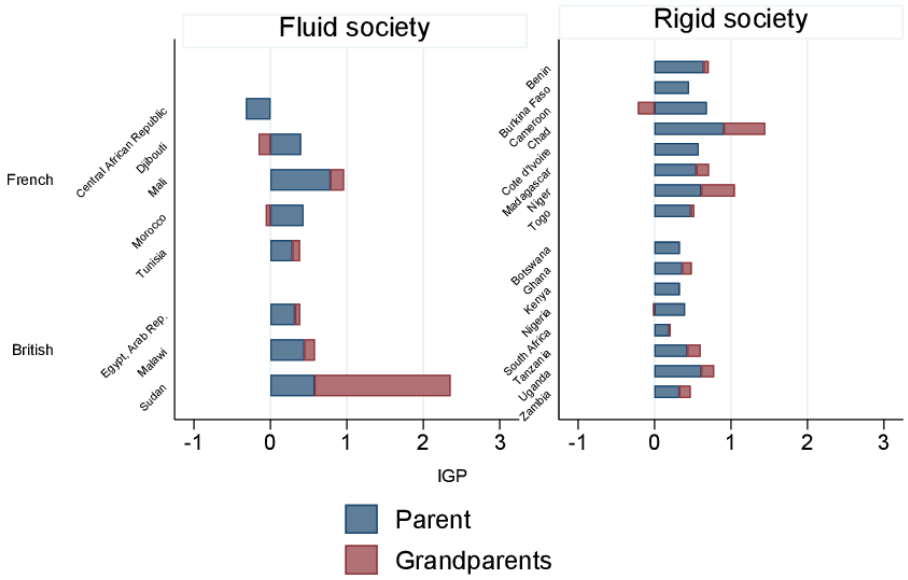
(a) size Income inequality, by dominant society type **(b)** size Education inequality, by dominant society type

Notes: The figures display income and education inequality measured by the Gini income and education coefficient (x-axis) versus intergenerational education persistence, IGP (y-axis.). Income gini was available for the countries at different points of time and hence is measured for the year closest to when the intergenerational education persistence was collected while education gini is for 2005. *Source*: Authors computation. Income Gini data from World Bank - World Development Indicators; IGP education from GDIM (2018) and education Gini data from Ziesemer (2016)

Fact 3: Multi-generation persistence in education for Africa shows evidence of downward mobility in some countries - all of them former French colonies, and dominated by fluid precolonial societies

Downward mobility across multiple generations can be seen in Cameroon, Central African Republic, Djibouti and Morocco. These countries are located in different parts of Africa and the common factor is that they were previously colonised by France and had precolonial African societies that were mainly fluid (See Figure 3.4). This observation goes against the generally accepted norm that education attainment has been on the increase over time. It points to the need to further understand how the precolonial characteristics and colonial origins may interact with the country specific environment and education policies in explaining decreased education attainment over successive generations.

Figure 3.4: Multi-generational Persistence in education, by dominant historic society type and colonial origin



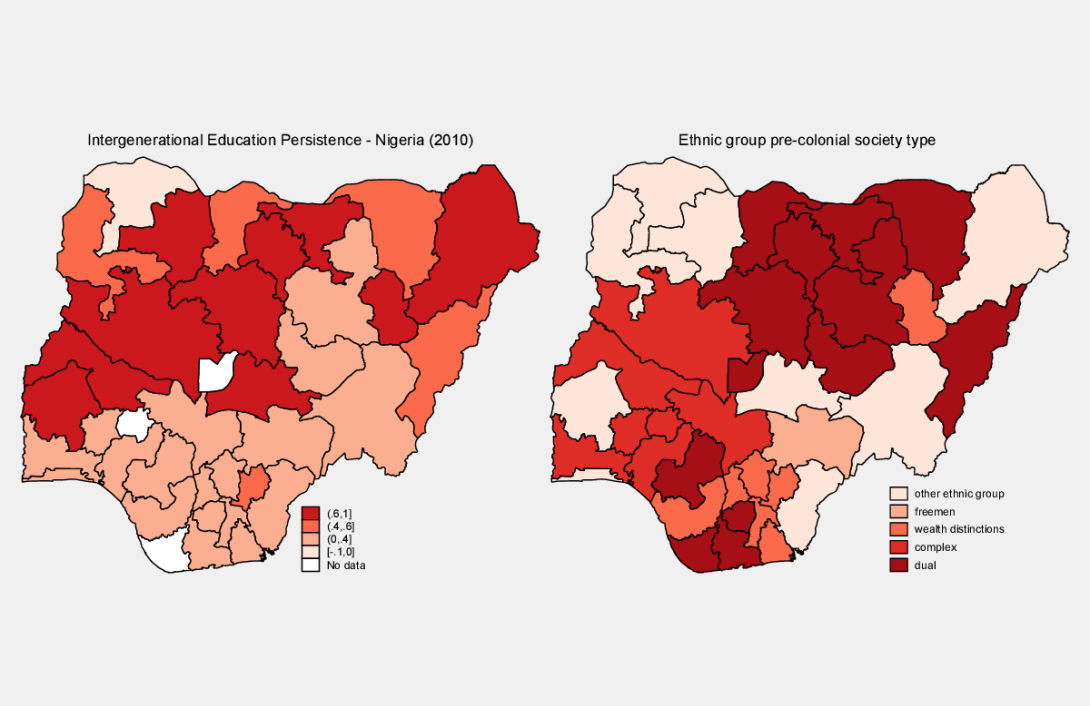
Notes: The figure compares intergenerational persistence in education from fathers to children, and from grandparents to children in rigid and fluid societies, separated by colonial origin. *Source*: Authors computation from GDIM (2018).

Fact 4: Within-country analysis of intergenerational education persistence in each federal state in Nigeria highlights differences in mobility within the country. The majority of states in the Northern sphere have higher levels of persistence compared to other states irrespective of the historically class categorization.

An analysis of intergenerational persistence within Nigeria reveals broad disparities geographically. Higher levels of persistence are seen in the North and Western areas, regions occupied by both rigid and fluid groups. Though some states occupied by the Dual groups do have high persistence, the majority have lower levels of persistence. As shown in Figure 3.5, geographical reasons, rather than historic class systems seem to be more important for mobility in Nigeria.

In summary, at the aggregate level, the stylized facts point to an association between the precolonial African societies and intergenerational persistence in Africa. While the mechanism is not evident, there are some pointers to geography, and to some extent,

Figure 3.5: Intergenerational persistence in Nigeria, comparison to historical class stratification



Notes: The figure illustrates intergenerational persistence in education in the different states in Nigeria based on their dominant type of historical society. *Source*: Authors computation- historic ethnic african society type from Murdock, Blier, and Nunn (2010) , state-level intergenerational persistence sourced from GDIM (2018)

colonial origin, as key to understanding the drivers in differences in mobility when historic class systems are taken into account. This is explored further in the country level analysis that follows.

3.4 DATA AND METHODS

3.4.1 *Household Data*

Country level analysis was conducted on six countries. These are Ghana, Guinea, Madagascar, Malawi, Niger and Nigeria. We used comparable nationally representative household surveys which collect retrospective parental education data and from which it was possible to identify the ethnicity of the individuals. The countries (survey: year) are Ghana (Ghana Living Standards Survey (GLSS): 2017), Guinea (Integrated Core Survey for Poverty Assessment (EIBEP): 2002), Madagascar (Enquéte Permanente Auprés Des Ménages (EPM): 2005), Malawi (Integrated Household Survey: 2017), Nigeria (General Household Survey Panel(GHSP): 2010) and Niger (National Survey on Household Living Conditions and Agriculture (ECVMA): 2014). These surveys collect education information on all occupants of the household, though the

analysis is limited to those aged over 20 years. Households, clustered by enumeration areas, were randomly selected and sampling weights were used to make the sample nationally representative.

The countries were selected because of comparability of findings as the surveys are all World Bank affiliated.[17] Furthermore, they collected ethnicity information which is used to match the individuals to the precolonial ethnic class systems and by collecting retrospective data on parental education, we circumvent challenges of co-resident bias (see Alesina et al. (2021) on other methods of dealing with the bias in estimating African mobility).

Ethnic group is observed for each respondent in Ghana, Niger, and Madagascar. For Malawi and Guinea, only the main language used by the head of household is observed and we use this as a proxy for ethnicity. This approach has been followed on the basis that the major language spoken by the head of the household is a strong predictor of the individuals ethnicity (Baskerville et al. (2014), Debaere, Lee, and Lee (2013), Grin and Sfreddo (1998), and Mateos (2014) also consider language as a proxy of ethnicity). For these countries, we limit the observations to their direct relatives (Children, parents and those classified as direct relatives to the head of household). [18] For Nigeria, we follow previous papers in identifying the dominant ethnic tribes in the localities (see Archibong (2018) and further, ensure that we use Afrobarometer survey data for ethnicity identification that is closest in the year to the LSMS survey data used. We only identify an ethnic tribe as dominant if over 60 % of the population in that region as per the Afrobarometer survey is from the group.
In this study, the education attainment of the children is the dependent variable and is operationalized as the number of years of schooling that an individual attains. We convert the years of schooling into categorical measures of none, primary, secondary and tertiary education for the mobility measures and transition matrices.

The main independent variable is parental education. It is measured as the highest number of years of schooling of either parent in the household. We used the highest education of either parent, as opposed to the average, in the estimations. Hertz et al. (2007) notes that the correlations results from using the higher parental education are similar to those obtained from using the average education, though the regression results are higher when the latter is adopted. This implies that our estimates are closer to the lower bounds of the true intergenerational elasticities. We refer to the persistence from parents education and children's education as parental capital, in line with the mobility literature.

The estimations controlled for age of the individuals, the gender of the children, number of individuals present in the household (household size) and to control for

17 We did not use Cote D'Ivoire or Ugandan data in this Chapter. This is because of the focus on within-country mobility in this paper which required more recent data to compare countries, as opposed to the pooled analysis in Chapter 2, leading to the exclusion of Cote D'Ivoire. Challenges in using Ugandan data are discussed in Chapter 2.

18 The exceptions are made for those groups classified as matrilineal groups, e.g. the Chewa in Malawi, for whom all relatives of the head of household and the spouse are included

non-linearities arising from the cohort effect, we used age squared. Ethnic group is observed for each respondent in Ghana, Niger, Nigeria and Madagascar. For Malawi and Guinea, only the main language used by the head of household is observed and we therefore limit the observations to their direct relatives (Children, parents and those classified as direct relatives to the head of household).[19]

3.4.2 *Descriptive Statistics*

The descriptive statistics of the dependent variable and main independent variable are presented in Tables 3.2 and 3.3. The highest education mean years of schooling of children is seen in Ghana at 7.40 years while the lowest is seen in Madagascar at 2.18 years. For the mothers, Nigeria had the highest mean years of schooling at 2.8 years of schooling while the lowest in seen in Niger. In terms of gender disparities between the children and their parents, the least amount of disparity is seen in Madagascar where the there is a difference of less than a year between the average years of schooling of the parents and the children.

Table 3.2: Descriptive Statistics of Sampled Countries

Country	Sample Description			Mean Years of Schooling					
	Year	Sample Size	EF	Children		Mother		Father	
				Mean	S.D	Mean	S.D	Mean	S.D
Ghana (F)	2017	29,533	0.673	7.48	5.44	2.68	4.39	4.56	5.50
Guinea (F)	2002/03	13,181	0.739	2.34	4.59	0.61	2.64	0.99	3.37
Madagascar(R)	2005	24,483	0.879	2.18	3.71	1.67	2.50	2.31	3.03
Malawi (F)	2017	21,068	0.674	5.94	4.34	0.78	2.45	1.40	3.40
Niger (R)	2014	9,131	0.651	2.90	3.79	0.30	1.50	0.57	2.22
Nigeria (F)	2010	12,788	0.850	6.82	5.59	2.78	4.06	3.91	4.69

Notes: The table presents country level statistics on the data used and education level of the parents and children. The notation R and F alongside the country names indicate whether the country was dominated in the pre-independence period by rigid or fluid ethnic tribes. See text for variable definition. EF refers the the ethnic fractionalization index of the country. *Source*: Authors calculation based on LSMS data; Ethnic fractionalization index (Alesina et al., 2003)

With regards to the distribution of the historical ethnic groups, as can be seen in Table 3.3, different countries have different compositions.[20] In terms of within country ethnic fragmentation, the ethnic fractionalization index, developed by Alesina et al. (2003), shows a relatively high degree of heterogeneity with respect to number of

19 The exceptions are made for those groups classified as matrilineal groups for whom all relatives of the head of household and the spouse are included

20 We updated the following ethnic group classification from Murdock, Blier, and Nunn (2010): Ghana - Freemen (Sisala), Dual (Gurunse); Guinea - Freemen (Toma/ Lomagouwe, Bassari); Madagascar - Freemen (Betsimisaraka, Mahafaly, Sihanaka, Tsimihety); Malawi - Freemen(Sena); Nigeria - Freemen(Igbo), Wealth Distinct (Hausa/Fulani).

ethnic groups within the countries, particularly for Madagascar and Nigeria.[21] In all the countries included in the analysis, Dual societies were found in all of them, with absence among freemen societies being in five of the six countries.[22] Other types of societies are found less commonly, though there were no ethnic groups from the Elite classification in any of the included countries. We differentiate between other local ethnic groups and those who identified as European because of the huge disparity in education years of schooling between them and to ensure that the analysis is not biased. It is important to make this distinction and see the individual effect on intergenerational transmission of education because of the vast differences in opportunities between local and foreign individuals, particularly in Africa.

In all the countries except Guinea, ethnic groups with historic Dual societies have higher levels of attainment that the other classified ethnic groups. For Guinea, the absence among freemen category have slightly higher average years of schooling than the other groups. There is a clear difference in education attainment between those who identified as being of European descent indicating persistence in higher educational opportunities based on origin, in this case, European descent. The average age of the respondents in the sampled country is similar around 40 years of age.

A balance test of the pooled survey data reveals significant differences in means for respondents between the three main groups (absence among freemen, Dual and Wealth Distinct) across all variables. The main differences are with regards to parental education and age of the respondent and in the model we control for these variables (see Table B.1 in the appendix).

3.4.3 *Econometric Framework*

OLS estimation method

The econometric framework for the country-level analysis is based on the standard intergenerational mobility model which has parental education level as the independent variable and child outcome as the dependent variable. We estimate relative mobility levels for each country and utilize an interaction model of the form:

$$y_{ijk(t)} = \beta_0 + \beta_1 y_{ijk(t-1)} + \beta_2 E_{jk} + \beta_3 E_{jk} * y_{ijk(t-1)} + \beta_4 \sum x_{ijk} + \epsilon_{(t)} \tag{3.1}$$

Where $y_{ijk(t)}$ denotes years of education for child i born in time period t and is a member of ethnic group j which falls under historic specification k. $y_{ijk(t-1)}$ corresponds to the maximum parental years of education, E_jk is the historic ethnic classification variable, k, of ethnic group j, x_{ijk} is a vector of control variables and the error term is given by $\epsilon_{(t)}$. The interaction model allows us to examine whether there are statistically significant differences in persistence between the ethnic classes, and is given by the coefficient β_3. We include urban/rural and ethnic group fixed effects. The base ethnic classification is selected as the largest ethnic classification group per

21 The ethnic polarization index provides information on the extent of ethnic fragmentation within the sampled countries. It reflects the likelihood that two randomly selected individuals will not belong to the same group. The index lies between 0 and 1, with 1 being the highest measure and implying that each person belongs to a different group.

22 We used the cluster classifications on pages 116 to 153 of the *Ethnographic Atlas* to identify the social stratification of some of the ethnic groups which had similar cultures to those observed in the atlas as explained by Murdock (1967)

Table 3.3: Descriptive Statistics of Within Country Historical Ethnic Class Systems

Country	Pre-colonial Classification	n	Years of schooling							
			Children		Mother		Father		Age °	
			Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Ghana	Freemen	7,989	5.23	7.02	0.95	3.62	1.88	5.23	40.1	21.1
	Dual	16,175	8.23	4.74	3.23	4.21	5.43	5.10	40.7	14.7
	Wealth Distinct	230	5.42	10.53	0.53	3.89	1.27	6.47	38.9	28.8
	Other local groups †	4,475	6.94	5.44	2.40	4.22	4.00	5.30	40.4	15.9
Guinea	Freemen	387	1.53	2.79	0.32	1.46	0.43	1.70	45.28	15.12
	Wealth Distinct	4,217	1.31	3.14	0.27	1.51	0.47	2.09	47.48	16.71
	Dual	6,232	2.09	4.42	0.55	2.52	0.92	3.29	44.93	18.73
	Other local groups	87 †	1.68	3.24	0.57	2.56	0.69	2.90	45.08	16.39
	Foreign ψ	2,199	6.28	7.14	1.86	5.15	2.87	6.13	41.62	18.47
Madagascar	Freemen	5,737	1.58	2.98	1.19	1.99	1.79	2.55	37.76	14.02
	Dual	10,895	2.57	3.94	1.98	2.68	2.58	3.14	38.02	14.00
	Other local groups †	7,526	2.09	3.83	1.60	2.53	2.35	3.19	37.36	14.44
Malawi	Freemen	17,924	5.85	4.20	0.75	2.34	1.35	3.26	39.22	15.41
	Dual	1,829	8.17	5.40	1.41	4.00	2.50	5.59	41.10	22.05
	Other local groups †	1,268	5.19	4.31	0.46	1.80	0.84	2.68	42.45	18.64
	Foreign ψ	41	15.51	2.94	9.97	6.08	12.19	4.95	41.81	14.91
Niger	Wealth Distinct	5,464	2.89	3.39	0.27	1.29	0.50	1.90	40.20	13.90
	Complex	2,459	2.78	4.54	0.36	1.86	0.72	2.84	41.18	17.23
	Dual	887	3.00	4.64	0.26	1.81	0.56	2.72	40.23	18.59
	Other local groups †	9	5.64	6.98	-	-	0.10	1.86	42.33	44.35
	Foreignψ	202	7.21	8.87	1.56	6.63	2.82	8.62	41.86	25.91
Nigeria	Freemen	382	5.06	5.08	0.50	2.07	1.36	3.32	39.73	13.89
	Wealth Distinct	2,649	8.24	5.51	2.55	4.50	3.43	4.94	42.65	18.82
	Complex	2,111	8.78	4.78	3.04	4.14	4.68	4.82	41.54	14.48
	Dual	4,275	5.45	5.09	3.47	3.60	4.36	3.97	38.86	14.72
	Other local groups †	2,637	5.89	6.74	1.57	3.92	2.90	5.31	38.98	17.68

Notes: The table presents within country descriptive statistics for the ethnic groups stratified by historical class system. † refers to local ethnic groups which could not be matched to a historical class code in the dataset. ψ Foreign in this case refers to those who identified with European descent or were from outside the country. Age °= average age in years *Source*: Authors calculation based on LSMS data

country. Further robustness checks are done where we estimate three models: using parental average rather than parental maximum, including only fathers and sons in the estimations and using the same ethnic classification as the base for the interaction estimations.

Mobility and Transition Matrices

The regression analysis is complimented with mobility and transition matrices which show the probability of successive generations remaining in the same education category as their parents for the different ethnic classifications. Following standard practices, we compute the Shorrock/Prais, Bartholomew, Eigen Value and determinant indices. Aside from the Bartholomew index, the other measures are referred to as convergence mobility indices and measure the degree to which future states do not depend on the initial state i.e. how rapidly parental education origin is forgotten. In

comparison, the Bartholomew index is an equilibrium mobility index and measures the extent to which the process leads to movements between states over time, i.e. interprets mobility as movement between states and computes the average number of categories moved between generations (Aebi, Neusser, Steiner, et al., 2006; Bartholomew, 1967; Blanden, 2009). The mobility functions, which are monotonic, are restricted to the range of zero and one, with a value of zero representing immobility and one implying perfect mobility (Shorrocks, 1978).[23]

In order to compute both the transition matrices and mobility matrices, we divide the education attainment of the parents and the children into four main categories, namely, those with no education, primary, secondary and post-secondary education.[24] For all the countries, these categories represent transitions between major institutional divisions of schooling. Bootstrapping procedures are used to simulate the sampling distribution of the statistics in the mobility matrices.

3.5 RESULTS

3.5.1 *Results from the Country Level OLS Regression model*

The results from the OLS regression model are presented in Table 3.4. The country results, presented in alphabetical order, show group differences in intergenerational persistence. Model 1 is estimated with no control variables and fixed effects for ethnic groups or locality and these are gradually introduced in the other specified models.

Given the number of countries included in the analysis, we provide a summary of the results here for the most refined specified models, shown in column 3 and 4, and focus on the interaction coefficient in countries where it is significant. Statistically significant interactions are found in three of the six countries. These are Ghana, Madagascar and Malawi. The models are all statistically significant based on the omnibus F-statistic and a Wald test of the interactions found the results to be significant. This means that for these countries, there are differences in education persistence across generations between the ethnic groups based on classifications of the class system that was historically in existence. Intergenerational persistence is lower for Dual societies compared to the absence among freemen groups in Ghana and Malawi. Alternatively, it is higher in Madagascar, Guinea and Niger, though the interaction is statistically insignificant in the latter two. This implies that the country level measure of persistence is appropriate in analyzing mobility in Guinea, Nigeria and Niger but there are differences in persistence between the pre-independence society groups for the other countries and understanding intergenerational persistence for them should be done in consideration of these differences. The results are in line with findings of significant within country heterogeneity for African countries in terms of intergenerational mobility by Alesina et al. (2021). These results are robust to different estimation techniques, such as Coarsened Exact Matching (CEM), a monotonic matching procedure,

23 The specification of these commonly used mobility matrices are presented in the appendix

24 For Guinea and Niger, we introduced a middle school category in line with the education system in the individual countries.

to reduce the selection bias between the sampled individuals on various covariates; and and Instrumental Variable strategy that deals with possible endogeniety and utilizes ethnic group distance from the capital as an instrument for parental education on the matched data (see appendix for the results tables and discussions).

For Guinea, Nigeria and Niger, the interaction coefficients are not significant and hence we focus on the main effects. Education persistence from parents to children is higher in Niger than Nigeria and Guinea, with higher persistence in the Dual group in Niger and Guinea and the opposite obtaining in Nigeria, albeit statistically insignificant. Those who identified as French (European descent) in Guinea have much higher levels of education than the indigenous ethnic groups indicating persisting inequalities in terms of education access, possibly along racial lines though we do not directly observe race of the respondents in the surveys.[25] A possible reason for this could be differences in social capital between the groups which lead to different opportunity sets available and hence different outcomes. In Niger, the partial effect of the ethnic classification also shows higher levels of education for those who were classified as foreign. Similar to Guinea, those in the Wealth Distinct group had lower levels of education than the other precolonial specifications though we only find statistically significant differences when compared to the Dual group.

Margin plots which show predicted values of children's years of schooling based on specified years of schooling of their parents for the different ethnic classifications in countries which had significant interactions are shown in Figure 3.6. The margin plots provide a visualization of the *simple slopes* for the different ethnic classifications (Curran, Bauer, and Willoughby, 2004). Dis-ordinal interactions are observed amongst the ethnic classifications, with the exception of Malawi for the respondents of European descent for whom an ordinal interaction is observed from the local ethnic groups. This can be interpreted as a persistence of ranked system over time with respect to ethnic relations as discussed by Horowitz (1985), whereby at each level of parental education, the predicted years of schooling of those who identified with the European descent is significantly higher than the local group, though the gap reduces at higher levels of indigenous parental education.

We used the Johnson and Neyman (1936) procedure to identify the regions of significance for the groups, i.e. the areas for which education persistence is significantly different between the classifications. The rule of thumb is that areas further from the intersection are significantly different and the plots reveal that for Ghana and Malawi, the differences between the Dual and the Freemen groups are mainly at lower levels of parental education while for Madagascar, it is at higher levels of education.[26] We explore these disparities further in the next section using mobility and transition matrices.

25 It is possible that those who identified as French could be of African descent but have adopted the French culture and in this case, cultural capital as put forward by Bourdieu (1986) and discussed in Stanton-Salazar and Dornbusch (1995) could be playing a role in differences in outcomes

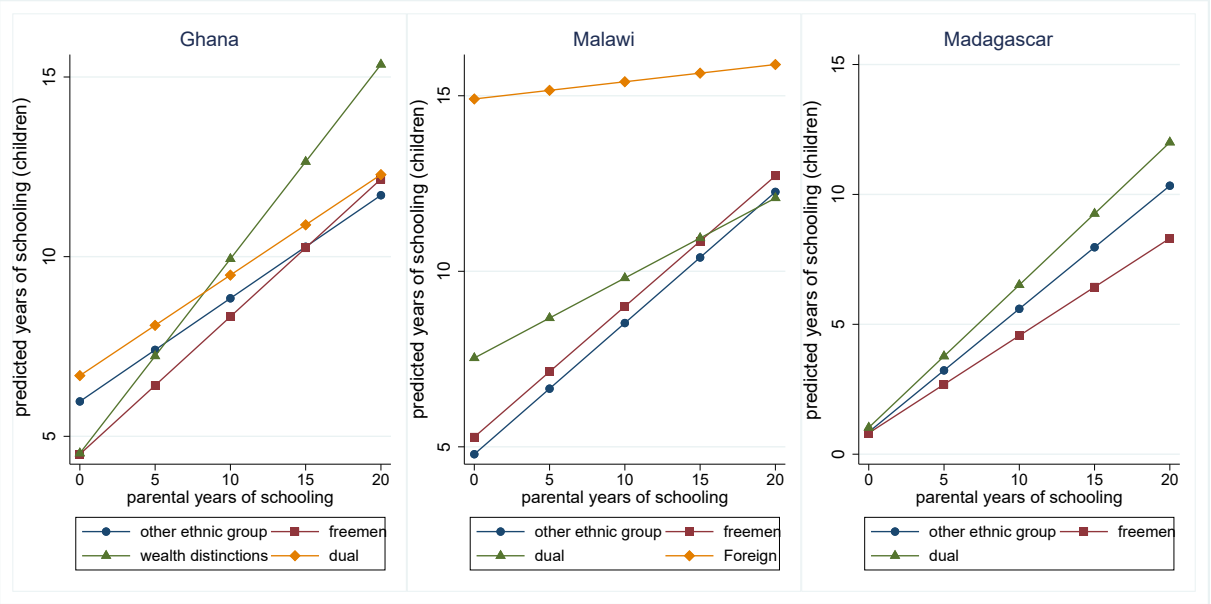
26 Curran, Bauer, and Willoughby (2004) sets out the formal test of regions of significance as follows: choose a specific critical value for the test statistic and then solve the main equation for the specific values of parental persistence that yield this critical value.

Table 3.4: Effect of parental education on children education : Country level OLS regression results

	Dependent Variable, respondent education level y_t			
	(1)	(2)	(3)	(4)
	GHANA			
Parental capital (PC)	0.616***	0.531***	0.416***	0.383***
	(0.023)	(0.023)	(0.030)	(0.029)
PC*Class(Dual)	-0.159***	-0.145***	-0.102***	-0.103***
	(0.025)	(0.024)	(0.030)	(0.029)
PC*Class (W.D.)	0.010	0.036	0.172	0.158
	(0.144)	(0.158)	(0.163)	(0.150)
PC*Class (Other)	-0.132***	-0.119***	-0.100**	-0.096**
	(0.030)	(0.029)	(0.036)	(0.034)
	GUINEA			
Parental Capital (PC)	0.383***	0.339***	0.338***	0.245***
	(0.038)	(0.039)	(0.039)	(0.034)
PC*Class(Freemen)	-0.105	-0.132	-0.137	-0.098
	(0.074)	(0.078)	(0.081)	(0.064)
PC*Class (Dual)	0.043	0.052	0.033	0.019
	(0.047)	(0.048)	(0.049)	(0.042)
PC*Class(Other)	0.012	0.035	0.036	0.061
	(0.189)	(0.201)	(0.201)	(0.166)
PC*Class(Foreign)	-0.031	-0.015	-0.014	0.001
	(0.050)	(0.051)	(0.051)	(0.042)
	MADAGASCAR			
Parental Capital (PC)	0.415***	0.409***	0.416***	0.375***
	(0.029)	(0.029)	(0.028)	(0.026)
PC*Class(Dual)	0.242***	0.238***	0.200***	0.174***
	(0.041)	(0.040)	(0.040)	(0.036)
PC*Class(Other)	0.136**	0.134**	0.114*	0.099*
	(0.050)	(0.051)	(0.052)	(0.047)
	MALAWI			
Parental Capital (PC)	0.576***	0.485***	0.469***	0.372***
	(0.015)	(0.017)	(0.018)	(0.016)
PC*Class(Dual)	-0.164***	-0.175***	-0.166***	-0.144***
	(0.026)	(0.026)	(0.026)	(0.026)
PC*Class(Other)	0.001	-0.046	-0.049	0.002
	(0.038)	(0.036)	(0.037)	(0.036)
PC*Class(Foreign)	-0.450***	-0.436***	-0.420***	-0.323***
	(0.087)	(0.076)	(0.076)	(0.076)
	NIGER			
Parental Capital (PC)	0.597***	0.527***	0.525***	0.378***
	(0.034)	(0.035)	(0.035)	(0.028)
PC*Class(Complex)	0.094	0.083	0.084	0.082
	(0.053)	(0.056)	(0.056)	(0.049)
PC*Class(Dual)	0.121*	0.109	0.086	0.064
	(0.058)	(0.063)	(0.062)	(0.058)
PC*Class(Foreign)	-0.375**	-0.327**	-0.321**	-0.188
	(0.119)	(0.101)	(0.107)	(0.110)
PC*Class(Other)	-0.536**	-0.665**	-0.664**	-0.538*
	(0.194)	(0.224)	(0.224)	(0.213)
	NIGERIA			
Parental Capital (PC)	0.452***	0.372***	0.310***	0.275***
	(0.034)	(0.033)	(0.032)	(0.029)
PC*Class(Freemen)	0.142	0.063	0.118	0.078
	(0.106)	(0.101)	(0.102)	(0.084)
PC*Class(Wealth Distinct)	0.110**	0.011	0.081*	0.077*
	(0.042)	(0.037)	(0.037)	(0.033)
PC*Class(Complex)	0.055	0.013	0.072	0.064
	(0.043)	(0.041)	(0.040)	(0.036)
PC*Class(Other)	0.052	0.048	0.109*	0.090*
	(0.047)	(0.046)	(0.045)	(0.039)
Controls for x	No	Yes	Yes	Yes
Ethnic FE	No	No	Yes	Yes
Urban-Rural FE	No	No	No	Yes

Notes: *p<0.05,** p<0.01, *** p<0.001, Sample size: Ghana=27,853, Guinea=13,016, Madagascar=21,517, Malawi=21,066, Niger=8,994, Nigeria=11,965. Base for ethnic classification interaction-Absence among Freemen (Ghana, Madagascar, Malawi) Wealth D. (Guinea, Niger), Dual (Nigeria). Source: authors' compilation based on LSMS data (World Bank).

Figure 3.6: Margins Plot - Predicted values of children's education



Notes: The figure illustrates the difference in predicted years of schooling for children given the years of schooling of their parents, based on the historical classification of their ethnic group. *Source*: Authors calculation using LSMS data

Mobility and Transition Matrices

We examine the distribution of the extent to which children's education is dependent on the parents education in the mobility matrices presented in Table 3.5. The results are presented for each country and highlight differences between the country level mobility matrices with those of the within group matrices. Greater mobility indicator values indicate higher mobility and the results show that for the anglophone countries, the Dual classification has higher levels of mobility than the country average and other ethnic classification, and this result is particularly so for the Eigen value mobility measure. The reverse is true for the francophone countries. The extent of the variance is different for the countries but by and large, there are minor differences in pattern between the countries at the national level. The results from the mobility estimates also reinforce findings from the regression model that Dual is more mobile in comparison to other classifications in anglophone countries than in francophone countries.

The transition matrices which show the education attainment of children given their parents education are illustrated in Figures B.1-B.3. We focus my discussion on countries for which the interactions were significant though the full transition tables are presented in the appendix. For Ghana, the regions of significance were identified to be at lower levels of parental education and as can be seen in Figure B.1, there is a higher proportion of parents with no education and whose children also have no education in the absence among freemen group, compared to the national average and the Dual group. A higher proportion of children in the Dual group have secondary of more despite having parents with no or primary education. This is indicative of the

Table 3.5: Summary Mobility Matrices - Rigid and Fluid Historical Ethnic Societies

	Children and Parents Education (Categorical)							
	GHANA			**NIGERIA**				
	Country	Freemen	Dual	Country	Freemen	Wealth D.	Complex	Dual
MB_S	0.728***	0.706***	0.757***	0.698***	0.762***	0.753***	0.719***	0.643***
	(0.006)	(0.019)	(0.009)	(0.010)	(0.019)	(0.100)	(0.016)	(0.015)
MB_B	0.236***	0.230***	0.248***	0.219***	0.240***	0.243***	0.237***	0.202***
	(0.002)	(0.008)	(0.002)	(0.003)	(0.005)	(0.028)	(0.006)	(0.005)
MB_E	0.942***	0.945***	0.945***	0.430***	0.436***	0.494*	0.890***	0.363***
	(0.009)	(0.252)	(0.054)	(0.009)	(0.019)	(0.211)	(0.174)	(0.017)
MB_D	0.992***	0.992***	0.994***	0.985***	0.998***	0.993***	0.986***	0.970***
	(0.001)	(0.004)	(0.001)	(0.002)	((0.002)	(0.014)	(0.004)	(0.006)
n	27115	7827	14939	12603	2840	390	2287	4355
	MADAGASCAR			**NIGER**				
	Country	Freemen	Dual	Country	Freemen	Complex	Dual	Foreign
MB_S	0.746***	0.783***	0.719***	0.700***	0.699***	0.759***	0.459***	0.801***
	(0.010)	(0.025)	(0.011)	(0.017)	(0.028)	(0.028)	(0.062)	(0.070)
MB_B	0.244***	0.260***	0.231***	0.200***	0.196***	0.229***	0.113***	0.227***
	(0.004)	(0.012)	(0.005)	(0.007)	(0.010)	(0.010)	(0.015)	(0.026)
MB_E	0.472***	0.543***	0.426***	0.387***	0.373***	0.427***	0.158	0.953***
	(0.010)	(0.027)	(0.011)	(0.018)	(0.026)	(0.021)	(0.286)	(0.216)
MB_D	0.994***	0.997***	0.993***	0.997***	0.996***	0.999***	0.941***	1.000***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)	(0.033)	(0.003)
n	21517	5187	9565	8994	5448	2452	886	199
	MALAWI			**GUINEA**				
	Country	Freemen	Dual	Country	Freemen	Wealth D.	Dual	Foreign
MB_S	0.735***	0.731***	0.821***	0.835***	0.934***	0.831***	0.842***	0.879***
	(0.011)	(0.012)	(0.026)	(0.012)	(0.057)	(0.024)	(0.013)	(0.018)
MB_B	0.209***	0.207***	0.247***	0.296***	0.376***	0.308***	0.308***	0.318***
	(0.003)	(0.004)	(0.008)	(0.005)	(0.048)	(0.012)	(0.007)	(0.008)
MB_E	0.536***	0.529***	0.674***	0.511***	0.949***	0.537***	0.532***	0.658***
	(0.133)	(0.140)	(0.158)	(0.012)	(0.139)	(0.047)	(0.021)	(0.048)
MB_D	0.990***	0.989***	0.998***	1.000***	1.000***	1.000***	1.000***	1.000***
	(0.002)	(0.002)	(0.002)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
n	21066	17927	1830	13016	380	4194	6178	2177

Notes: MB_S = Shorrock/ Prais index;MB_B=Bartholomew; MB_E=1-Second largest eigenvalue; MB_D = Determinant index. Standard errors in parentheses Source: authors' compilation based on LSMS data (World Bank).

findings from the regression results that the Dual group has higher levels of mobility than absence among freemen. For Madagascar which had regions of significance at higher levels of parental education, in Figure B.2, the results are reversed. It can be seen that a higher proportion of children in Dual have similar attainment to their parents as compared to those in absence among freemen for whom higher proportion of children have low education attainment. In essence, the higher persistence observed among the Dual compared to the absence among freemen group is explained by the difference in proportion of their children who end up with no education. For Malawi, more of the Dual group children have higher education than their parents compared to the absence among freemen group. Very high levels of transitions are observed among the foreign group as well (see figure B.3). Overall, the transition matrices show

differences in within group (historical classification) patterns of education attainment for the children, which are masked by national level analysis, and are in line with the findings from the regression results.

To provide an in-depth analysis, we delve into the educational policies of 2 countries, with significant differences between the ethnic classifications, one anglophone and the other francophone. These are Ghana and Madagascar.[27] A review of educational policies in Ghana starting from the precolonial period is provided by Akyeampong (2009) and Adu-Gyamfi, Donkoh, and Addo (2016). The authors note that changes in education policies had differing effects on the demand for and equity in education. For example, on independence, the government identified education as being key to increasing economic productivity and reducing poverty. This led to the Accelerated Development Plan of 1951 and Education Act of 1961 which expanded education but were criticised as being elitist and replaced after the military coup of 1966 (Adu-Gyamfi, Donkoh, and Addo, 2016). By the 1980s, the education system in Ghana had nearly collapsed and the new government put in place the 1987 Education Reforms whose aim was to expand and improve quality of education and reduced the structure of the education system. In 1995, the Free and Compulsory Universal Basic Education (FCUBE) programme was introduced and while it is yet to achieve its purpose, critics note that the poorest were still left behind due to other fees associated with obtaining education (Akyeampong, 2009). All these changes have implications for access to education and could explain the variance in within country education mobility.

For Madagascar, Lewin (2009) identifies it as being amongst countries with high levels of enrolments at low grades, but with very high attrition rates as the grade level reach secondary level education. Review of the education system in Madagascar by Venart and Reuter (2014) reveals that by 2002, over 50 percent of the workforce had not received any formal education, and the education sector was poorly funded by the government. Students from rural areas faced poor quality education and their completion rate was as low as 12 percent, compared to 60 percent in urban areas. Viens and Lynch (2000) further notes that the higher education system in the country had almost collapsed by the early 1990s with poor quality of education and inefficiency within the university. Government reforms, in close collaboration with donor partners, were put in place though benefits of education reform are long term. Under these circumstances, prospects for mobility are limited and higher education persistence is expected within Madagascar.

3.5.2 *Pooled Country Analysis using OLS*

The previous section focuses on within country comparison of intergenerational persistence between groups based on their historical stratification. In this section, the data is pooled across countries to investigate persistence between the ethnic classifications

27 We also use these 2 countries for the further analysis presented in the online appendix, namely, Coarsened Exact Matching (CEM) and instrumental variables strategies. The results show that Dual societies are more mobile in Ghana and less mobile in Madagascar, in line with the obtained results. However, the IV results do not identify a causal effect of historical ethnic classification on mobility.

on a more aggregated level. Country fixed effects are utilized in the regression model. Results show that intergenerational persistence is higher in groups which were historically more fluid, namely the absence among freemen group. As can be seen in column 2 of Table 3.6, there is lower persistence among the Dual and Foreign groups and this is statistically significant. In terms of absolute mobility, results show that given that parental years of schooling are zero, offspring who belong to historically Dual group have more years of schooling (on average by 0.88 years of schooling) than the absence among freemen, while the other fluid groups such as Complex and Wealth Distinct have less years of schooling.

Table 3.6: Effect of parental education on children education: Pooled Country regression results

	Dependent Variable, respondent education level y_t			
	(1)	(2)	(3)	(4)
Parental capital (PC)	0.560***	0.443***	0.470***	0.366***
	(0.026)	(0.025)	(0.025)	(0.022)
Class (Wealth Distinct)	2.014***	-3.911**	2.557***	-2.593**
	(0.271)	(1.271)	(0.267)	(0.988)
Class (Complex)	2.596***	1.024	3.057***	1.043
	(0.377)	(1.292)	(0.373)	(0.999)
Class (Dual)	0.377	0.773	0.418	0.762
	(0.232)	(1.174)	(0.239)	(1.193)
Other	0.627*	-2.282	0.573	-2.177
	(0.288)	(1.493)	(0.299)	(1.139)
Class (Foreign)	4.484***	1.002	4.636***	0.609
	(0.445)	(2.209)	(0.431)	(1.993)
PC*Class(Wealth D.)	0.036	-0.025	-0.003	0.005
	(0.032)	(0.031)	(0.031)	(0.026)
PC*Class(Complex)	-0.043	-0.033	-0.049	-0.001
	(0.036)	(0.036)	(0.035)	(0.030)
PC*Class(Dual)	-0.123***	-0.108***	-0.101***	-0.079**
	(0.032)	(0.031)	(0.030)	(0.026)
PC*Class(Other)	-0.059	-0.021	-0.036	0.002
	(0.037)	(0.037)	(0.036)	(0.031)
PC*Class(Foreign)	-0.229***	-0.172***	-0.191***	-0.147***
	(0.043)	(0.044)	(0.043)	(0.037)
Constant	5.008***	6.753***	6.249***	7.655***
	(0.189)	(1.289)	(0.356)	(1.007)
Controls for x	No	Yes	Yes	Yes
Ethnic Group FE	No	No	Yes	Yes
Urban-Rural FE	No	No	No	Yes
Country FE	Yes	Yes	Yes	Yes
N	104871	104414	104840	104414
R^2 N				

Notes: *p<0.05,** p<0.01, *** p<0.001; Base for ethnic classification interaction and categorical results- Absence among Freemen group. Base for colonial interaction and categorical results- Former French colonies. Source: authors' compilation based on LSMS data (World Bank).

It is interesting to note that historical rigidities have persisted in the sampled countries which were former French colonies while a different situation obtains in the former British colonies. A possible explanation for the French colonies could be that the class stratification that existed in the pre-independence period has persisted within ethnic groups and hence those which were rigid remained rigid and vice versa. But what is more puzzling is the evolution of these groups in two former British colonies,

namely Ghana and Malawi. We theorize that the introduction of the concept of the state in these colonies led to the development of opportunity rigidities for education or occupation advancement within the ethnic groups, and these effects may have been stronger in the formerly fluid groups than those that existed in the Dual group. For example, in the post independence period, in Ghana, effort was made to increase education opportunities to the previously disadvantaged groups which were mainly in the Northern parts of the country and were dominated by the fluid groups. The distribution of these opportunities may have been unequal resulting in intergenerational persistence over time. In essence, there is a possibility that new education opportunities led to the development of stratification that was previously not there creating a cadre of individuals who were benefiting as opposed to the others. Another reason could be that missionary activity and education was more easily available for the members of the ethnic group which were of higher stature and this solidified over time into rigidities in terms of education persistence across generations. However, this is speculative and more research would be required to understand this.

3.5.3 *Additional Model Specification and Robustness Checks*

This section provides a summary of results from three additional estimations undertaken on the country level data as robustness checks. Firstly, we estimate the linear model using parental average as the measure of parental education rather than the maximum parental education. Secondly, we check the results when only fathers and sons are included and finally, we estimate the model using a constant interaction base (absence amongst freemen) for all the six countries. The results from all three models are presented in Table B.3 of the appendix.

When we use the average parental education as our measure of analysis, our results show higher estimates of the variables, inline with the arguments by Hertz et al. (2007) on the comparability of the two measures. We observe variations in persistence between the ethnic classifications but find that the results are insignificant in Niger and Guinea, in line with the main results. Additionally, we find dual groups are more mobile in Ghana and Malawi, as well as Nigeria, while they have higher persistence in Madagascar. This is again in line with the results found.

Focusing the analysis on only fathers and sons is in line with the traditional intergenerational mobility literature which has mainly focused on male relationships and is important because of the historical imbalance in terms of education opportunities between men and women. It is also relevant for Africa where women were traditionally excluded from educational advancement during the colonial period as noted by Nafziger (1988) and for whom the regression results indicate have lower levels of education attainment than men. We find similar results in that there are differences in intergenerational persistence in education from fathers to sons between the ethnic group classifications. In line with findings from the regression analysis, persistence is higher among the absence among freemen class in Ghana and Malawi, while it is lower in Madagascar. The results are statistically significant. The results still point to distinct patterns in evolution of persistence in the countries.

Analysis of the patterns from the econometric model which uses a constant ethnic classification base for all countries confirms the pattern in the results. We find that there is higher persistence in Guinea amongst the Dual group while there is lower persistence amongst the Dual in Nigeria. The results are statistically significant in Guinea while for Nigeria, as in the previous country level regression, there are no observed differences in persistence between the groups. However, the small sample size of the Absence among Freemen in Guinea (2.9%) and Nigeria (3.2%) in comparison to the other ethnic classifications make the results less readily generalizable.

3.6 CONCLUSION

This paper sets out to determine the extent of historic persistence by examining differences in intergenerational transmission of education between ethnic groups based on their precolonial and early colonial period class stratification systems. These ethnic groups were representative of incipient whole societies in the precolonial period and by creating national boundaries which included the different types of societies, this presents an opportunity to analyse how these ethnic class structures have evolved into the contemporary period. The results show that a statistically significant association between the type of historic class stratification system that existed within the ethnic group and differences in persistence in three of the six countries. These are Ghana, Madagascar and Malawi. In Guinea, Nigeria and Niger, there are no significant differences in persistence between groups. The findings show that national mobility statistics masks differences in within-group mobility in African countries, and focused analysis of defined group mobilities may be a more nuanced method of reducing persistence in status, in our case for ethnic groups.

The results challenge the notion of uniformity in institutional lock-in amongst African countries and instead argues that the extent of the importance of precolonial period characteristics in explaining intergenerational persistence in African countries differs individually. Instead, we postulate that a key factor in understanding the effect of historic ethnic systems for Africa is an analysis of the interaction between colonial administrative policies and the variation and implementation of country education policies in the immediate post independence period. In most anglophone countries, the post independence period was characterised by expansion of education access even though this stalled in the 1970 to 1980 period. In comparison, in francophone countries, education access was expanded but not enforced to the same extent and historical rigidities seem to have persisted unchanged within the different classifications. The results are also consistent with recent studies that have highlighted the importance of understanding the interaction between the precolonial and colonial institutions within individual countries to explain observed educational outcomes (Müller-Crepon, 2020; Walters, Chisadza, Clance, et al., 2020). What cannot be identified from the results is the mechanism through which education expansion led to the development of rigidities among the fluid groups resulting in less mobility in the anglophone countries. The findings also provide evidence that though ethnic traits from the precolonial period are associated with within country variations in mobility

for some countries, their relevance in understanding different facets of contemporary Africa as a whole are limited.

Appendices

B

APPENDIX

B.1 ADDITIONAL ESTIMATION RESULTS

Table B.1: Balance Table of pooled survey data

Variable	(1) Mean Dual	(2) Mean Freemen	(3) Mean Wealth D.	(4) Freemen vs Dual	(5) Wealth D. vs Dual	(6) Freemen vs Wealth D.
Education	5.239	4.781	6.003	-1.213***	0.008	-1.817***
	(5.355)	(4.843)	(5.506)	(0.087)	(0.097)	(0.093)
Parent educ.	4.057	1.621	2.630	-2.401***	-1.392***	-1.835***
	(4.563)	(3.524)	(4.414)	(0.067)	(0.084)	(0.077)
Age	39.714	39.401	42.643	-0.545*	2.697***	-1.766***
	(15.835)	(15.495)	(17.350)	(0.236)	(0.298)	(0.261)
Hh. size	7.035	5.305	6.655	-1.244***	0.106	-0.897***
	(5.127)	(2.824)	(4.191)	(0.053)	(0.074)	(0.053)
Observations	40,925	32,637	12,425	97,120	76,908	68,620

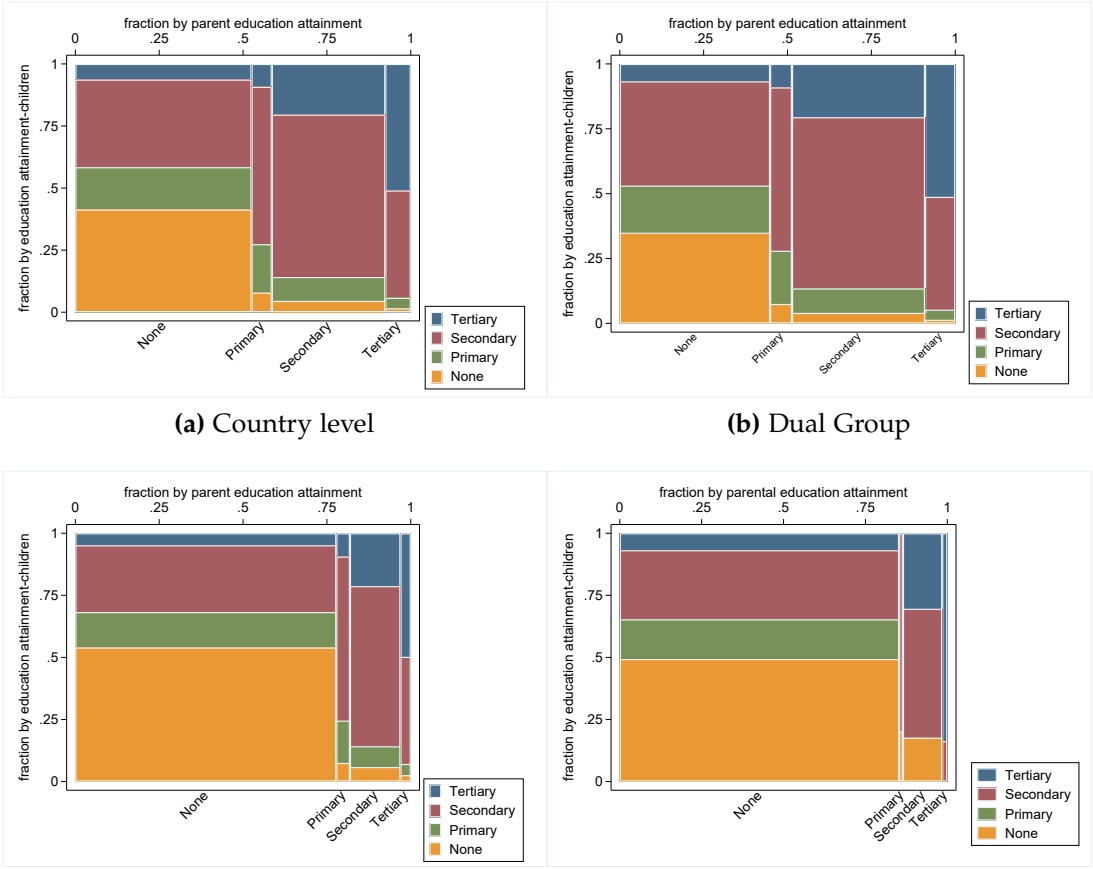
*p < 0.05, ** p < 0.01, *** p < 0.001

Table B.2: Country Distribution of Ethnic Classes

	Class Stratification System						Society Composition		
COUNTRY NAME	1(AF)	2 (WD)	3 (E)	4 (D)	5 (C)	Total	Fluid	Rigid	Type
ALGERIA	1	4	6	1	1	13	6	7	B
ANGOLA	4	1	0	6	0	11	5	6	B
BENIN	3	0	0	3	0	6	3	3	C
BOTSWANA	2	0	2	0	0	4	2	2	C
BURKINA FASO	10	1	2	2	1	16	12	4	A
BURUNDI	0	0	0	0	2	2	2	0	A
CAMEROON	19	4	0	10	0	33	23	10	A
C.AFRICAN REPUBLIC	8	0	0	1	0	9	8	1	A
CHAD	5	0	0	6	0	11	5	6	B
CONGO	3	2	0	1	0	6	5	1	A
COTE D'IVOIRE	9	2	1	4	0	16	11	5	A
CONGO (DRC)	29	3	0	18	2	52	34	18	A
DJIBOUTI	0	2	0	0	0	2	2	0	A
EGYPT	0	2	1	0	1	4	3	1	A
EQUATORIAL GUINEA	2	1	0	1	0	4	3	1	A
ERITREA	2	1	3	0	1	7	4	3	A
ETHIOPIA	3	4	1	4	2	14	9	5	A
GABON	2	1	0	0	0	3	3	0	A
GAMBIA	1	0	0	2	0	3	1	2	B
GHANA	8	1	0	6	0	15	9	6	A
GUINEA	5	1	1	2	0	9	6	3	A
GUINEA-BISSAU	4	0	1	2	0	7	4	3	A
KENYA	14	4	1	3	0	22	18	4	A
LESOTHO	1	0	0	2	0	3	1	2	B
LIBERIA	5	2	0	1	0	8	7	1	A
LIBYA	0	1	2	1	0	4	1	3	B
MADAGASCAR	2	0	0	5	0	7	2	5	B
MALAWI	4	0	0	2	0	6	4	2	A
MALI	5	2	6	4	2	19	9	10	B
MAURITANIA	0	0	4	2	1	7	1	6	B
MOROCCO	1	4	0	0	1	6	6	0	A
MOZAMBIQUE	7	0	0	1	0	8	7	1	A
NAMIBIA	2	2	0	1	0	5	4	1	A
NIGER	0	2	5	5	1	13	3	10	B
NIGERIA	24	7	0	16	2	49	33	16	A
RWANDA	1	0	1	0	2	4	3	1	A
SENEGAL	4	0	0	5	1	10	5	5	C
SIERRA LEONE	2	1	0	1	0	4	3	1	A
SOMALIA	1	2	0	0	0	3	3	0	A
SOUTH AFRICA	1	3	1	6	0	11	4	7	B
SUDAN	17	9	3	4	3	36	29	7	A
SWAZILAND	0	0	0	1	0	1	0	1	B
TANZANIA	15	2	2	21	2	42	19	23	B
TOGO	6	0	0	6	0	12	6	6	C
TUNISIA	0	1	1	0	2	4	3	1	A
UGANDA	8	4	3	6	1	22	13	9	A
ZAMBIA	7	1	0	7	0	15	8	7	A
ZIMBABWE	1	0	1	1	0	3	1	2	B
TOTAL	**246**	**77**	**48**	**170**	**28**	**571**	**353**	**218**	**A**

Class codes:1= Absence among freemen, 2= Wealth distinctions, 3= Elite,4 = Dual, 5=Complex
Ethnic society Codes: Fluid=Absence among freemen, Wealth distinctions, Complex; Rigid= Elite, Dual
Country society Composition: A= Fluid society, B= Rigid society, C=Mixed society
Source: Authors computation from Murdock (1962) Nunn(2009) Michalopoulos and Papaioannou(2013)

Figure B.1: Education Transition Matrices - Intergenerational Transmission of education in Ghana



(a) Country level

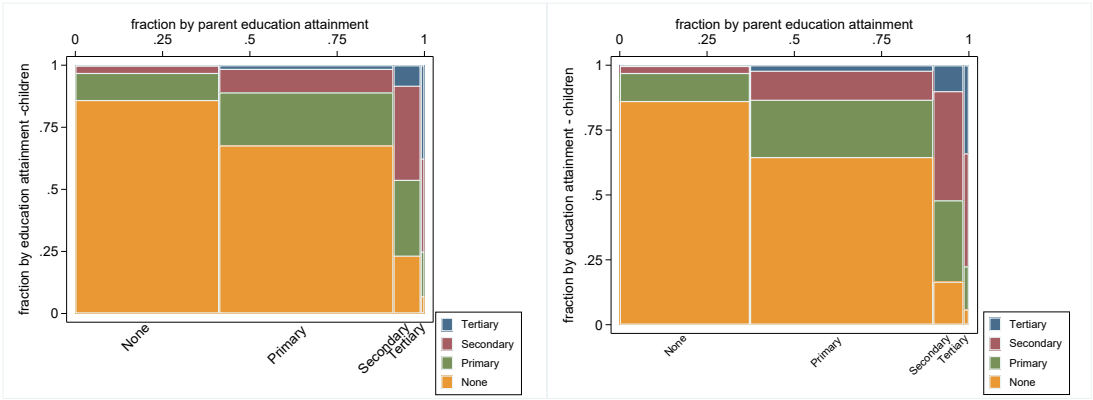
(b) Dual Group

(c) Freemen

(d) Wealth Distinct

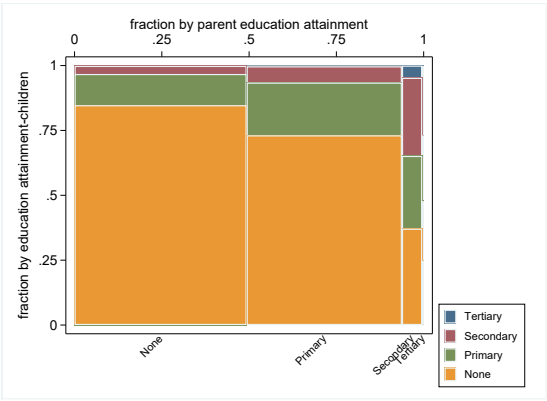
Notes: The figure illustrates education transition matrices of parents and children in Ghana. *Source*: Authors calculation based on data from LSMS.

Figure B.2: Education Transition Matrices - Intergenerational Transmission of education in Madagascar



(a) Country level

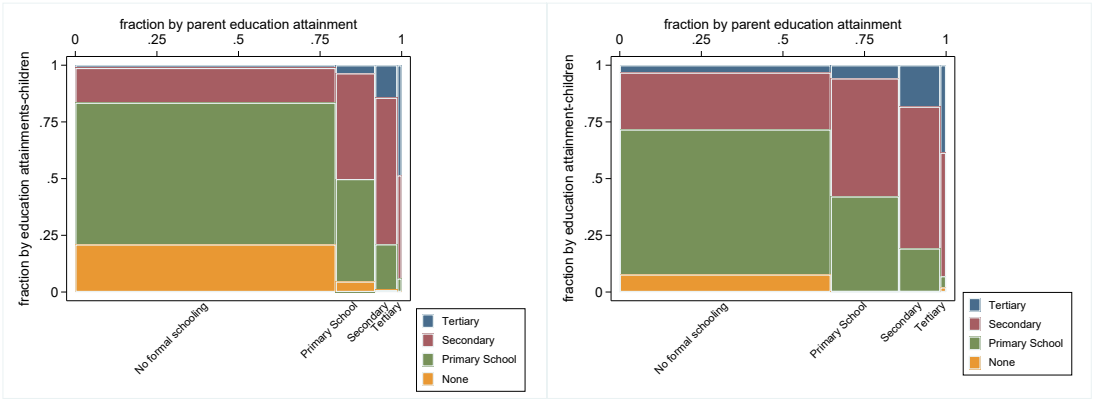
(b) Dual Group



(c) Freemen

Notes: The figure illustrates education transition matrices of parents and children in Madagascar. *Source*: Authors calculation based on data from LSMS.

Figure B.3: Education Transition Matrices - Intergenerational Transmission of education in Malawi



(a) Country level **(b)** Dual Group

(c) Freemen **(d)** Foreign

Notes: The figure illustrates education transition matrices of parents and children in Malawi. *Source*: Authors calculation based on data from LSMS.

Table B.3: Robustness Checks - Effect of parental education on children education : Country level OLS regression results

	Dependent Variable, respondent education level y_t					
	Parental Average		**Fathers/ Sons**		**Constant base(Freemen)**	
	(1)	(2)	(3)	(4)	(5)	(6)
	GHANA					
Parental capital (PC)	0.811***	0.494***	0.602***	0.402***	0.616***	0.383***
	(0.034)	(0.039)	(0.028)	(0.035)	(0.023)	(0.029)
PC*Class(Dual)	-0.245***	-0.145***	-0.212***	-0.174***	-0.159***	-0.103***
	(0.036)	(0.038)	(0.031)	(0.034)	(0.025)	(0.029)
PC*Class (W.D.)	0.162	0.362	-0.310	-0.140	0.010	0.158
	(0.197)	(0.190)	(0.338)	(0.318)	(0.144)	(0.150)
PC*Class (Other)	-0.199***	-0.126**	-0.172***	-0.162***	-0.132***	-0.096**
	(0.040)	(0.045)	(0.040)	(0.049)	(0.030)	(0.034)
	GUINEA					
Parental Capital (PC)	0.485***	0.316***	0.390***	0.229***	0.278***	0.147**
	(0.044)	(0.042)	(0.044)	(0.036)	(0.063)	(0.054)
PC*Class(Freemen)	-0.160	-0.136	-0.152	-0.097		
	(0.084)	(0.074)	(0.088)	(0.079)		
PC*Class(Wealth Distinct)					0.105	0.098
					(0.074)	(0.064)
PC*Class (Dual)	0.026	0.012	0.077	0.049	0.148*	0.117*
	(0.052)	(0.049)	(0.054)	(0.046)	(0.067)	(0.059)
PC*Class(Other)	-0.081	-0.014	-0.191	-0.035	0.117	0.159
	(0.214)	(0.182)	(0.274)	(0.272)	(0.195)	(0.170)
PC*Class(Foreign)	-0.118*	-0.062	-0.074	-0.028	0.074	0.099
	(0.058)	(0.049)	(0.060)	(0.047)	(0.066)	(0.057)
	MADAGASCAR					
Parental Capital (PC)	0.520***	0.469***	0.088***	0.081***	0.415***	0.375***
	(0.040)	(0.037)	(0.007)	(0.007)	(0.029)	(0.026)
PC*Class(Dual)	0.280***	0.208***	0.046***	0.030**	0.242***	0.174***
	(0.056)	(0.049)	(0.010)	(0.010)	(0.041)	(0.036)
PC*Class(Other)	0.191**	0.146*	0.023*	0.015	0.136**	0.099*
	(0.068)	(0.063)	(0.010)	(0.010)	(0.050)	(0.047)
	MALAWI					
Parental Capital (PC)	0.762***	0.495***	0.516***	0.337***	0.576***	0.372***
	(0.017)	(0.020)	(0.018)	(0.020)	(0.015)	(0.016)
PC*Class(Dual)	-0.212***	-0.185***	-0.152***	-0.131***	-0.164***	-0.144***
	(0.033)	(0.034)	(0.032)	(0.032)	(0.026)	(0.026)
PC*Class(Other)	0.136*	0.071	-0.020	0.015	0.001	0.002
	(0.056)	(0.060)	(0.051)	(0.047)	(0.038)	(0.036)
PC*Class(Foreign)	-0.617***	-0.443***	-0.426***	-0.291***	-0.450***	-0.323***
	(0.096)	(0.079)	(0.080)	(0.077)	(0.087)	(0.076)
	NIGER					
Parental Capital (PC)	0.872***	0.556***	0.538***	0.335***		
	(0.038)	(0.033)	(0.041)	(0.050)		
PC*Class(Complex)	0.114	0.099	0.112	0.137*		
	(0.072)	(0.064)	(0.069)	(0.059)		
PC*Class(Dual)	0.053	0.013	-0.024	-0.067		
	(0.073)	(0.072)	(0.087)	(0.084)		
PC*Class(Foreign)	-0.528***	-0.275*	-0.379**	-0.225		
	(0.125)	(0.120)	(0.139)	(0.148)		
PC*Class(Other)	-0.811***	-0.723***	-0.538***	-0.441***		
	(0.197)	(0.213)	(0.041)	(0.068)		
	NIGERIA					
Parental Capital (PC)	0.452***	0.300***	0.414***	0.264***	0.594***	0.353***
	(0.043)	(0.035)	(0.037)	(0.034)	(0.100)	(0.081)
PC*Class(Freemen)	0.392***	0.202*	0.054	0.000		
	(0.098)	(0.098)	(0.068)	(0.074)		
PC*Class(Wealth Distinct)	0.203***	0.102*	0.047	0.035	-0.032	-0.001
	(0.054)	(0.041)	(0.047)	(0.041)	(0.103)	(0.082)
PC*Class(Complex)	0.152**	0.094*	-0.025	-0.029	-0.087	-0.014
	(0.055)	(0.044)	(0.049)	(0.043)	(0.105)	(0.083)
PC*Class(Dual)					-0.142	-0.078
					(0.106)	(0.084)
PC*Class(Other)	0.144*	0.128*	0.007	0.034	-0.090	0.012
	(0.064)	(0.053)	(0.047)	(0.045)	(0.106)	(0.084)
Controls for x	No	Yes	No	Yes	No	Yes
Ethnic /Urban-Rural FE	No	Yes	No	Yes	No	Yes

Notes: *p<0.05,** p<0.01, *** p<0.001, Sample size: Ghana=27,853, Guinea=13,016, Madagascar=21,517, Malawi=21,066, Niger=8,994, Nigeria=11,965. Base for ethnic classification interaction-Absence among Freemen (Ghana, Madagascar, Malawi) Wealth D. (Guinea, Niger), Dual (Nigeria). *Source*: Authors calculation from LSMS dataset

B.2 MOBILITY MATRICES SPECIFICATION

The specification of these commonly used mobility matrices are presented as follows (Aebi, Neusser, Steiner, et al., 2006):
The Prais index:

$$\frac{K - tr(P)}{K - 1} \tag{B.1}$$

The Eigen value index:

$$1 - \delta(P) \tag{B.2}$$

The Bartholomew index:

$$\sum_{i=1}^{K} \pi(i) \sum_{j=1}^{K} P(i,j)|i - j| \tag{B.3}$$

The Determinant index:

$$1 - det(P) \tag{B.4}$$

In all these equations, P refers to the irreducible transition matrix, π is the invariant distribution of P, $\delta(P) = max|\lambda| : \lambda \in \rho(P)$ and $\lambda \neq 1$ The indices i and j always denote generic states running from 1 to K.

B.3 COARSENED EXACT MATCHING AND INSTRUMENTAL VARIABLES APPROACHES

Methodology

Possible selection bias in the regression model specified above can be overcome by randomization of individuals into the different classifications. As an additional robustness check and to reduce selection bias, I use Coarsened Exact Matching (CEM) procedure on the data. CEM is a monotonic imbalance reducing methodology and amongst its attributes, it eliminates the need for a separate procedure to restrict the data to common empirical support, increases efficiency and is robust to measurement error. CEM works by temporarily coarsening each variable into substantively meaningful groups, matching exactly on these coarsened data and then keeping the original values of the matched data (Blackwell et al., 2009). By applying CEM on the data, selection bias is reduced and there is assurance of a higher balance between the respondents in two groups of interest, defined by the two main ethnic classification in a country. The individuals are matched on the basis of age, sex, parental education level, urban-rural locality and household size.

The measure of imbalance in the original dataset is measured using the L_1 statistic. The overall L_1 statistic is based on the L_1 difference between the multidimensional histogram of all pretreatment covariates in the both groups (Blackwell et al., 2009). It is represented as:

$$L_1(f,g) = \frac{1}{2} \sum_{l_1,\ldots l_k} |f_{l_1 \ldots l_k} - g_{l_1 \ldots l_k}| \tag{B.5}$$

Where $f_{l_1 \ldots l_k}$ and $g_{l_1 \ldots l_k}$ represent the k dimensional frequencies for the two groups. An L_1 measure of 1 implies total imbalance in the data while a measure of 0 implies perfect global balance from the coarsening.

To deal with possible measurement error and endogeneity of parental education, I further instrument for it using a historical geographic variable, namely the distance from the capital of the ethnic group settlement, presented in Michalopoulos and Papaioannou (2013). The intuition behind this is that education opportunities during that period were to an extent influenced by distance to the capital areas where the colonial governments set up their administrations. Infrastructure development, particularly of schools, and other economic activities was usually concentrated in the capital or nearby areas and ethnic tribes which were located in those areas would have been more likely to benefit from education and other opportunities which were available than those in areas that were further. Most of the capitals were located along the coast in countries with access to oceans, and were the point of entry for missionaries who played a key role in the development of education in Africa - areas with less mission activities have been found to have lower levels of human capital development (Gallego and Woodberry, 2010; Woodberry, 2012; Woodberry, 2004).

The first stage equation therefore implies that the level of parental education is a function of the historical distance from the capital of the ethnic group:

$$y^k_{ij(t)} = \beta_1 DC^k_j + \beta_2 E^k_j * DC^k_j + \beta_3 \sum {x_{ij}}^k + \mu_{(t)} \tag{B.6}$$

Where $y^k_{ij(t)}$ denotes years of education for child i in ethnic group j which falls under historic ethnic class specification k. DC^k_j refers to the distance from the capital calculated from the centroid of the ethnic group j of historic ethnic class specification k, E^k_j is the historic ethnic classification dummy variable of ethnic group j, ${x_{ij}}^k$ is a vector of control variables, which include various precolonial attributes of the ethnic groups, and the error term is given by $\mu_{(t)}$. Region and ethnic group fixed effects are included. I use generated CEM weights in the evaluation and estimation for the OLS and IV models in this section.

Results

Reducing Selection Bias - Application of Coarsened Exact Matching

For this section, I focus my analysis on Ghana and Madagascar which have significant differences in mobility between the groups from the precolonial period and had differing evolution in persistence between groups. Only two groups, which are the majority groups in both countries, are included in the analysis, Dual and the Absence amongst Freemen group. The multivariate L_1 statistics are reported in Table B.4. After matching, the L_1 for the individual variables is approximately zero for all the variables and this implies global balance at the individual level. The multivariate L_1 reduces from 0.526 before matching to 0.287 for Ghana, and from 0.402 to 0.317 for Madagascar, after matching indicating a reduction in imbalance in both the marginal and joint distributions of the data after applying CEM.

Table B.4: The L_1 measure of imbalance before and after Coarsened Exact Matching

	Ghana				Madagascar			
	Before Matching		After Matching		Before Matching		After Matching	
	L_1	mean	L_1	mean	L_1	mean	L_1	mean
Age	0.056	0.152	0.039	-0.080	0.034	-0.353	0.035	-0.054
Parental Education	0.329	-3.406	0.007	-0.007	0.055	-0.367	9.0e-05	-9.0e-05
Sex	0.001	0.001	4.4e-15	-1.6e-14	0.022	-0.022	1.5e-14	1.7e-14
Household Size	0.171	1.419	0.058	0.036	0.053	-0.331	0.010	-0.010
Locality	0.276	0.276	2.9e-15	4.2e-15	0.070	0.070	1.6e-14	1.3e-14
Multivariate L_1	0.526		0.287		0.402		0.317	

Notes:L_1 refers to the L_{1j} measure, which is L1 computed for the jth variable separated. The mean is the difference in means between the two groups. Authors computation based on LSMS data

The results from the matched OLS regressions are presented in Table B.5. The results confirm observed patterns from the main regressions and show that in Ghana, Dual have less persistence than the Absence among Freemen while the opposite obtains in Madagascar.

Table B.5: Effect of parental education on children education : Country level OLS regression results after Matching

	Dependent Variable, respondent education level y_t							
	Ghana				**Madagascar**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parental capital	0.643***	0.524***	0.396***	0.348***	0.490***	0.476***	0.480***	0.445***
	(0.015)	(0.014)	(0.014)	(0.014)	(0.016)	(0.016)	(0.016)	(0.016)
PC*Class(Dual)	-0.097***	-0.098***	-0.103***	-0.114***	0.142***	0.142***	0.091***	0.087***
	(0.019)	(0.017)	(0.018)	(0.017)	(0.020)	(0.020)	(0.021)	(0.020)
Constant	3.418***	10.490***	12.637***	13.590***	0.892***	-0.795***	-0.327	0.339
	(0.059)	(0.222)	(1.350)	(1.323)	(0.057)	(0.225)	(0.236)	(0.236)
Controls for x	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Ethnic FE	No	No	Yes	Yes	No	No	Yes	Yes
Urban/ Rural FE	No	No	No	Yes	No	No	No	Yes
R^2	0.175	0.289	0.359	0.385	0.210	0.222	0.234	0.252
F	1493.07	1228.79	348.60	377.54	1196.35	551.30	294.69	304.17

Notes: *p<0.05,** p<0.01, *** p<0.001, n= 21,172 (Ghana), 13,529 (Madagascar); Base for ethnic classification interaction and categorical results- Absence among Freemen group. *Source*: Authors calculation from LSMS dataset

Addressing Endogeniety - Use of Instrumental Variables

This section presents the results of the instrumental variable strategy using distance from the capital as an instrument for parental capital. The estimates of the implied first stage results are shown in Table B.6 for Ghana and Madagascar. The first stage F-statistic indicates that the instrument is not weak and the coefficient results show that

distance from the capital is in itself a statistically significant predictor of parental education. It is more complicated to test for exogeneity of the instrument as the equation is exactly identified but correlation analysis shows a negative relationship between distance from the capital and education of the respondents in both countries. As it was not possible for an indigenous ethnic group to determine the setting up of the capital during the colonial period, I argue that the actual distance is exogenous and a sufficient instrument for this case.

Table B.6: Selected Coefficients from First Stage Regression

Dependent Variable	Parental education level				Parental education level*Ethnic Classification			
	Ghana		Madagascar		Ghana		Madagascar	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Distance to coast (DC)	-1.949***	0.996***	-2.734***	-2.246***	-3.554***	-1.975***	-9.119***	-7.967***
	(0.125)	(0.187)	(0.175)	(0.382)	(0.101)	(0.157)	(0.137)	(0.304)
DC*EC(Dual)	-1.790***	-1.008***	-0.754***	-1.486***	0.968***	1.395***	5.630***	5.070***
	(0.132)	(0.125)	(0.149)	(0.160)	(0.107)	(0.105)	(0.116)	(0.128)
F-statistic	366.60	603.54	399.75	256.77	638.70	479.29	2223.04	627.59
Controls for x	No	Yes	No	Yes	No	Yes	No	Yes
Ethnic Group FE	No	Yes	No	Yes	No	Yes	No	Yes
Urban/ Rural FE	No	Yes	No	Yes	No	Yes	No	Yes

Notes: *p<0.05,** p<0.01, *** p<0.001; The table shows selected coefficients of interest from the first stage regression implied by the IV regressions for Ghana and Madagascar. Standard errors are in parentheses. There are a minimum number of observations of 11,965 in Nigeria and maximum number of 27,816 in Ghana. Results from all the coefficients are not presented but are available on request from the author. The variable description are presented in the methodology section. PC stands for parental capital/ parental education level, DC for distance from the capital and EC(*) for the historic ethnic classification. The base variable for the interaction and categorical results is the Absence among Freemen (AF) group. *Source*: Authors calculation based on data from LSMS.

The results from the IV regression are shown in Table B.7 and the results are in line with the findings from the least squares regression - persistence is lower in Ghana among the Dual as compared to the Absence amongst Freemen, while higher in Madagascar (columns 3 and 4). However, the coefficients are not statistically significant. Hence I find no causal effect of the ethnic classification and conclude that the precolonial characteristics, while important in explaining within country differences in intergenerational persistence have had no causal effect on mobility in contemporary Africa.

Table B.7: Effect of Parental education on children education: Instrumental Variables estimates using matched data

	Dependent Variable, respondent education level y_t			
	Ghana		Madagascar	
	(1)	(2)	(3)	(4)
Parental capital (PC)	0.880***	-0.804	0.890***	0.316**
	(0.085)	(1.093)	(0.052)	(0.096)
PC*Class(Dual)	0.793***	-0.343	0.089**	0.021
	(0.079)	(0.688)	(0.028)	(0.041)
Constant	2.996***	27.713*	0.033	-0.583
	(0.095)	(13.760)	(0.100)	(0.366)
Controls for x	No	Yes	No	Yes
Ethnic Group FE	No	Yes	No	Yes
Urban/Rural FE	No	Yes	No	Yes
N	21172	21172	13546	13546

Notes: *p<0.05,** p<0.01, *** p<0.001; The table shows IV estimates of the regression model. Standard errors are in parentheses.The regression uses CEM weights. PC represents parental capital or parental education. The base variable for the interaction and categorical results is the Absence among Freemen group. *Source*: Authors calculation based on data from LSMS.

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4

THE MEDIAN VOTER AND INTERGENERATIONAL TRANSMISSION OF EDUCATION - THEORY AND EVIDENCE FROM GHANA

ABSTRACT

This chapter examines the relationship between policy, political institution and intergenerational transmission of human capital when households are faced with credit constraints and a convex human capital technology that determines their ability to invest in children's education. The paper looks into inequality of opportunities, with some households facing better initial conditions to invest in children's education than others, and relates it to human capital accumulation across different stages of economic development. The findings suggest that democratic settings may be a mode of accelerating social mobility in the early stages of development when the poor are the majority and hence the median voter as they prefer higher redistribution through public investment in education. The results are supported by evidence from a linear structural regression model which uses cross sectional survey data from Ghana for two periods, 1992 and 2017. The empirical analysis demonstrates higher levels of education mobility in rich households, with persistence increasing in poorer households in the latter period, suggesting reduced redistribution which may result from changes to the median voter characteristic over time.

Keywords: Intergenerational Mobility, Human Capital Accumulation, Democracy, Africa.
JEL Codes: C21, C51, I24, J62

4.1 INTRODUCTION

The effects of capital market imperfections on human capital accumulation and growth has received considerable interest in the development literature. Capital market imperfections can impede growth by amplifying productivity differences between individuals of diverse wealth backgrounds leading to lower economic efficiency and higher inequality, particularly in non-egalitarian societies. Market imperfections also determine the magnitude of redistribution through public education and the ability of households to finance education. Long run effects of public education financing on inequality and growth compared to private funding is the focus of Glomm and Ravikumar (1992) while Glomm (1997) compares the growth effects of public and private education regimes, showing that growth is potentially higher under public education given sufficiently high levels of initial human capital. Agénor (2011) further examines the growth trade-off of financing public infrastructure investment against the provision of education services within an endogenous growth model. We address human capital accumulation and redistribution in this work, similar to Alesina and Rodrik (1994), Persson and Tabellini (1994), and Saint-Paul and Verdier (1993), with a focus on the function of democratic political institutions, though our study is undertaken in the context of the developing world.

This chapter investigates the interaction between government education policy, political institutions and intergenerational transmission of human capital when households are faced with credit constraints and are unable to borrow to finance investment in human capital. The agents are confronted with a convex human capital technology that determines their ability to invest in he education of their children. We develop an endogenous growth model that shows the differences in intergenerational human capital transitional dynamics when households are faced with disparities in their initial wealth conditions. In the theoretical model, we find that in earlier phases of economic development, in democratic settings, the poorer median voter votes for a redistributive strategy, which leads to increased public education spending and hence lowers educational persistence. We find that high levels of inequality in a democracy may thus advance efficiency (through promoting social mobility) if redistribution is done through human capital investment.

In particular, we formulate a simple general equilibrium model set up within an overlapping generation framework with heterogeneous households, differentiated by wealth, each composed of two-generations, a parent and a child. Human capital accumulation depends positively on three inputs, parental investment, parental human capital and government expenditure. Households in the model face a fixed education cost threshold which determines the ability to invest privately in offspring education. Income and productivity of individuals is dependent on aggregate human capital in the economy, which characterize the different stages of development. In the early stage of development, aggregate human capital is inadequate, with low incomes and productivity. Hence, only the rich can afford to invest in their offspring education. Because of the spillover productivity effects from the existing aggregate human capital, the economy continues to grow resulting in higher incomes and an increasing amount

of households investing in their children's education. Eventually, the economy moves to a higher stage of development where all households can invest in their children's education. We show that given sufficiently high initial human capital levels, the tax rate selected by poor households will always be higher than that preferred by the rich. Based on the median voter theorem by Meltzer and Richard (1981), this implies that in the early stages, in democratic settings, higher tax revenue leads to more government expenditure. As an input in human capital accumulation, this accelerates the transition of the economy to a higher stage of development and has implication for intergenerational transmission of education.

We test the model's empirical implications using a constructed sample of 36,987 individuals from two cross-sectional Ghana Living Standards Surveys (GLSS). Ghana is selected because of the availability of comparable survey data across a relatively long period of time and the two periods, 1992 and 2017, are taken as representative of a generational change. Ghana is also a stable democratic state in SSA and this allows us to test the model implications as regards the education and the median voter characteristics. Quintiles based on consumption expenditure are used to separate individuals into poor and rich categories, with individuals in the top two quintiles taken as rich while those in the bottom three are assigned as poor households. The results from the structural estimations show higher levels of mobility amongst rich individuals compared to the poor individuals in both periods, indicating that the offspring who have higher incomes are able to access more education opportunities. The results in the latter period show higher education persistence for the poor and this may be reflective of the changing characteristic of the median voter at higher levels of development. The increased variation implies that democracy may have an equalizing effect with regards to social mobility in the short run but in the long term, more policies to increase mobility may be needed, particularly if the level of redistribution changes.

This chapter builds on the previous two chapters which sought to understand the role of ethnic institutions in the African mobility process. In this chapter, we examine a different feature of the African landscape and take into account the high levels of inequality which permeate the African landscape, developing a theoretical model with heterogeneous agents and bringing in the aspect of political institutional characteristics in understanding human capital accumulation across developmental stages.

A sizeable literature deals with theories of the relationship between democratic institutions, inequality and growth. Most of the work highlight the importance of the median voter in determining the size of redistribution in countries with majority rule and universal suffrage (Alesina and Rodrik, 1994; Downs et al., 1957; Meltzer and Richard, 1981; Perotti, 1996; Persson and Tabellini, 1994). The seminal paper by Meltzer and Richard (1981) demonstrates the role of the median voter in determining the size of government and level of redistribution in democratic societies. The lower the mean income of the median voter in the income distribution is, the larger is the size of the redistribution, in this way reducing inequality. This outcome is extended to different political regimes by Acemoglu and Robinson (2000). Acemoglu et al. (2015) however argue that under certain conditions, democracy may not always lead to increased redistribution or lower inequality. Factors such as high land inequality or if

the economy has already undergone significant transformation may lead to higher inequality and they argue that the effect of democracy on fiscal distribution and economic structure may then be ambiguous. This paper contributes to this strand of literature by showing how the median voter under democratic settings may advance efficiency if redistribution is done through human capital investment and contextualizing the findings using data from Africa.

The paper further contributes to studies which have sought to understand intergenerational mobility in Africa. Cross-country comparisons of intergenerational mobility in Africa include the works of Alesina et al. (2021), Azomahou and Yitbarek (2020), Bossuroy and Cogneau (2013), Hertz et al. (2007), and Narayan et al. (2018) and Funjika and Getachew (2022). Hertz et al. (2007) provide education mobility estimates for 51 countries including four African countries, and find large regional disparities in persistence. They document high initial levels of educational persistence in the African countries which has been declining over time, in line with findings from more recent work by Azomahou and Yitbarek (2020). In addition, Narayan et al. (2018) provide estimate of mobility for 148 countries and argue that higher public investment in education and better policies are crucial in increasing low levels of mobility in African and South Asian countries, host to the poorest people. Alesina et al. (2021) also examine intergenerational mobility in 23 African countries and find high levels of heterogeneity in persistence both across and within countries, with rural areas having higher levels of persistence. We contribute to this strand of literature by providing a theoretical exposition of intergenerational mobility across different economic stages.

Finally, the paper relates to the literature which sets out to understand the underpinnings of intergenerational persistence (Asiedu et al., 2021; Basu and Getachew, 2015; Glomm, 1997; Piketty, 2000). A survey of existing theories of persistent inequality across generations is presented in Piketty (2000), focusing on the role of wealth, ability, capital markets, segregation and self-fulfilling beliefs in perpetuating intergenerational inequalities. Basu and Getachew (2015) analyse the effects of a human capital adjustment cost, defined as a marginal cost schedule of augmenting human capital, on social mobility. They find that a higher adjustment cost for human capital acquisition slows down social mobility and results in persistent inequality across generations. Andrews and Leigh (2009) argue that the relationship between social mobility and inequality is not so clear cut and depends on re-distributional effects, which further depend on the placement of the median voter and the political influence of the wealthy. Peer effects from segregated communities are also key. Asiedu et al. (2021) develop a collective household decision model that allows for dynamic interactions between parental gender bias, intergenerational mobility and intra-household bargaining power. By assuming no credit markets, altruistic parents and human capital in place of physical capital as the prime engine of growth within the endogenous growth model, the paper further relates to Basu and Getachew (2015), Galor and Moav (2004), Glomm and Ravikumar (1992), and Moav (2002). However, these papers abstract from discussions of the median voter influence and the re-distributive effects for different stages of development.

The rest of the paper is organized as follows. In section 4.2, we formally set up the model which shows the aggregate dynamics of human capital accumulation and culminates in the stages of development. The model calibration and empirical analysis follow in sections 4.3 and 4.4. Section 4.5 provides a summary of key findings and policy implications and concludes. Proofs for propositions developed are provided in the Appendix.

4.2 MODEL SET UP

4.2.1 *Preferences and Technology*

The model is similar to that of Basu and Getachew (2015). It is set up within an Overlapping Generations Framework. In each period t, there are two generations living in a household, a child and an adult. The adult, who is the parent of the child, is assumed to be altruistic and hence cares about the future outcome of the child. The preferences of all individuals are identical but the agents are heterogeneous in terms of household wealth. At the beginning, we have two types of households in the model, λ rich households and 1-λ poor households.[1] The savings behaviour within the two types of households is symmetric and population growth is assumed to be constant.

The consumption of the child is included in the adult consumption. We therefore set the consumption of the offspring to zero. We assume that there is no credit market, following Benabou (2002), Getachew and Turnovsky (2020), and Loury (1981) and Basu and Getachew (2015). This means that education financing in the first period of life cannot be achieved through the market and depends mainly on parental investment and publicly provided education. This assumption is convenient as it enables us to analytically solve the model and facilitates for the underlying intuition pertaining to the impact of policy on human capital accumulation and growth.[2]. Using this postulation, we are also able to represent endogenous inequality because of marginal diminishing returns to investment at the individual level and idiosyncratic shocks(see also Benabou (2000, 2002), Getachew and Turnovsky (2015, 2020), and Loury (1981) for social mobility within a missing credit markets framework). It is also more convincing than the assumption of perfect capital markets which has been argued to be unrealistic, particularly for developing countries, as it negates a large number of individual dynamics by implying that they often coincide with aggregate dynamics, limiting their applicability to inequality and mobility studies (Getachew, 2016).[3] Perfect capital markets also imply instantaneous equalization of intra- and inter-temporal

1 The terms "high income" and "rich" are used interchangeably. We also use the terms "low income" and "poor" interchangeably.

2 Solon (2004) also assumes credit market constraints and this allows for an interior solution to the model which highlights the effects of 4 main variables on mobility, hereditability, more productive human capital, returns to human capital and public investment in human capital

3 Banerjee (2003) also challenges the hegemony of perfect capital markets in developing countries, pointing at specific factors that may exclude individuals from the markets. Factors discussed include transaction costs, insufficient information on potential borrowers particularly those who are poorer, inefficiency and dynamic costs which lead to lower education investment in children.

individual household productivity, suggesting that the economy reverts to its long run balanced growth part in the first period, while credit constraints allow us to understand the inequality dynamics to drive the growth process, as per (Getachew, 2016; Romer, 1986).

4.2.2 *Utility function and budget constraint*

The assumption that agents are altruistic implies that they receive utility from investment in their children's human capital. The logarithmic utility function for the adult at time t is thus set up as follows:

$$U_{it}(c_{it}, h_{it+1}) = ln\, c_{it} + \beta\, ln\, h_{it+1} \tag{4.1}$$

Where c_{it} represents adult consumption. The degree of parental altruism is given by $0 < \beta < 1$, and the parameter h_{it+1} represents the human capital of the child. The utility function is twice continuously differentiable on the set of strictly positive real numbers, $\mathbb{R}_{++}$, i.e. there is no satiation and the individuals have decreasing marginal utility.

The parent/ adult is endowed with a unit of labour which is supplied in-elastically.[4] Household income for the adult is composed of wages, w_t, from the supplied labour which is taxed by the government at the rate τ and which is augmented by the individuals human capital. The net household income is then allocated between consumption, c_{it},and expenditure on the children's education, e_{it}. The households face a fixed education threshold, $\bar{s}$, and if total household income is below this level, the household does not invest in the child's education. The budget constraint of the household is thus given by:

$$c_{it} + (e_{it} + \bar{s}) \equiv (1 - \tau) I_{it} \tag{4.2}$$

where

$$I_{it} = \begin{cases} w_t & \text{if } h_{it} = 1 \\ w_t + h_{it}\phi_t & \text{if } h_{it} > 1 \end{cases} \tag{4.3}$$

and

$$c_{it} \geq 0,\ e_{it} \geq 0,\ \bar{s} \geq 0, \tau \in (0, 1) \tag{4.4}$$

In equation (4.3), $h_{it} = 1$ refers to basic human capital of unskilled workers. I_{it} is the disposable income of the adult and is dependent on the human capital or education background of the adult. The wage rate per unit of labour is given by w_t and $h_{it}\phi_t$ is the skills premium. The gross income of skilled individuals is composed of the labour income and skill premium while for the unskilled individuals, it is only composed of the labour income.

4 Our model abstracts from the labour-leisure discussion and assumes the household do not take leisure into account

4.2.3 *Technology of Human Capital Production*

In the spirit of Basu and Getachew (2015), the only form of reproducible capital in each period is human capital. The human capital production function for the offspring is of Cobb Douglas form and is given by:

$$h_{it+1} = e_{it}^{\eta} h_t^{\theta} z_t^{1-\eta-\theta} \tag{4.5}$$

where $\eta \in (0,1)$, $\theta \in (0,1)$, and $1-\eta-\theta > 0$. The parameters η and θ are elasticities of learning and represent the impact of parental investment and parental education on human capital accumulation. The parameter h_t represents the average human capital in the economy and is representative of the externality or spillover effect on human capital production. Government expenditure on human capital development is denoted by z_t. If parents do not invest in the children's human capital, in the absence of public education, the offspring will have basic human capital when they become adults and will provide unskilled labour.

Solution to the household problem

The household maximization problem is given by:

$$\begin{aligned} \max_{c_{it}, h_{it+1}} \quad & ln\, c_{it} + \beta\, ln\, h_{it+1} \\ \text{s.t.} \quad & c_{it} + e_{it} + \bar{s} = (1-\tau) I_{it}, \\ & h_{it+1} = e_{it}^{\eta} h_t^{\theta} z_t^{1-\eta-\theta} \end{aligned} \tag{4.6}$$

The first order condition which shows the i^{th} household solution for education investment is obtained by maximizing with respect to e_{it}:

$$e_{it}^{*} = \frac{\beta\eta}{1+\beta\eta}[(1-\tau) I_{it} - \bar{s}] \tag{4.7}$$

Some observations can be made based on the above solutions. Investment in human capital development of the offspring is a function of parental altruism, the level of net household income at time t and the minimum education threshold level - if net household income is less than or equal to the threshold level of saving, then the adult will not invest in the child human capital. Alternatively, high income households will be able to invest in the human capital of their children. Increases in parental altruism also leads to more investment in the children's education.

The effective education investment is therefore given by:

$$e_{it} = max(0, e_{it}^{*}) \tag{4.8}$$

4.2.4 *The Firm*

There is a perfectly competitive environment and we assume a representative firm with a Cobb-Douglas production function. Output is produced by both skilled and

unskilled workers at time t and labour input is augmented by the stock of human capital, as in Romer (1986). Labour supply is in-elastically supplied, $l_t = 1$, and the stock of technology, given by A, is exogenous to the model.

In order to maximize their profits, given w_t, h_t and l_t, the firms ensure that they set the marginal products of inputs to equal the real price as follows:

$$w_t = A(1-\alpha)h_t \tag{4.9a}$$

$$\phi = \alpha A \tag{4.9b}$$

where α is the factor share of human capital, and h_t is the aggregate human capital at time t.[5] We see from (4.9) that ϕ is constant over time and that individuals receive the same rate for each unit of human capital.

4.2.5 *The Government*

The government uses income tax revenues earned in period t to finance public investment in education. Public education expenditure includes both infrastructure projects (building of schools) as well as spending on education services, in line with the arguments of Agénor (2011). Total government revenue is the sum of taxes collected from labour income from both skilled, λw_t, and unskilled, $(1-\lambda)w_t$ workers and human capital incomes, $\lambda\phi h_{it}$. Aggregating over households, the government budget constraint is given by:

$$z_t \equiv \tau w_t + \tau\phi h_t = \tau(w_t + \phi h_t) \tag{4.10}$$

Using (4.9), equation (4.10) can be written as:

$$z_t \equiv \tau(A(1-\alpha)h_t + \alpha A h_t) = \tau A h_t \tag{4.11}$$

We make the assumption that the government has a balanced budget in each period, meaning that public expenditure equals tax revenue.

4.2.6 *Optimum Human Capital Accumulation*

In our model, we have two types of households, high and low income households. Those with low incomes are not able to attain the education threshold and hence do not invest in the human capital of their children, particularly in the early stages of development. Therefore, only high income households can attain the education threshold and have the funds to invest in their children's education. The optimal human capital associated to the i^{th} household is given by:

$$h_{it+1} = max(1, h^*_{it+1}) \tag{4.12}$$

5 Equation (4.9) is derived from a production function of Cobb-Douglas form, specified as $y_t = Ah_t^{\alpha}(l_t h_t)^{1-\alpha}$. Labour is thus augmented with human capital. As workers are compensated according to their marginal productivity, we arrive at (4.9) from the first order conditions.

From (4.12), we see that if the parents do not invest in the human capital of their children, the individuals grow up to have basic human capital, $h_{it+1} = 1$, while those who do invest have children with higher levels of human capital.

We replace e_{it} with its optimal value from (4.7) into the human production function, (4.5), substitute for I_{it} using equation (4.9) and for z_t from (4.11) to get the following expression for the optimum human capital, h_{it+1}:

$$h_{it+1} = \begin{cases} [\psi(Ah_tC' - \bar{s})]^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta} & \text{if } h_{it} = 1 \\ [\psi(Ah_tD' - \bar{s})]^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta} & \text{if } h_{it} > 1 \end{cases} \tag{4.13}$$

with

$$\psi = \left[\frac{\beta\eta}{1+\beta\eta}\right]$$
$$C' \equiv (1-\tau)(1-\alpha)$$
$$D' \equiv C' + (1-\tau)\frac{\alpha}{\lambda}$$

Human capital of individuals with skilled and unskilled parents is represented by equation (4.13). Individuals from skilled parents benefit in two ways: (i) through intergenerational human capital externalities, and (ii) their parents are more likely to invest more in their education.

The growth factor in human capital depends on parental altruism represented by the constant ψ, the ratio of net household income to minimum level of savings given by $(Ah_tD' - \bar{s})$ and $(Ah_tC' - \bar{s})$ for high and low income households respectively. Household income is higher in rich households because of the addition labor factor share and this increases the growth factor effect on the household. It further depends on the aggregate human capital in the economy, h_t, and government investment.

4.2.7 *Education Investment Threshold*

Considering (4.8) and (4.12), we obtain the functional form of the threshold of human capital, for rich and poor households respectively, below which there is no education investment by solving for h_t in equation (4.13). It is characterized as:

$$\psi Ah^PC' - (\tau A)^{\frac{\eta+\theta-1}{\eta}}(h^P)^{\frac{\eta-1}{\eta}} - \psi\bar{s} = 0 \tag{4.14a}$$
$$\psi Ah^RD' - (\tau A)^{\frac{\eta+\theta-1}{\eta}}(h^R)^{\frac{\eta-1}{\eta}} - \psi\bar{s} = 0 \tag{4.14b}$$

Solving (4.14a) and (4.14b) for h^i, where $i = P, R$ gives $\bar{h}^P$ and $\bar{h}^R$ which represent the threshold levels of aggregate human capital beyond which poor and rich households invest in their children's education. The education investment threshold function depends on parental altruism and investment, the average after tax incomes less the savings threshold, government investment and aggregate human capital. For rich households, the investment threshold further depends on the additional labor factor share, $\frac{\alpha}{\lambda}$.

Following from equations (4.14a) and (4.14b), the following relation can be identified:[6]

Proposition 1.

$$\bar{h}^R < \bar{h}^P$$

The relation is intuitive and implies that at every stage of development, rich households are more likely to invest in their children's education than poorer households, ceteris paribus.[7] This assumption is key in understanding household behaviour and implies that social mobility would differ based on the type of household.

4.2.8 *Aggregate Human Capital Dynamics*

The aggregate human capital is derived by summing human capital of skilled and unskilled individuals in the economy from rich and poor households (i.e. educated and uneducated parents). Given that we have λ skilled parents at time t, aggregate human capital is given by:

$$h_{t+1} = \lambda h^R_{t+1} + (1-\lambda)h^P_{t+1} \tag{4.15}$$

where h^R_{t+1} and h^P_{t+1} are the human capital of individuals from rich and poor households respectively. The first term refers to the total number of skilled individuals from rich households while the second term is the total number of unskilled individuals from poor households. If only rich households invest in education, this means that the aggregate human capital is smaller and composed of only the first term in the function but if all households invest then the aggregate human capital increases.

Aggregate human capital from the perspective of the rich representative individual is given by:

$$h^R_{it+1} = [\psi(Ah_t(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-\bar{s})]^{\eta}(h_t)^{\theta}(\tau A h_t)^{1-\eta-\theta} \tag{4.16}$$

From this, we see that steady state human capital with regards to the representative rich individual is given by:

$$h^R = \frac{\psi\bar{s}}{\psi A(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-(\tau A)^{\frac{\theta+\eta-1}{\eta}}} \tag{4.17}$$

The aggregate human capital of the characteristic poor individual is given by:

$$h^P_{it+1} = [\psi(Ah_t(1-\tau)(1-\alpha)-\bar{s})]^{\eta}(h_t)^{\theta}(\tau A h_t)^{1-\eta-\theta} \tag{4.18}$$

6 The proof to the proposition is included in the appendix.

7 We show that this relation holds under various scenarios in the numerical section 4.4 and prove the Proposition in the appendix. Equating the coefficients in equations (4.14a) and (4.14b):

$$h^P C' = h^R D'$$

The equation implies that $h^P > h^R$ since $D' > C'$. Since $h^R > 1$ and $\lambda \in (0,1)$, the restriction $\eta - 1 < 1$ should hold.

Steady state human capital for the poor, given that $(h^P_{t+1} = h^P_t = h_t)$, can thus be given by:

$$h^P = \frac{\psi \bar{s}}{\psi A(1-\tau)(1-\alpha) - (\tau A)^{\frac{\theta+\eta-1}{\eta}}} \tag{4.19}$$

Note that given $\bar{s} \neq 0$, constant returns to scales do not apply on equations (4.16) and (4.18), despite a constant return to scale assumption on the original human capital production function, equation (4.5). This implies that there is no growth in the long run but the economy converges to a steady state that aggregates human capital.

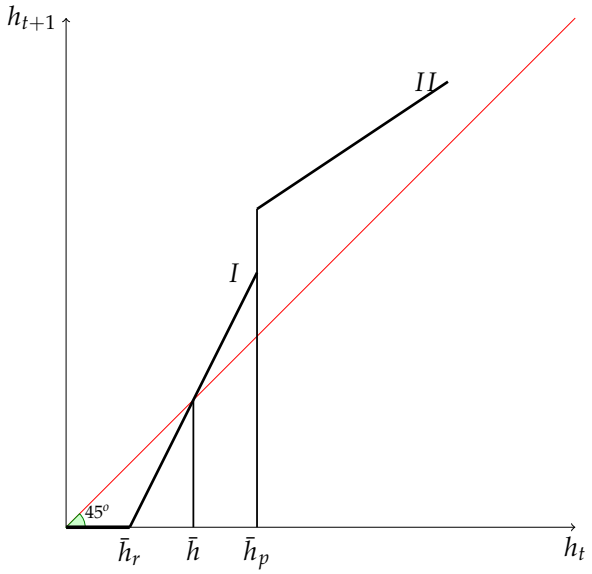
4.2.9 *Human Capital Dynamics and Stages of Development*

Using equations (4.13) and (4.15), the development stages of the economy are characterized by the following dynamic system :

$$h_{t+1} = \begin{cases} 1 \quad \text{if } h_0 < \bar{h}^R \\ \psi^\eta \lambda[(Ah_t D' - \bar{s})^\eta (h_t)^{1-\eta} (\tau A)^{1-\eta-\theta}] \quad \text{if } \bar{h}^R < h < \bar{h}^P \\ \psi^\eta (h_t)^{1-\eta} (\tau A)^{1-\eta-\theta} \left[\lambda (Ah_t D' - \bar{s})^\eta + (1-\lambda)(Ah_t C' - \bar{s})^\eta\right] \quad \text{if } h > \bar{h}^P \end{cases} \tag{4.20}$$

The development stages represent growth in aggregate human capital accumulation over time. In our model, the economy evolves endogenously from the early stage where only rich households are able to invest in their children's education to the advanced economy where all households are able to invest in education. The stages of development are presented in Figure 4.1 and we see that in the initial stage of the economy, below the education threshold capital for rich individuals ($h < \bar{h}_r$), there is no investment in offspring human capital and the offspring have basic human capital, i.e. $h_{t+1} = 1$. If the initial human capital is sufficiently high,$h_0 > h^r$, rich households begin investing in their children's education and this increases the aggregate human capital stock. The increased aggregate human capital moves the economy to another stage of development where poor households are able to invest in their children, through economy wide productivity spillovers which raise the labor income, and persistence in intergenerational education transmission first reduces before increasing as more individuals invest in human capital of their offspring. Eventually, intergenerational persistence converges to the long term equilibrium and the economy is at the full potential where all households are able to invest in their children's education, $h > \bar{h}^p$.

Figure 4.1: Stages of Development within the Economy



The figure shows the stages of development within an economy from the early stages where there is no human capital investment to stage I where rich households are able to invest as the education threshold is reached and later on stage II where all households invest in education.

4.2.10 *The Optimal Tax Rate*

The optimal tax rate is one that maximizes the welfare of the respondent across their lifetime and is determined by maximization of U with respect to τ. The welfare function for the individual across their lifetime is given by:

$$W_{it} : \sum_{t=0}^{\infty} R^t U_{it}(c_{it}, h_{it+1}) \tag{4.21}$$

Where R^t is the generational discount factor across the lifetime of the individual. The tax rate in a democratic state is determined through majority voting and may differ based on the re-distributional preferences of rich and poor households. To find the preferred tax rate for each type of household, we substitute for c_t and h_{it+1} in the welfare function, using the optimal values for e_{it} from equation (4.7), and for h_{it+1} from equation (4.13) for rich and poor households respectively.[8] The preferred tax rate is the discounted solution of the following welfare maximization:

8 After substituting for ϕ_t and w_t in equation (4.3), after-tax income for rich and poor households is given by:

$$I^r_{it} = Ah_t(1 + \frac{\alpha}{\lambda} - \alpha)$$
$$I^p_{it} = Ah_t(1 - \alpha)$$

$$Max_{\tau} = \sum_{t=0}^{\infty} R^t \begin{cases} ln[(1-\tau)I_{it} - e_{it} - \bar{s}] + \beta ln\left[\psi(1-\tau)I_{it} - \bar{s})\right]^{\eta}(h_t)^{\theta}(\tau A h_t)^{1-\eta-\theta} & \text{if } h_{it} = 1 \\ ln[(1-\tau)I_{it} - e_{it} - \bar{s}] + \beta ln\left[\psi(1-\tau)I_{it} - \bar{s})\right]^{\eta} \quad (h_t)^{\theta}(\tau A h_t)^{1-\eta-\theta} \text{ if } h_{it} > 1 \end{cases} \tag{4.22}$$

We can compute the steady state human capital maximizing tax rate from both the perspective of the rich and the poor using equations (4.17) and (4.19) respectively.

The steady state human capital maximizing tax rate from the perspective of the rich is given by:

$$\frac{\delta h^R}{\delta \tau} = 0 <=> \psi(1 + \frac{\alpha}{\lambda} - \alpha) + \frac{\theta + \eta - 1}{\eta}(\tau)^{\frac{\theta-1}{\eta}}(A)^{\frac{\theta-1}{\eta}} = 0$$

$$\tau^{R^*} = \frac{1}{A}\left(\frac{1-\theta-\eta}{\eta}\frac{1}{\psi(1+\frac{\alpha}{\lambda}-\alpha)}\right)^{\frac{1-\theta}{\eta}} \tag{4.23}$$

The steady state human capital maximizing tax rate for the poor individual is given by:

$$\frac{\delta h^P}{\delta \tau} = 0 <=> \psi(1 - \alpha) + \frac{\theta + \eta - 1}{\eta}(\tau)^{\frac{\theta-1}{\eta}}(A)^{\frac{\theta-1}{\eta}} = 0$$

$$\tau^{P^*} = \frac{1}{A}\left(\frac{1-\theta-\eta}{\eta}\frac{1}{\psi(1-\alpha)}\right)^{\frac{1-\theta}{\eta}} \tag{4.24}$$

The human capital maximizing tax rates, τ^{R^*} and τ^{P^*}, are decreasing in the TFP parameter, A, and α. This implies that advancement in technological progress and increases in the factor share of human capital leads to lower tax rates that need to collected from the households to ensure their human capital is maximized. However, increases in the elasticities of learning, θ and η, lead to higher human capital maximizing tax rates. For rich households, it further depends on the ratio between the labor capital share and the proportion wealthy in the society. Given a constant labor capital share, as the fraction of wealthy households in the society increases, the preferred tax rate reduces.

We see immediately from equations (4.23) and (4.24) that $\tau^{R^*} < \tau^{R^*}$ because of the additional term $\frac{\alpha}{\lambda}$ in (4.23). The intuition is straight forward and implies that the rich individual pays more for the same service due to the additional taxes on the skills premium. We therefore derive the following proposition:[9]

Proposition 2. *The preferred tax rate for poor households is always higher than that preferred by rich households,*

$$\tau^{P*} > \tau^{R*}$$

given that the initial human capital in the economy satisfies the following condition:

$$h_0 > \frac{1}{A(\alpha - 1 - \frac{\alpha}{\lambda})}$$

9 The proof to the proposition is included in the appendix.

The proposition shows that given that the initial human capital in the economy is sufficiently high, as indicated, then the tax rate that is selected by the poor households will always be higher than that preferred by the rich. This has important implications for redistribution as it implies that when the median voter is poor, more funds will be available for redistribution through public education under democratic settings.

From the point of view of the rich and poor individuals, τ^{R^*} and τ^{R^*} are also welfare maximizing tax rates.

Welfare for the rich and poor is given by:

$$W_t^R = ln\left(\frac{1}{1+\beta\eta}[Ah_t(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-\bar{s}]\right)+\beta\ ln\ h_{t+1}^R$$
$$W_t^P = ln\left(\frac{1}{1+\beta\eta}[Ah_t(1-\tau)(1-\alpha)-\bar{s}]\right)+\beta\ ln\ h_{t+1}^P$$

Where h_{t+1}^R and h_{t+1}^P are as given in equations (4.16) and (4.18).

In the steady state, human capital and welfare for the rich is given by:

$$h_{t+1}^R = h_t^R = h^R \text{ and } W_t^R = W^R$$

For the poor, this is given as:

$$h_{t+1}^P = h_t^P = h^P \text{ and } W_t^P = W^P$$

Steady state welfare can then be derived as:

$$W_s^R\sum_{t=0}^{\infty}(1+R)^{-t}W^R = \frac{1+R}{R}W^R$$
$$W_s^P\sum_{t=0}^{\infty}(1+R)^{-t}W^P = \frac{1+R}{R}W^P$$

The welfare maximising tax rate for the rich can be represented as:

$$\frac{\delta W_s^R}{\delta\tau} = \frac{\delta W_s^R}{\delta h^R}\frac{\delta h^R}{\delta\tau} = 0 = \frac{\delta h^R}{\delta\tau} \tag{4.25}$$

The same applies for the poor individual that the welfare maximizing tax rate is similar to the human capital maximizing tax rate.

The rest of this paper tests the main implication of the model, namely that the education threshold is lower in rich households than in poorer households and that in subsequent generations and stages of development, individuals from rich households will have higher levels of mobility. The theory also has predictions about the effect of public expenditures on intergenerational persistence in education, showing that poor households always prefer higher tax rates. This amplifies the role of the median voter in determination of the level of public expenditure on education, and under democratic settings, this may accelerate the pace at which economies transition between stages of development.

4.3 NUMERICAL ANALYSIS

In this section, we use numerical calibrations to test the education threshold assumption developed in the theoretical model. Available data from Ghana or from a developing country context is used in determining the benchmark values used in the calibration. Ghana is selected for the numerical calibration and the empirical analysis that follows on the basis of two reasons: availability of comparable data that collects retrospective parental information over an extended period of time and allows us to undertake the generational analysis, and because as a stable democratic nation with relatively high inequality levels, (UNU-WIDER (2021) show that the Gini index for Ghana marginally reduced from 46.10 in 1991 to 43.52 in 2017)[10] this allows us to undertake the empirical analysis as per model specification and within an African context. Ghana was the first SSA country to gain independence from British colonial rule in 1957. The country underwent periods of political instability and military rule, between 1966 to 1992, but it has transitioned to full democratic rule and is generally perceived as a beacon of democratic stability in the region (Abdulai and Crawford, 2010; Asamoah, 2014).

To assess the relationship between the education threshold for low and high income households, we calibrate the model set out in equation (4.14a) and (4.14b) using the benchmark values presented in Table 4.1.

Table 4.1: Benchmark values

Baseline Parameters		
Parental altruism	β	0.3
Parental investment	η	0.3
Parental elasticity	θ	0.3
Tax rate	τ	0.23
Human capital share	α	0.3
Proportion of rich households	λ	0.25
Savings threshold	$\bar{s}$	5.0
Technology production	A	20.32

Notes: The table presents the benchmark values used in the calibration. The values are obtained from Ghana, or where data is not available, studies on developing countries.

The baselines values, as much as possible, are obtained from available literature from Ghana, or where unavailable, other African or developing country. Following De La Croix and Michel (2002) and Basu and Getachew (2015), the psychological discount factor, β is set to 0.96 and hence parental altruism for a period of a generation (30 years) is $0.96^30 \approx 0.3$. Total factor productivity (TFP), A, is obtained by calibrating

10 A Gini coefficient of 0 means that the income distribution is equal, while a Gini of 100 indicates that all of the society's total income accrues to only one person/household unit, leaving the rest with no income at all (UNU-WIDER, 2021).

the growth equation for Ghana and we obtain a value of 20.32.[11] The individual factor share of human capital, α, for which social mobility is sensitive to, is set at 0.3. This follows Basu and Getachew (2015) who derive a mobility estimate of 0.6 from this factor share value, which is relatively close to the estimate for mobility obtained for Sub-Saharan Africa (which are on average, 0.66 for income persistence and 0.50 for education using data from the Global Database of Intergenerational Mobility). The tax rate is obtained by averaging the 30 year tax rate on income, profit and capital gains for Ghana and is set at 0.23.[12] The elasticities of learning, η and θ, are set to 0.3 which is within the acceptable range from similar studies and represent parental investment and education influences on child outcomes (Basu and Getachew, 2015; Glomm, 1997). No existing estimates for education threshold can be identified in the literature and so we set the initial threshold level to be 5 and experiment for different values, $\bar{s} \in \{0, 10\}$, in the numerical analysis. λ, which represents the proportion of rich individuals in the economy is set at 0.25, reflecting the expected higher proportion of poor households in the early stages of development.

Table 4.2: Baseline model results

	Rich Households	Poor Households	Aggregate
Education threshold	0.47	0.74	0.67
Steady state human capital	1.18	1.53	1.44
Consumption	26.55	7.20	12.04
Welfare	628.46	61.15	202.98

Notes: Initial starting value for aggregate human capital, h_0, taken to be 2. h_0 must be greater than 1 which is the minimum starting value for a closed form solution and represents the initial aggregate human capital level. Change of the initial starting value upwards for the education threshold does not change the magnitudes of the results. Initial starting points for consumption and welfare are taken as 0. Simple arithmetic population weights based on the proportion of rich and poor households using the baseline parameter are used to compute the aggregate values.

From the baseline values, the numerical analysis shows that the education threshold level for rich households is lower than that of poor households, meaning they are more likely to invest in their offspring education. Changes upwards or downwards in the fixed education threshold, $\bar{s}$, does not the alter the comparative response of rich

11 We use the log of the average annual GDP growth rate over a period of 30 years (1987-2017) as a proxy for human capital growth and solve for A by calibrating the following growth model:

$$g_t = A * (\eta * \theta * (1 - \eta - \theta))$$

where $g_t = ln(\frac{h_{t+1}}{h_t})$. The annual GDP growth rate is obtained from the World Development Indicators (https://databank.worldbank.org/source/world-development-indicators)

12 Available data for taxes on income, profits and capital gains (% of revenue) is from 1990 to 2017 and is obtained from the World Development Indicators (https://databank.worldbank.org/source/world-development-indicators).

households, i.e., the aggregate education threshold for the rich remains below that of the poor. Steady state human capital is derived from the aggregate human capital functions of the rich and poor individuals. Steady state human capital of the rich is lower than the poor implying that rich households are able to attain the level of human capital which maximizes their output at an earlier stage than poorer households. Using the respective aggregate steady state human capital level for poor and rich households, we can then compute the consumption and welfare of the households. As expected, results from the calibration shows that consumption and welfare of the rich is higher, implying that on aggregate, these households are better off than thanthat of the poor.

Table 4.3: Impacts of changes to the education savings threshold and tax rates on household education investment and Consumption

		Aggregate Education Threshold and Consumption Values					
		Rich Households		Poor Households		Aggregate	
		(h^R)	(c^R)	(h^P)	(c^P)	(h)	(c)
Changes to baseline model	Δ *Parameter*						
Decrease, savings threshold:	$\bar{s}$ = 0	0.41	35.32	0.55	13.59	0.52	19.03
Increase, savings threshold:	$\bar{s}$ = 10	0.58	18.50	1.04	1.08	0.92	5.44
Decrease, tax rate:	τ =0.15	0.63	30.32	0.95	8.59	0.87	14.03
Increase, tax rate:	τ =0.30	0.43	23.50	0.64	6.08	0.59	10.44

Initial starting value for aggregate human capital, h_0, taken to be 2. h_0 must be greater than 1 which is the minimum starting value for a closed form solution and represents the initial aggregate human capital level. Change of the initial starting value upwards for the education threshold does not change the magnitudes of the results. Initial starting points for consumption, welfare and mobility taken as 0. Simple arithmetic population weights based on the proportion of rich and poor households are used to compute the aggregate values.

Results showing the effect of variations in the different parameters on the education threshold for rich and poor households are presented in Table (4.3). We compare the results to those obtained from the baseline values. When we vary the education savings thresholds and the tax rate, the calibration show that an increase (decrease) in the savings threshold is associated with a decrease (increase) in the education threshold. Consistently, we see that the rich households are still more likely to invest in their children. A decrease in the tax rate raises the education thresholds, while an increase decreases the threshold, with a larger effect on poor households. This may reflect the higher sensitivity to changes in the tax rate amongst low income households. The effect may operate through increased government provision of education and is in line with our argument that poor households prefer higher tax rates and are

thus more responsive to changes in the rate.[13] The aggregate education threshold also declines with a decline in the savings threshold and vice versa. Household consumption is also affected by the changes in the threshold and tax rates, with changes to the savings threshold leading to higher changes in consumption of rich households.

4.4 EMPIRICAL ANALYSIS

The empirical validity of the model is examined in this section. The time unit is a generation and we assume a period of at least twenty years between surveys to represent a change in generation.

4.4.1 *Data*

We use pooled cross-sectional data for Ghana from the Ghana Living Standards Surveys (GLSS) for two periods - 1991/2 and 2017. The GLSS collects household level information on education, health, housing, employment, income and expenditure. The 1991/2 survey used a two stage sampling procedure with enumeration areas (EA) selected in the first stage at a probability proportional to the size (number of households) as recorded in the 1984 Population Census. Systematic sampling was then used to select households within each EA. Given the high response rate achieved, the sample is considered as self-weighting and hence weights are not provided. For 2017, the households were clustered by EA, and randomly selected with sampling weights used to make the sample nationally representative. We restrict our sample to respondents who are older than 20 years of age in the surveys to minimize the number of school going children and have a constructed sample size of 36,987. The main data limitations for the survey is the lack of retrospective income data for parents who are not co-resident and to circumvent this, we use education as the measure of mobility.

The dependent variable is the education attainment of the respondent. It is operationalized as the number of years of schooling that an individual attained. We have a total of 8,708 observations in 1991/2, with a mean value of 4.78 years of school. There are 28,279 observations in 2017 with a mean of 7.48 years of schooling. Summary statistics for this and other variables appear in Table 4.4.

The main independent variable of interest is parental education. It is measured as the highest number of years of schooling of either parent in the household.[14] We used

13 See the appendix for the implicit function derivations, from equations (4.14a) and (4.14b), which derive the response of poor and rich households when there is a change in the tax rate and shows that the education threshold response of rich households further depend on the ratio of the labor capital share, α to the proportion of rich households in the economyλ_r i.e. $\frac{\eta}{\lambda}$. This may explain their muted response.

14 While parental education may have measurement error problems, we are not able to provide an estimate of the size of the measurement error and do not instrument for it because of the difficulty in identifying a valid instrument, particularly for Africa where data availability remains a concern, and as noted by Azomahou and Yitbarek (2020).

the highest education level of either parent as the measure of parental education and refer to the persistence from parents education and children's education as parental capital, in line with the mobility literature. The descriptive statistics show that mothers in 1992 had less than a year of schooling on average while in 2017, the average had increased to 2.68 years of schooling. Fathers had 2.34 years of schooling on average in 1992 but by 2017, this had increased to 4.56 years.

We control for the age of the individuals, the gender of the children, number of individuals present in the household (household size) and control for non-linearity arising from the cohort effect using age squared in line with the existing literature (Azomahou and Yitbarek, 2020; Behrman and Knowles, 1999). Locality characteristics may also affect education outcomes with rural/urban differences being a key factor in explaining mobility in Ghana as discussed by Alesina et al. (2021), and hence we also introduce fixed effects for the region and rural/urban locality. Other factors that may explain higher educational outcomes in Ghana include the introduction of free basic education in 1995 and subsequent extension to secondary school level in 2017, introduction of the school feeding program in 2005 and subsequent scaling up across all districts, increased education financing and general economic development and technological advancement which has reduced the digital divide (Akyeampong, 2009; Akyeampong et al., 2010; Macbearth, 2010; Sulemana, Ngah, and Majid, 2013). Analyzing these factors is outside the scope of the paper and could be a possible extension of this work.

Table 4.4: Sample Summary Statistics - Ghana 1991/2 and 2017

	1991/2			2017		
	n	Mean	SD	n	Mean	SD
Education (years of schooling)	8,708	4.78	4.871	28,279	7.484	5.437
Mother's education (years of schooling)	8,678	0.852	2.682	27,933	2.683	4.385
Father's education (years of schooling)	8,572	2.338	4.259	27,115	4.563	5.498
Age (Years)	8,708	39.97	15.753	28279	40.62	16.19
Household size	8,647	5.539	3.202	28279	5.024	3.273
Female(%)	4,833	55.52		15,418	54.31	
Proportion poor(%)	6,311	72.98		20,542	72.64	
Below poverty line (%)	3,959	45.78		9,007	19.44	

Notes: The table presents summary statistics of respondents in the 1991/2 and 2017 Ghana survey. We refer to the 1991/2 survey as 1992 henceforth for convenience. *Source*: Own calculations from Ghana statistical agency

The variable correlations are presented in Table 4.5 and all our variables have the correct expected signs. We see a strong positive relation between respondent education and parental education. The table also shows a strong correlation between the mother and father education suggestive of the existence of assortative marriages with respect to education. There is a negative relationship as expected between the educa-

tion and age and household size meaning that an increase in age or in household size correlates with a reduction in years of schooling for the children and parents.

Table 4.5: Correlation Matrix of Sample Statistics - Ghana

	Education	Mother's education	Father's education	Age
1992				
Mother's education	0.3056*			
Father's education	0.4379*	0.5209*		
Age	-0.3725*	-0.2160*	-0.2753*	
Household size	-0.1086*	-0.0533*	-0.0761*	-0.0432*
2017				
Mother's education	0.4466*			
Father's education	0.5128*	0.6382*		
Age	-0.3280*	-0.2575*	-0.2591*	
Household size	-0.1924*	-0.1343*	-0.1671*	-0.0588*

Notes: The table presents correlation coefficients between the main variables from the 1991/2 and 2017 Ghana surveys. *Source*: Ghana statistical agency

4.4.2 *Methodology*

Intergenerational mobility is measured using the persistence in education attainment from parents to children. We estimate the standard mobility model, based on the work of Becker and Tomes (1986), which has parental education as the independent variable and child outcome as the dependent variable. In line with the theoretical model, the structural equation is estimated for two types of households, poor and non poor - where poor is defined as households in the bottom three consumption expenditure quintiles and non poor for households in the top two consumption expenditure quintiles (top 40 percent). While this measurement is not without its biases, and may not accurately capture rich households as inferred in our model, it does provide a clear basis for separation of the households. We assume that individuals who are classified as non poor are able to attain the household saving threshold and invest in children's education while those classified as poor are not able to do so, and hence are more dependent on public education. The model is set out as follows:

$$h_{i(t)} = \beta_0 + \beta_1 \, h_{i(t-1)} + \beta_2 \sum x_{i(t)} + \alpha_i + \epsilon_{(t)} \tag{4.26}$$

Where $h_{i(t)}$ denotes years of education for child i, $h_{i(t-1)}$ corresponds to the maximum years of education of either of the respondents parents, $x_{i(t)}$ is a vector of control variables and the error term is given by $\epsilon_{(t)}$. α_i refers to region and locality fixed effects which control for the time invariant within-country characteristics in each of the two years. The linear estimate of β_1 is reported as the measure of intergenerational persistence of educational attainment. Alternatively, $1 - \beta$ is a measure of the intergenerational mobility. Higher levels of β_1 imply stronger persistence from parents to children and hence low levels of social mobility and vice versa.

We also estimate a variation of the Rank based regression technique as applied to income mobility by Dahl and DeLeire (2008) and Chetty et al. (2020) and extended to educational data by Asher, Novosad, and Rafkin (2018). We divide our observations into ten year birth-cohorts and then generate education quantiles for the children and parental education which act as a measure of the ranking of the respondents within their birth cohort. We then regress the children's rank within their birth cohort distribution on the parental rank within their distribution using equation (4.26) and focus our discussion on relative rank mobility.

In our sensitivity analysis, we present results from two different models. Firstly, we provide estimates using OLS techniques for the persistence between fathers and sons only, as was standard in earlier studies on intergenerational mobility (See for example Haider and Solon (2006), Solon (1992), and Zimmerman (1992)). In the second model, we take into account the relatively low levels of education amongst parents and children and estimate a discrete choice model with a constructed binary index for education. We code the index as 1 if the respondent (or either of their parent) had any education and zero otherwise. The standard probit model is then estimated on the full sample to study the prevalence of education switches for children given their parental education attainment. The set of explanatory variables for the probit model are the same as for the OLS regressions to allow for comparison. The country-level regression analysis is augmented with ten year birth cohort graphical trend analysis of social mobility for a sample of permanently democratic transitioned countries as categorized by Papaioannou, Siourounis, et al. (2007).[15] The analysis focuses on birth cohorts from 1940 to 1980 and is dis-aggregated by region to highlight the differences in democratic trends. The trend analysis uses intergenerational education mobility data from GDIM (2018).

4.4.3 *Results*

Baseline results

Table 4.6 reports the parameter estimates from the baseline linear regression. Columns (1) to (4) are results based on the 1992 survey while columns (5) to (8) are 2017 parameter estimates. The results for each survey year are dis-aggregated by income (poor and rich). The parameter estimates before controls are used, shown in columns (1) and (3), illustrate higher levels of education persistence amongst the poor (0.517) compared to the rich (0.406) in the early stages of democracy after the transition from military rule (1992). Persistence is slightly higher in 2017 for the poor as shown in column 5, whilst reducing for the rich (column 7), with coefficients of 0.532 and 0.353 respectively. When compared to national level intergenerational mobility estimates of Ghana from GDIM (2018) (estimate of 0.526), the coefficients from the poor are closer, while the rich indicate higher levels of mobility, reflecting the poverty demographic distri-

15 Papaioannou, Siourounis, et al. (2007) use subjective political freedom indicators such as the Polity, Freedom House and Przeworski et al. (2000) classifications, electoral archives, and historical resources in 174 countries for the period 1960-2005 and identify 63 incidents of permanent democratic transitions, 3 reverse transitions from democracy to autocracy and 6 episodes of borderline democratization.

bution of households in Ghana, i.e. there are more poor than rich households.When controls are introduced in the model, our point estimates are lower but the coefficients display a similar pattern with higher levels of mobility within richer households than for the poor.

We also observe much lower persistence in rich households in 2017, with increased variation in persistence between the two types of households and coefficients differing by 5 percentage points compared to 2 percentage points in 1992.

Table 4.6: Intergenerational education elasticity in Ghana - OLS results

	Dependent variable: respondent education level y_t							
	1992				**2017**			
	Poor		**Rich**		**Poor**		**Rich**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parent education	0.517***	0.284***	0.406***	0.265***	0.532***	0.342***	0.353***	0.297***
	(0.017)	(0.017)	(0.019)	(0.020)	(0.011)	(0.012)	(0.016)	(0.015)
Controls for x	No	Yes	No	Yes	No	Yes	No	Yes
Locality FE	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.208	0.435	0.150	0.385 0.292	0.420	0.165	0.256	
N	8647	8647	8647	8647 28279	28279	28279	28279	

Notes: This table presents results from OLS model. Standard errors in parentheses. *p<0.05,** p<0.01, *** p<0.001. Source: authors' compilation based on GLSS data.

Rank based regression results

The results of the rank-based regression, presented in Table 4.7 show higher persistence in children from less privileged backgrounds. We observe an increase in persistence over the two periods with 40 percent of children from less privileged backgrounds being in the same education quintile as their parents in 2017, up from 37 percent in 1992. When controls are included, the difference in persistence amongst poor households reduces with persistence lower in the latter period. In line with the results from the linear regression, amongst the rich, there is a reduction in persistence with fewer children remaining in the same education quintile as their parents, with and without controls. Generally, the results show that children from poor households are more likely to remain in the same category as their parents while those from rich households have higher rates of education mobile and are less likely to maintain the same category as their parents. From the rank-based estimations, we also observe increased variation in intergenerational persistence between rich and poor households in 2017 compared to 1992.[16]

16 When we use 5-year birth cohort to construct the quintiles, results from the latter survey show that the poor have less mobility than the rich and increased gap in persistence between households. See Table C.1 in the appendix for estimation results.

Table 4.7: Intergenerational education elasticity in Ghana - Results from the Rank-rank regression

	Dependent variable: Education level y_t							
	1992				**2017**			
	Poor		**Rich**		**Poor**		**Rich**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parental Education	0.365***	0.331***	0.295***	0.299***	0.404***	0.299***	0.240***	0.235***
	(0.017)	(0.017)	(0.018)	(0.018)	(0.011)	(0.010)	(0.014)	(0.013)
Controls for x	No	Yes	No	Yes	No	Yes	No	Yes
Locality FE	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.160	0.259	0.121	0.214	0.211	0.304	0.097	0.186
N	8631	8631	8631	8631	27638	27638	27638	27638

Notes: The table presents results from the rank based OLS regression model. The ranks are based on 10 year birth cohorts, starting from the 1937/1946 to the 1987/1996 birth cohort for the 2017 survey. For the 1992 survey, the birth cohorts start from 1897/1906 to 1967/1976. Standard errors in parentheses. *p<0.05,** p<0.01, *** p<0.001. Source: authors' compilation based on GLSS data.

Linking the empirical results to the model

Results from the empirical estimation shows increased level of persistence in Ghana for poor households between 1992 and 2017, while the rich households are more mobile. The coefficients are significant for both years indicating that parental education plays a crucial role in the children's outcome in Ghana. We link these results to the model predictions in two ways. Firstly, our model postulates that the education threshold is lower in rich households than in poorer households. In our estimations, we show that across generations, the level of persistence is lower amongst the rich and this implies that more children from wealthier background are likely to attain higher education than their parents. This may be because wealthier households are able to invest more in their children's education.

Secondly, we postulate that under democratic settings, because the median voter determines the tax rate and hence the amount of revenue for public education, we expect to see higher levels of mobility in the earlier periods when there are more poor households and higher redistribution. We observe this in the estimation results for the poor, who are more mobile in the early stages but persistence increases in the second stage. A possible reason from the rise in persistence amongst poor households in the latter survey could be a change in the population demographics in terms of rich/poor households, which affects the median voter characteristic. The median voter may change from the very poor, with different redistribution preferences resulting in less public investment in education as the preferred tax rate changes. This would imply that fewer children from poorer backgrounds are able to access public education, while the rich households have higher net incomes, leading to the increased levels of persistence for the poor while rich households are better off. This may be

reason for the observation in Ghana where the proportion of poor household living below the poverty line reduces from 46 percent in 1992 to 19 percent in 2017, changing the median voter characteristic (Table 4.4). This would have the effect of reducing publicly available educational investment and hence reducing human capital development amongst households who are not able to privately invest in the education of their children.

4.4.4 *Sensitivity Analysis*

In this subsection, we address two possible problems with the regression results presented in the preceding section. To begin with, there may be questions on the effect of including women and female children in the analysis. The literature has tended to estimate social mobility with respect to fathers and sons because of the complications that existed with regards to female educational access and labor force participation. In support of this, the data shows much lower levels of educational attainment for mothers. We check for the robustness of our results in this regard by estimating the results for only fathers and sons. The estimates of the regression are presented in Tables C.2 in Appendix B. The results show that educational persistence between fathers and sons increased in Ghana between the periods 1992 and 2017, though by a lesser margin for the non poor. This is similar to the main regression results when both male and females are included in the analysis. The persistence coefficients are however lower, implying generally higher levels of mobility for sons compared to when pooled with females. The rich households are also more mobile in the latter period and we document an increase in variation between the two household types over surveys, in line with what is observed in the main linear estimations.

The second econometric problem that can arise is measurement error resulting from the conversion of parental education levels, collected categorically for those not in the household, to years of schooling. To circumvent this and taking into account low parental education particularly for the 1992 survey and for poorer households, we estimate a probit model to obtain the predicted probability of children being educated conditional on their parents education (Table C.3). We focus the discussion on the models with full controls included. The results show that in both rich and poor households, educated parents were more likely to have educated children than parents who had no education. Rich parents who have had schooling were also more likely to have children who also went to school than poor parents in the earlier survey. For the latter survey, we see higher likelihoods in the poor households, possibly reflecting the redistributive role of the median voter. The results show that educated parents are more likely to invest in their children's education than uneducated parents, reflecting the model assumption that unskilled households have children with basic skills and in the absence of publicly provided education, will continue to produce offspring who provide unskilled labour.

As a final sensitivity check, we compare the results obtained for Ghana to the trends in social mobility in permanent democratic nations between regions across five 10-year birth cohorts. This is meant to give insight on how democratic countries in SSA

compare to those in other regions in terms of long term trends in intergenerational persistence. Figure C.1 presents the regional trends and though we see variations in persistence between cohorts, by and large, there is a downward trend in intergenerational persistence over time. This is most apparent for Latin American and Caribbean democratic countries for which inequality has also been reducing over time (Gasparini et al., 2011; López-Calva and Lustig, 2010). In SSA, there is a downward trend in persistence but we see an increase in the last birth cohort in most countries inferring a reduction in social mobility in the 1980 birth cohort, similar to our findings for Ghana. This links to our model prediction that democratic states are initially faced with a reduction in persistence which then increases over time as more individuals become educated. At this stage, policies aimed at other measures of intergenerational persistence such as income and occupation may become more relevant for reducing inequality, as discussed by Iversen, Krishna, and Sen (2019).

4.5 CONCLUSION

The paper sets out to examine intergenerational transmission of human capital when households are faced with a savings threshold that determines the ability to invest in children's education. The paper develops a two period overlapping generations model with heterogeneous households and altruistic parents. Both private and public education are available in the model. One of the crucial features is the non-existence of a credit market for households to borrow for investment in the children's education. Hence human capital accumulation depends on only three input: parental altruism, parental investment and government expenditure. We derive the household education investment threshold and use numerical calibrations to show that rich households are more likely to invest in children's education than poor households. Given that the initial human capital in the economy is sufficiently high, our model shows that the tax rate preferred by the poor is higher than that of the rich households. Application of the median voter theorem suggests that public expenditure on education will be high if the proportion of poor households is high. This acts as an catalyst for social mobility as it increases access to better quality education for children from poor households, reducing intergenerational persistence in education, and increasing the level of aggregate human capital and productivity in the economy. This eventually leads the economy to move to another stage of development until eventually all households are able to invest in the children's education.

Numerical analysis which uses plausible parameters for a developing country shows that reducing the burden of household consumption expenditure, through e.g. increased public provision of consumer goods and services, enables them save more and has a positive effect on the likelihood of investing in children's education. However, this effect is moderate when compared to other policy options such as increasing taxes to fund public education, or an increase in parental altruism. Empirical analysis for Ghana using survey data for two periods, 1991 and 2017, shows higher levels of mobility amongst the rich compared to the poor in both stages of development observed after the country returned to democratic rule with persistence levels increasing

in the latter year for poor households. This finding is in line with the model prediction that rich households are more likely to predict in education than poor households at all stages of development, and that changing median voter demographic characteristic may affect public provision of education in latter years. The results are robust to the sensitivity analysis and in line with observed global trends in persistence amongst permanently democratised countries.

The policy implication that arises from this paper relates to the re-distributive importance of democratic institutions and subsequent effects in intergenerational mobility process in developing countries. The paper suggests that a move to full democratisation leads to higher public expenditure on education and increased levels of social mobility in the early stages, especially for poor households, and this accelerates movement between development stages. We expect that this will have positive societal benefits and may lead to lower levels of inequality in the long term.

Appendices

C

APPENDIX

C.1 ADDITIONAL ESTIMATION RESULTS

Table C.1: Intergenerational education elasticity in Ghana - Results from the Rank-based regression using 5-year birth cohorts

	Dependent variable: education level y_t							
	1992				**2017**			
	Poor		**Rich**		**Poor**		**Rich**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parental Education	0.379***	0.233***	0.304***	0.239***	0.384***	0.290***	0.249***	0.243***
	(0.017)	(0.015)	(0.019)	(0.016)	(0.011)	(0.010)	(0.014)	(0.013)
Controls for x	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.161	0.355	0.122	0.305	0.198	0.298	0.106	0.197
N	8631	8631	8631	8631	27638	27638	27638	27638

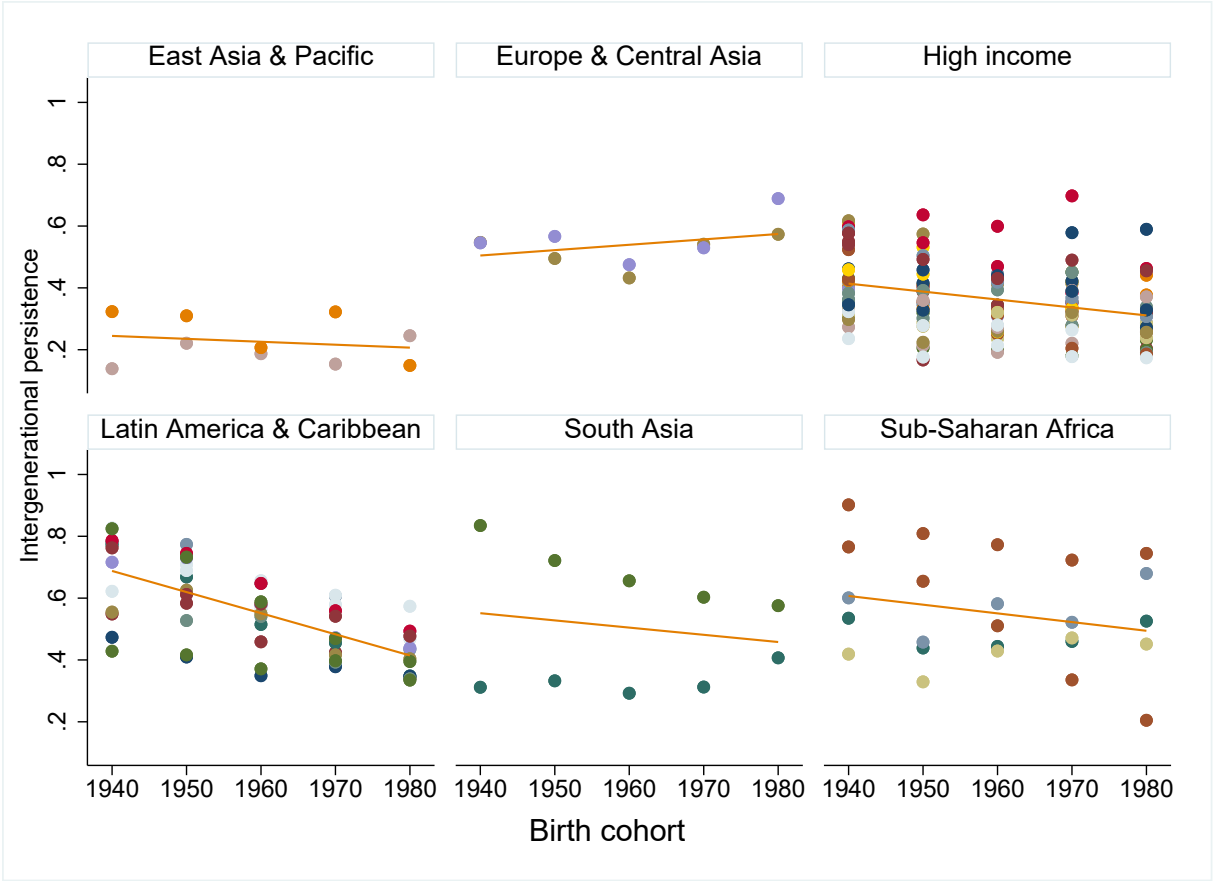
Notes: The table presents results from five year birth cohorts. The 1992 survey begins from the 1897/1901 to the 1967/1971 cohort while the 2017 survey includes the 1937/1941 to 1992/1997=12 cohorts. Standard errors in parentheses. *p<0.05,** p<0.01, *** p<0.001. Source: authors' compilation based on GLSS data.

Table C.2: Intergenerational education elasticity for fathers and sons in Ghana - OLS results

	Dependent variable: Sons education level y_t							
	1992				**2017**			
	Poor		**Rich**		**Poor**		**Rich**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fathers Education	0.499***	0.244***	0.395***	0.242***	0.496***	0.291***	0.304***	0.278***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Controls for x	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.177	0.397	0.132	0.351	0.249	0.356	0.141	0.170
N	4842	4842	7609	7609	14572	14572	26098	26098

Notes: The table presents the OLS results from the estimation model where only fathers and sons are included. Standard errors in parentheses. *p<0.05,** p<0.01, *** p<0.001. Source: authors' compilation based on GLSS data.

Figure C.1: Birth Cohort Analysis - Intergenerational Persistence by geographic region



Notes: The figure shows intergenerational persistence by region using 10 year birth cohorts for permanent democratic states. Source: authors' compilation based on GDIM data.

Table C.3: Intergenerational education elasticity in Ghana - Probit results

	Dependent variable: respondent education level y_t							
	1992				**2017**			
	Poor		**Rich**		**Poor**		**Rich**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parental Schooling								
No	0	0	0	0	0	0	0	0
Yes	1.496***	0.980***	1.227***	1.044***	1.539***	0.983***	1.132***	0.926***
	(0.059)	(0.064)	(0.070)	(0.083)	(0.04)	(0.04)	(0.06)	(0.07)
Controls for x	No	Yes	No	Yes	No	Yes	No	Yes
F	638.801	92.402	308.296	41.815	1627.784	173.493	362.727	35.274
N	8647	8647	8647	8647	28279	28279	28279	28279

Notes: The table presents the likelihood of children attending school if their parents have more than one year of education. Standard errors in parentheses. $^{*}p<0.05$,** $p<0.01$, *** $p<0.001$. Source: authors' compilation based on GLSS data.

C.2 THEORETICAL MODEL DERIVATIONS

C.2.1 *Education Investment Threshold*

To derive the education investment threshold which determines the investment in the children's education, we substitute for $h_{it+1} = 1$ from equation (4.13). We have different threshold levels for the two types of household as shown below:

Low income households

To derive the education investment threshold for low income households, we use the first line of equation (4.13) and substitute for $h_{it+1} = 1$, which is basic human capital, and get the expression for $\bar{h}_i^P$, which is equation (4.14a) :

$$\begin{aligned}
\bar{h}_i^P : [\psi(Ah_tC' - \bar{s})]^\eta (h_t)^\theta (\tau A h_t)^{1-\eta-\theta} &= 1 \\
[\psi(Ah_tC' - \bar{s})]^\eta &= \frac{1}{(\tau A)^{1-\eta-\theta}} h_t^{1-\eta} \\
\psi Ah_tC' &= (\tau A)^{-\frac{(1-\eta-\theta)}{\eta}} h_t^{\frac{\eta-1}{\eta}} + \psi\bar{s} \\
\psi Ah_tC' - (\tau A)^{-\frac{(1-\eta-\theta)}{\eta}} h_t^{\frac{\eta-1}{\eta}} &= \psi\bar{s}
\end{aligned}$$

High income households

To solve for equation (4.14b), we substitute for $h_{it+1} = 1$ from the second line of equation (4.13). We obtain the following expression for $\bar{h}_i^R$:

$$\begin{aligned}
\bar{h}_i^R : [\psi(Ah_tD' - \bar{s})]^\eta (h_t)^\theta (\tau A h_t)^{1-\eta-\theta} &= 1 \\
[\psi(Ah_tD' - \bar{s})]^\eta &= \frac{1}{(\tau A)^{1-\eta-\theta}} h_t^{1-\eta} \\
\psi Ah_tD' &= (\tau A)^{-\frac{(1-\eta-\theta)}{\eta}} h_t^{\frac{\eta-1}{\eta}} + \psi\bar{s} \\
\psi Ah_tD' - (\tau A)^{-\frac{(1-\eta-\theta)}{\eta}} h_t^{\frac{\eta-1}{\eta}} &= \psi\bar{s}
\end{aligned}$$

Proof of Proposition 1

Proof.

$$\psi Ah^PC' - \chi(h^P)^{\frac{\eta-1}{\eta}} = \psi Ah^RD' - \chi(h^R)^{\frac{\eta-1}{\eta}} \tag{C.1}$$

where

$$\chi \equiv (\tau Ah_t)^{1-\eta-\theta}$$

Let $h^P = \alpha h^R$ where $\alpha > 0$. Substituting this into equation (C.1), we have:

$$\psi A(\alpha h^R)C' - \chi(\alpha h^R)^{\frac{\eta-1}{\eta}} = \psi A h^R D' - \chi(h^R)^{\frac{\eta-1}{\eta}}$$

This can be simplified as:

$$\psi A\alpha C' - \chi(\alpha)^{\frac{\eta-1}{\eta}}(h^R)^{\frac{-1}{\eta}} = \psi AD' - \chi(h^R)^{\frac{-1}{\eta}} \tag{C.2}$$

Below, we prove by contradiction that:

$$h^P > h^R <=> \alpha > 1$$

First let $\alpha = 1$. Then equation (C.2) becomes:

$$\psi AC' - \chi(h^R)^{\frac{\eta-1}{\eta}} = \psi AD' - \chi(h^R)^{\frac{-1}{\eta}}$$

Since $D' > C'$, this means that $\psi AD' > \psi AC'$.
Then let $\alpha < 1$, from equation (C.2), we have $\psi AD' > \psi A\alpha C'$. This implies that for the equality in equation (C.2) to hold, $\chi(h^R)^{\frac{-1}{\eta}} > \chi\alpha^{\frac{\eta-1}{\eta}}(h^R)^{\frac{-1}{\eta}}$, which in turn implies that:

$$\alpha^{\frac{\eta-1}{\eta}} h^R <=> h^R < \alpha^{\frac{1-\eta}{\eta}}$$

Given that $h^R \geq 1$, the last term will not hold since $\{\alpha\} \in (0,1)$ ■

C.2.2 *Solving the implicit function*

To solve the implicit function showing how a change in the tax rate affects the household education threshold, we differentiate (4.14a) and (4.14b) with respect to the two parameters of interest, h_t and τ.

B.1.2. High income households

The partial derivatives of the implicit function for *high income* households is obtained by differentiating (4.14a) as follows:

$$F(h_t,\tau)^R : \psi A h_t[(1-\tau)(1-\alpha+\frac{\alpha}{\lambda})] - (\tau A)^{\frac{\eta+\theta-1}{\eta}} h_t^{\frac{\eta-1}{\eta}} = \psi\bar{s}$$

$$\begin{aligned}
F'_{h_t^R} &: \psi A[(1-\tau)(1-\alpha+\frac{\alpha}{\lambda})] - \frac{\eta-1}{\eta}(\tau A)^{\frac{\eta+\theta-1}{\eta}} h_t^{\frac{-1}{\eta}} = 0 \\
&: (\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}} h_t^{\frac{-1}{\eta}} = \psi\eta A[(1-\tau)(1-\alpha+\frac{\alpha}{\lambda})] \\
&: h_t^{\frac{-1}{\eta}} = \frac{\psi\eta A[(1-\tau)(1-\alpha+\frac{\alpha}{\lambda})]}{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}} \\
&: h_t = \left[\frac{\psi\eta A[(1-\tau)(1-\alpha+\frac{\alpha}{\lambda})]}{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}}\right]^{-\eta} \\
&: h_t* = \left[\frac{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}}{\psi\eta A[(1-\tau)(1-\alpha+\frac{\alpha}{\lambda})]}\right]^{\eta}
\end{aligned}$$

$$\begin{aligned}
F'_{\tau^R} &: \psi A h_t(\alpha-1-\frac{\alpha}{\lambda}) - \frac{\eta+\theta-1}{\eta}(\tau A)^{\frac{\theta-1}{\eta}} A h_t^{\frac{\eta-1}{\eta}} = 0 \\
&: (\eta+\theta-1)(\tau A)^{\frac{\theta-1}{\eta}} A h_t^{\frac{\eta-1}{\eta}} = \psi\eta A h_t(\alpha-1-\frac{\alpha}{\lambda}) \\
&: (\tau A)^{\frac{\theta-1}{\eta}} = \frac{\psi\eta A h_t(\alpha-1-\frac{\alpha}{\lambda})}{(\eta+\theta-1) A h_t^{\frac{\eta-1}{\eta}}} \\
&: (\tau A)^{\frac{\theta-1}{\eta}} = \frac{\psi\eta h_t^{\frac{-1}{\eta}}(\alpha-1-\frac{\alpha}{\lambda})}{(\eta+\theta-1)} \\
&: \tau^* = \frac{1}{A}\left[\frac{\psi\eta h_t^{\frac{-1}{\eta}}(\alpha-1-\frac{\alpha}{\lambda})}{(\eta+\theta-1)}\right]
\end{aligned}$$

B.1.1. Low income households

We repeat as above for *low income* households to obtain the partial derivatives by differentiating equation (4.14b) with respect to h_t and τ:

$$F(h_t,\tau)^P : \psi A h_t[(1-\tau)(1-\alpha)] - (\tau A)^{\frac{\eta+\theta-1}{\eta}} h_t^{\frac{\eta-1}{\eta}} = \psi\bar{s}$$

$$\begin{aligned}
F'_{h_t^P} &: \psi A[(1-\tau)(1-\alpha)] - \frac{\eta-1}{\eta}(\tau A)^{\frac{\eta+\theta-1}{\eta}} h_t^{\frac{-1}{\eta}} = 0 \\
&: (\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}} h_t^{\frac{-1}{\eta}} = \psi\eta A[(1-\tau)(1-\alpha)] \\
&: h_t^{\frac{-1}{\eta}} = \frac{\psi\eta A[(1-\tau)(1-\alpha)]}{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}} \\
&: h_t = \left[\frac{\psi\eta A[(1-\tau)(1-\alpha)]}{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}}\right]^{-\eta} \\
&: h_t* = \left[\frac{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}}{\psi\eta A[(1-\tau)(1-\alpha)]}\right]^{\eta}
\end{aligned}$$

$$\begin{aligned}
F'_{\tau^P} &: \psi A h_t(\alpha-1) - \frac{\eta+\theta-1}{\eta}(\tau A)^{\frac{\theta-1}{\eta}} A h_t^{\frac{\eta-1}{\eta}} = 0 \\
&: (\eta+\theta-1)(\tau A)^{\frac{\theta-1}{\eta}} A h_t^{\frac{\eta-1}{\eta}} = \psi\eta A h_t(\alpha-1) \\
&: (\tau A)^{\frac{\theta-1}{\eta}} = \frac{\psi\eta A h_t(\alpha-1)}{(\eta+\theta-1) A h_t^{\frac{\eta-1}{\eta}}} \\
&: (\tau A)^{\frac{\theta-1}{\eta}} = \frac{\psi\eta h_t^{\frac{-1}{\eta}}(\alpha-1)}{(\eta+\theta-1)} \\
&: \tau^* = \frac{1}{A}\left[\frac{\psi\eta h_t^{\frac{-1}{\eta}}(\alpha-1)}{(\eta+\theta-1)}\right]^{\frac{\eta}{\theta-1}}
\end{aligned}$$

From the above, the implicit functions which shows the effect of a change in taxes on the education threshold of each type of household are given by:

For rich households

$$h_t'(\tau^R) = -\frac{F'_{\tau^R}}{F'_{h_t^R}} = -\left[\frac{\frac{1}{A}\left(\frac{\psi\eta h_t^{\frac{-1}{\eta}}(\alpha-1-\frac{\alpha}{\lambda})}{(\eta+\theta-1)}\right)^{\frac{\eta}{\theta-1}}}{\left(\frac{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}}{\psi\eta A[(1-\tau)(1-\alpha+\frac{\alpha}{\lambda})]}\right)^{\eta}}\right] < 0$$

For poor households

$$h_t'(\tau^P) = -\frac{F'_{\tau^P}}{F'_{h_t^P}} = -\left[\frac{\frac{1}{A}\left(\frac{\psi\eta h_t^{\frac{-1}{\eta}}(\alpha-1)}{(\eta+\theta-1)}\right)^{\frac{\eta}{\theta-1}}}{\left(\frac{(\eta-1)(\tau A)^{\frac{\eta+\theta-1}{\eta}}}{\psi\eta A[(1-\tau)(1-\alpha)]}\right)^{\eta}}\right] < 0$$

C.2.3 *Aggregate Model Dynamics*

To derive the first line of equation (4.20), we substitute the second line from equation (4.13) into the first part of (4.15) and use (4.8) to obtain:

Stage I

$$h_{t+1} = \lambda\left[h^r_{it+1}\right] \tag{C.4}$$

$$h_{t+1} = \psi^{\eta}\lambda[(Ah_tD' - \bar{s})^{\eta}(h_t)^{1-\eta}(\tau A)^{1-\eta-\theta}] \tag{C.5}$$

Stage II

To derive the second line of equation (4.20), substitute for skilled and unskilled human capital from equation (4.13) into (4.15) and use (4.8) to obtain:

$$h_{t+1} = \lambda\left[h^R_{it+1}\right] + (1-\lambda)\left[h^P_{it+1}\right]$$

$$h_{t+1} = \lambda\left[(\psi(Ah_tD' - \bar{s}))^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta}\right] + (1-\lambda)\left[(\psi(Ah_tC' - \bar{s}))^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta}\right]$$

$$h_{t+1} = \lambda\left[(\psi(Ah_tD' - \bar{s}))^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta}\right] + \left[[\psi(Ah_tC' - \bar{s})]^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta}\right] -$$

$$\lambda\left[(\psi(Ah_tC' - \bar{s}))^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta}\right]$$

$$h_{t+1} = \psi^{\eta}(h_t)^{1-\eta}(\tau A)^{1-\eta-\theta}\left[\lambda(Ah_tD' - \bar{s})^{\eta} + (1-\lambda)(Ah_tC' - \bar{s})^{\eta}\right] \tag{C.6}$$

C.1. Median Tax rate

The median tax rate can be obtained from equation (4.22). We substitute for all variables which are a function of τ, namely, net income, $(1-\tau)I_{i,t}$, and the education investment function $e_{i,t}$ given in equation (4.7). Note that net income for the two types of households is given by:

$$I_{it}^{r} : Ah_t(1+\frac{\alpha}{\lambda}-\alpha)$$
$$I_{it}^{p} : Ah_t(1-\alpha)$$

Substituting for I_{it} and e_{it}, consumption for the representative poor household is given by:

$$\begin{aligned} c_{it}^{P} &= Ah_t[(1-\tau)(1-\alpha)]\,\tau Ah_t - \frac{\beta\eta}{1+\beta\eta}[(1-\tau)I_{i,t}-\bar{s}]-\bar{s} \\ &= Ah_t[(1-\tau)(1-\alpha)]\,\tau Ah_t - \frac{\beta\eta}{1+\beta\eta}[Ah_t[(1-\tau)(1-\alpha)]-\bar{s}]-\bar{s} \\ &= \frac{1}{1+\beta\eta}[Ah_t[(1-\tau)(1-\alpha)]-\bar{s}] \end{aligned}$$

Similarly, consumption for the rich households is thus given by

$$c_{it}^{R} = \frac{1}{1+\beta\eta}[Ah_t(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-\bar{s}]$$

Human capital for the poor and rich individuals is as set out below:

$$\begin{aligned} h_{it+1}^{P} &= \psi(Ah_tC'-\bar{s})]^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta} \\ &= [\psi(Ah_t((1-\tau)(1-\alpha))-\bar{s})]^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta} \\ h_{it+1}^{R} &= \psi(Ah_tD'-\bar{s})]^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta} \\ &= \psi(Ah_t(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-\bar{s})]^{\eta}(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta} \end{aligned}$$

We therefore maximize the following function to obtain the representative tax rates:

$$Max_{\tau} = \sum_{t=0}^{\infty} R^t \begin{cases} ln\left[\frac{1}{1+\beta\eta}[Ah_t(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-\bar{s}]\right] + \beta ln\left[[\psi(Ah_t(1-\tau)(1-\alpha)-\bar{s})]^{\eta}\right. \\ \left.(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta}\right] \quad \text{if } h_{it}=1 \\ \\ ln\left[\frac{1}{1+\beta\eta}[Ah_t(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-\bar{s}]\right]\beta ln\left[\psi(Ah_t(1-\tau)(1+\frac{\alpha}{\lambda}-\alpha)-\bar{s})]^{\eta}\right. \\ \left.(h_t)^{\theta}(\tau Ah_t)^{1-\eta-\theta}\right] \text{ if } h_{it}>1 \end{cases} \tag{C.7}$$

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5

POLICY RELEVANCE

The results presented in this thesis point to a number of policy implications. We highlight the role of ethnicity in the mobility process in Chapter 2 and Chapter 3, and based on our findings, ethnicity is a key factor in understanding mobility for African countries. As such, policymakers have a clear role in ensuring opportunities for upward mobility is provided for all individuals irrespective of their ethnicity. Targeted ethnic group level interventions could seem a short-term measure to correct the for lack of opportunities for particular groups and may be more difficult to implement but the long term effects of reduced ethnic inequalities and higher intergenerational mobility have far reaching societal benefits and externalities. Higher intergenerational mobility affords all individuals an opportunity to attain their productive capabilities and increases overall economic performance (Blanden, 2009).

Horizontal inequality (inequality between groups) has been shown to be persistent and detrimental for redistribution and development, and can last for extended periods of time in the absence of policy interventions. Sustained group inequality has the potential can result in political violence, social instability and economic inefficiency, and indeed a body of research has identified strong linkages between group inequality and various negative outcomes such as conflict and poor economic development (e.g. Alesina, Michalopoulos, and Papaioannou (2016), Cederman, Weidmann, and Gleditsch (2011), Easterly and Levine (1997), Klasen and Lamanna (2009), and Stewart and Langer (2008). Though overall horizontal inequality in Africa has fallen over time, compared to non-African countries, there has only been a marginal reduction in education inequality between groups. This reduction is a result of overall growth in living standards, and not changes in the gaps in sub-national regional, ethnic, gender, or religious outcomes (Tetteh-Baah, 2019). In some African countries, group inequalities, particularly inequality between ethnic and religion-based groups, remain the most significant barriers to attaining horizontal equality in educational attainment. In particular, Tetteh-Baah (2019) finds that ethnicity remains a vital identity cleavage in Ivory Coast, Mozambique, and Nigeria, two of which are included in the selected countries. While religion is most important in Nigeria, other cleavages such as gender are important in Guinea.

Some of the targeted policy solutions include affirmative action, strengthening representative groups of marginalized ethnic groups, and propagation of indirect policies aimed at reducing group inequalities such as anti-discrimination policies and progressive taxation. Additionally, policies aimed at reducing the salience of group identities

by promoting the national identity and underscoring shared activities between ethnic groups may have long term benefits Langer and Stewart (2013) and Stewart and Langer (2008). Chetty et al. (2020) further suggests that interventions are not only aimed at resolving horizontal inequality but also in changing the intergenerational mobility process. Such interventions should be aimed at children and include mentoring programs for disadvantaged groups, levelling the schooling environment to ensure similar standards between poorer and more affluent regions, and integrating neighbourhoods/regions to reduce the importance of ethnicity. Careful domestication of such interventions is vital for African countries to attain equality of opportunities for all, and this is buttressed by the findings in Chapter 3 that evolution of ethnic based historical persistence has been different between the countries included.

The role of public policy in human capital accumulation is highlighted in Chapter 4. In terms of the pedagogical implications, the study suggests that in the face of credit constraints, rich households are more likely to invest in their children than poorer households, and will subsequently have a higher rate of mobility in the different stages of economic development. However, through the median voter, democratic settings may speed up the movement between developmental economic stages, increasing mobility for poor households particularly in the early stages of development though it reduces across stages as the median voter characteristic changes. Policy implication arise from the need for more aggressive and institutionalized re-distributive strategies that promote education opportunities in developing countries and that can be sustained even in the face of changing median voter and hence, from our model, reduced public financing. Such strategies that reduce the learning gap between households could include legislature that provides for free basic and secondary education, tertiary education quotas targeted at individuals from poorer households and rural areas, and increasing and upgrading education infrastructures in rural areas so that access and quality of education is improved. The paper also highlights the credit constraints effect on mobility and though increasing financial aid to support poor households may be a policy option, this should be carefully implemented, with Lam et al. (2013) finding that the effect for post-secondary education attainment in a developing country context may be limited if the schooling gap between groups at early stages of education is not moderated. This therefore suggests that interventions that reduce credit constraints hindering attendance at early and primary childhood education level should be targeted first to improve mobility at higher levels.

Overall, the thesis has some important policy relevance in terms of the respective policymakers' approach to increasing equality of opportunity concerning education. Furthermore, it points out possible reasons for low mobility in Africa and highlights the importance of considering historical factors when understanding contemporary African intergenerational mobility patterns.

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6

CONCLUSION

Understanding the underpinnings of intergenerational mobility in Africa is important for the reduction of inequality of opportunity on the continent. Previous studies have identified some of the contemporaneous circumstantial factors driving intergenerational persistence of status within African countries. These include race, gender, credit market constraints and geographical location of residence. Others point to the need to examine historical factors in understanding contemporary events. This thesis contributes to the discourse in this regard.

The objective was to understand the role played by different historic institutions in explaining perceived patterns in intergenerational mobility in Africa. In particular, we focus on the role played by ethnic and political institutions in the intergenerational mobility process and provide a robust discussion on the mechanisms at play and policy recommendations. This was done with the view that exploring different features relevant to African history, and similar developing regions globally, is one of the ways in finding solutions that can adequately address inequality of opportunity on the continent. We first set out two empirical papers which focused on the role of precolonial and colonial ethnic institutions. We then proceeded to the third paper which set out a theoretical exposition of intergenerational transmission of education across stages of economic development, with a numerical and empirical application using data from Ghana. A detailed summary of the three papers follows.

In the first paper, we explored the relationship between colonialism, ethnicity and intergenerational mobility in the post-colonial African states. We looked into the relationship between an individual's ethnic membership, a circumstantial factor, and intergenerational mobility, using education as the measure of status, in former British and French colonies. The basis of the analysis was the differences in administration styles with respect to ethnic relations adopted by colonialist administrations, in particular the use of ranked system by the British (hierarchy-based ethnic group stratification) compared to the unranked system used by the French (all ethnic groups seen on a horizontal scale). We posited that this contributes to differences in the intergenerational educational mobility outcomes observed in former British or French African colonies through the effect on the strength of ethnic relations.

Using pooled cross-sectional data from eight African countries, four former French colonies (Cote d'Ivoire, Guinea, Madagascar, Niger) and four former British colonies (Ghana, Malawi, Nigeria, Uganda), and a combined sample of 122,000 observations, different econometric modelling techniques demonstrated strong intergenerational

persistence in human capital skill levels between individuals and the human capital of their parents' ethnic group (ethnic capital). Our results showed that ethnic capital as measured by the average educational attainment of the parents' ethnic group is an important determinant of educational attainment of successive generations. Based on our findings, there is a clear role for policy makers in ensuring upward social mobility opportunities to individuals irrespective of their ethnicity. This is more so for former British colonies for which it is an important circumstantial determinant of the socio-economic outcome of children. Interventions at the ethnic group level may seem a short-term measure to correct for the lack of opportunities for particular ethnic groups, but in the long term the reduction in perceived ethnic differences in terms of opportunities will reduce the importance of ethnic capital in the intergenerational mobility process.

The second paper set out to examine whether historical (precolonial and early colonial period) ethnic group class stratification systems were important in understanding differences in intergenerational persistence of education within African countries. The intuition behind the paper was to investigate whether ethnic groups within a country which historically had different class systems would have different rate of intergenerational transmission of education. To achieve this, we first used country level intergenerational mobility estimates from the World Bank, GDIM, to graphically observe patterns between intergenerational education persistence in African countries and historical class systems based on the dominant type of historical class society in each country. Stylized facts from the graphical exploration indicated that geographic differences between regional blocs in Africa inter-played with colonial origin may play a role in explaining historical ethnic persistence.

A linear interaction regression model was then estimated using cross-sectional household survey data for six African countries - Ghana, Guinea, Madagascar, Malawi, Niger and Nigeria. The results reveal differences in intergenerational persistence based on the historical class stratification system in which the various ethnic groups fall. This suggests that national level estimates masks differences in mobility between groups within the country though in some countries, the differences are not statistically significant. The results challenge the notion of uniformity in institutional lock-in amongst African countries and instead contend that the extent of the importance of precolonial period characteristics in explaining intergenerational persistence in contemporary African countries differs. We postulate that a key factor in understanding the effects of historic ethnic systems on mobility is to examine the effect of colonial administrative policies and the variations in implementation of country education policies in the immediate post independence period.

The third paper used a theoretical approach to model intergenerational transmission of human capital across different stages of development. Households in the model were differentiated by their wealth and faced an education investment threshold that determined their ability to invest in their children's education. Human capital accumulation depended on only three input: parental altruism, parental investment and government expenditure. Within a two period overlapping generations model, we derived the household education investment threshold and showed that rich house-

holds were more likely to invest in children's education than poor households. We also showed that a higher tax rate was preferred by the poor households, and applying the median voter theorem, this implies that public expenditure on education will be high if the are more poor households in the economy. This would increase human capital accumulation as more poor households are able to access education opportunities, reducing intergenerational persistence in education, and increasing the level of aggregate human capital and productivity in the economy. This would lead the economy to progress to higher stages of development until eventually all households are able to invest in the children's education. Using data from Ghana and across two cross-sectional surveys, 1992 and 2017, to test the model implications, we differentiated rich and poor households by consumption expenditure quintiles. The results from the linear regression estimations showed higher levels of mobility in rich households compared to poor households in both periods, indicating that the offspring of rich households were able to access more education opportunities and hence were more likely to invest in their children. The results in the latter period show higher education persistence in the poor households and increased variation in intergenerational persistence in education between rich and poor households than in the early period. This may be reflective of the changing characteristic of the median voter with the increased variation implying that democracy may have an equalizing effect with regards to social mobility in the short run but more strategies need to be put in place for long term effects.

The three papers presented are linked by their discourse of historic institutions and their relevance for intergenerational mobility in Africa. We focus on institutions which are salient, not only for Africa but other developing regions as well, with the objective of providing insight on how to understand observed patterns in mobility. The thesis contributes to the literature in three distinct ways. Firstly, we contribute to the literature which aims to understand the effect of differing colonial administration systems on the evolution of intergenerational mobility and ethnicity. Secondly, we add to the studies that link precolonial African characteristics to contemporary occurrences with our focus on the role of historical class systems. Finally, we make a methodological contribution to the intergenerational transmission of human capital across generations and apply the model to a developing country setting.

The key message from this thesis is that comprehensive study of historical institutions which have shaped the African landscape is important in understanding intergenerational persistence of education in Africa. Because of historical events, intergenerational mobility between countries may follow different patterns and hence different strategies may be needed to address the inequality of opportunity that exists within the countries. We showed that the colonial period was important in shaping the trajectory of intergenerational persistence especially as it relates to ethnic relations while precolonial institutions may be relevant for development but have differing levels of importance for mobility across countries. We also showed that a move towards democratisation may be beneficial to African countries as they try to move towards the reduction of inequalities.

However, there are some caveats to our analysis. The first arises from the use of education as the only measure of mobility for Africa. As noted by Hertz (2001), education as a a human capital index is relatively coarse and assigns all individuals with no formal schooling the same status irrespective of different performance on other mobility measures such as income and occupation. However, because of a lack of suitable data for income and some of the observed weaknesses of using occupation as a measure across generations, education is selected and we undertake various sensitivity analyses to ensure our findings are robust. The second caveat relates to some of the assumptions made in the theoretical model developed in the fourth chapter. It is possible that changing the assumptions may lead to different outcomes. For example, the assumption of missing credit markets is an extreme case and although relaxing it to incomplete markets may not change the main results, it depicts a more realistic feature. This model can be extended in future works by taking into account the role of physical capital in the model as an input in the production function, including more heterogeneity between the agents and comparing the outcomes for different political institutions.

A final area of concern is on data availability and to some extent quality. Long panel data on intergenerational mobility, which offers significant advantage in identifying the key variables of interest, is not available for most, if not all, African countries. As such, the usual caveats of cross-sectional data apply, including omitted variable bias, model uncertainty, and endogeneity. To the extent possible, we controlled for some of these issues but further work using long panel data as it becomes available or identifying instruments that are more suitable and control for endogeneity would be an important extension to this work.

Other areas of further research include examining the role of religion for mobility in Africa as well as measuring the difference between education and income mobility in Africa as a way of assessing which is the more robust measure of mobility for the continent. Research that focuses on modelling the mobility effects of public expenditure on education, while taking into account government spending on health which can be considered a determinant of an individual's learning abilities, may also be a possible research area of interest. Importantly, finding a way to link individuals across multiple time periods, either through surnames as has been done by Clark (2012) or using administrative records(e.g. Lindahl et al. (2015)), may be instrumental in providing a clear exposition on mobility in Africa.

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