Unveiling the global determinants and effects of bilingual education policies in Africa

Mathilde Col*

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Abstract

Despite the linguistic consensus that learning in one's mother tongue is better for learning, some African countries still use the colonial language as the official language of instruction in primary schools. This paper investigates the determinants and impacts of bilingual education reforms in Africa, which have replaced colonial languages with local languages as the medium of instruction since independence. Utilizing a unique dataset on linguistic policies, I find that a British colonial legacy and lower ethnolinguistic diversity increase the likelihood of implementing such reforms. An analysis of microdata from 18 countries covering almost 3 million of individuals reveals that these policies marginally enhanced schooling and learning outcomes, particularly for women and in countries prioritizing a large integration of local languages in education. The findings highlight the modest benefits of bilingual education and the challenges in its implementation, with implications for education policy in post-colonial settings.

JEL codes: I28, N37

Keywords: Bilingual education, Language, Colonization, Ethnic diversity

^{*}University of Bordeaux, CNRS, Bordeaux School of Economics, UMR 6060, F-33600 Pessac, France. Email: mathilde.col@u-bordeaux.fr, Phone: +33616105454

1 Introduction

Sub-Saharan Africa (SSA) faces a global "learning crisis" characterized by low literacy levels (UNESCO, 2013). International organizations emphasize the role that learning in the mother tongue can have in overcoming this crisis (UNICEF, 2016; World Bank, 2018). The promotion of learning in a familiar language is supported by a large literature in linguistics that finds positive effects on test-scores and reduction of dropout rates (Benson, 2000; Cummins, 2000; Hovens, 2002).

Despite this consensus on the benefits of learning in the mother tongue, implementation difficulties at the national level have held back the global reform movement to replace the colonial language with local languages in education. In 2023, eighteen African countries still officially used the colonial language as the primary medium of instruction in primary education, accounting for 13% of the continent's population. Besides difficulties related to implementation, little is known about the drivers triggering the official introduction of local languages in education. Albaugh (2014) makes an exception and, using an original index of intensity of local language use, she shows differential trends between the colonial empires after independence. She also suggests that high ethnolinguistic diversity is a constraint in the use of local languages in education, as confirmed empirically by Laitin and Ramachandran (2022). Building on this approach, I go further by employing an alternative measure of local language adoption in education that minimizes coding errors, derived from an inventory of official linguistic reforms affecting mediums of education. Specifically, I build a comprehensive panel dataset listing all official changes in the languages of instruction in primary education for all African countries from independence to 2023.

Even among countries that have seen a change in their language of instruction since independence, some have experienced policy failures (e.g., Guinea, Madagascar). In Madagascar, for instance, the first generation taught in Malagasy is now called the "lost generation" because of the low learning levels of the individuals that went to school under this reform (Blum, 2011; Rapanoël, 2008; Sharp, 2002). These historical events appear in contradiction with an extensive literature that has shown positive impacts of bilingual education on test scores (Cummins, 2000; Hovens, 2002; Laitin, Ramachandran, and Walter, 2019; Mohohlwane et al., 2023), classroom participation and self-confidence (Benson, 2002), and girl's education (Benson, 2005). However, these results are based on highly controlled experiments and small samples that do not account for implementation issues and general equilibrium effects if they were implemented on a large scale. In a recent experiment on a medium-scale intervention in Kenya, Piper, Zuilkowski, and Ong'ele (2016) find no increase in learning in English after the introduction of bilingual education because of implementation obstacles. In particular, they document difficulties in finding skilled teachers in the language used in schools and a low demand for mother-tongue education from parents. Existing research on successfully implemented large-scale linguistic reforms that introduce local languages in education generally reports positive outcomes. Using the 1994 introduction of mother-tongue use in the Ethiopian education curriculum rather than Amharic only, Ramachandran (2017) shows an increase in reading capacities of 40% and Seid (2016) a rise in the primary enrollment rate and the probability that a child attends the right grade for her/his age. In the second part of the paper, rather than focusing on one specific reform, I consider the whole panel of African countries, and investigate the aggregated long-term impacts of bilingual education reforms on learning and schooling.

The aim of this article is to provide a more comprehensive and coherent approach to analyzing education policies that scale up the use of local languages in primary education of Sub-Saharan countries. In particular, I investigate in a first part the determinants that act as drivers in language policy change and the aggregate effects of these reforms on education at the continental level. Using the dataset on official language of instruction laws I compiled, I examine the multiple factors potentially driving this reform movement. I provide new evidence on the differential colonial legacies: former British colonies are likelier to use local languages as the main medium of instruction at the primary level, even when adding traditional controls used in the literature. The main mechanisms appear to be the early use of local languages in education by missionaries, even before the colonization period, and the higher rate of linguistic documentation in the British Empire. Ethnolinguistic diversity appears to be a weak obstacle in the official introduction of local languages, and matters only when the distance between languages is taken into account. Finally, I look at contemporary policy determinants and find that socialism and democracy are correlated with a higher probability of a linguistic policy change promoting local languages.

In a second part, I study the long-term impacts of bilingual education reforms on education at the continent level. Specifically, I use the sample of eighteen countries that introduced local languages in primary education and for which microdata on education are publicly available, covering around 3 million individuals. I estimate a high-dimensional fixed-effect model to overcome the common internal validity issues, and find that the effects on schooling and learning are significantly positive but relatively small (+1-2 percentage points). These positive effects are concentrated among women, and are driven by more linguistically inclusive policies. A study at the country level confirms the predictions that are robust to alternative estimation strategies.

This paper contributes to three other strands of the literature. First, I contribute to the strand of the economic history literature focusing on the differential legacy between the French and British colonial empires in education (Bekkouche and Dupraz, 2023; Bolt and Bezemer, 2009; Cogneau and Moradi, 2014; Dupraz, 2019; Gifford and Weiskel, 1971). Previous papers find that the colonial legacy on human capital is related to missionary expansion and public education provision. I further show that this legacy extends to the choice of the languages of instruction in primary education after colonization. Second, I provide additional evidence about an education intervention in the SSA context (Duflo, Kiessel, and Lucas, 2020; Evans and Mendez Acosta, 2021; Mbiti et al., 2019). Finally, I link this to the nascent literature on the quality of implementation (Angrist and Meager, 2023), as differences in the reform quality can partly explain the results at the country level found in this paper.

The paper proceeds as follows. Section 2 details the new dataset hand-coded on the linguistic reforms in education in Africa after the colonization. In Section 3, I use this dataset and cross it with many other data sources to determine the drivers of these reforms. In Section 4, I provide evidence on the long-term effects of at-scale bilingual education reforms on learning and schooling, using microdata from eighteen countries.

2 Data: List of linguistic reforms in post-colonial Africa

Description. For this study, I built a newly comprehensive dataset listing all the reforms in Africa that affected the languages used (or taught) in primary education or administration.¹ I focus my analysis on primary education, as the first grades have been shown to be the crucial learning years for bilingual education (Trudell, 2023). In this paper, I use only the first feature, i.e., the changes in the languages of instruction. For every country, I hand-coded every linguistic law since the independence, indicating for every reform the year the official law passed, the language(s) newly introduced, and specified whether the reform was about languages used in education or official/national languages. More details about the content of the dataset can be found in Section A.1.

The time range of the dataset covers the independence years to 2023 for 54 countries. Figure 1 shows full geographical and time coverage. The last coded reform is the Senegalese law imposing the use of the local languages for the first two years of primary education, supposedly implemented at the country level in 2027. In comparison with her data work on measuring the use of local languages in African countries, Albaugh (2014) coded it only at three points in time: at the independence, in 1980, and in 2010.

Using this dataset, I derive a dummy variable indicating whether the country officially uses a local language as the medium of instruction in public primary schools, for every year after the independence. It is equal to zero when the colonial language is the only language used by teachers and one otherwise. On this aspect, I also differ from the work done by Albaugh (2014) as I focus on the *de jure* part of the reform while she exploits the *de facto* aspect. Moreover, she built a continuous measure on the extent of the use of local language in instruction in every African country. I preferred using a 0-1 coding for two reasons. First, it avoids relying on complex sets of sub-indexes and necessary arbitrary decisions required to establish such a continuous measure. Second, using a continuous measure implies that a difference between a 0.1 and 0.2 degree of use of local languages is the same as the difference between a 0.7 and 0.8 indexes, which can be easily questioned. I overcome these potential issues by relying on a simpler, more straightforward and less prone to data coding error discrete index.

¹I also built an additional dataset listing pilots of bilingual education, detailed in Section A.4.

Data quality. I cross-referenced multiple sources detailed in Section A.2 to verify the data accuracy. I also cross-checked the data with the continuous measure of local language used compiled by Albaugh (2014). I checked whether our data were aligned for the three dates provided per country (independence, 1980, and 2011). The two datasets' main discrepancies arise from the respective studies' scope: I focus on official reforms, while Albaugh looks at the actual use of local languages (see Section A.3 for more details). I also used extensively and cross-checked the dataset with the information given by Jacques Leclerc (UC Laval), who built a detailed and sourced linguistic profile for every country in the world.² ³

Descriptive statistics. Eighty-four linguistic reforms are listed for the 54 African countries post-colonization period. I also hand-coded the situation at independence for every African country that went under colonization. Out of these 86 reforms, 60% (55) introduced a change in the language of instruction (LoI). These LoI policy changes are not uniformly distributed: almost half of the countries never experienced any change in the language of instruction since their independence.

In 2023, eighteen African countries still used the colonial language as the primary medium at school. For countries that switched toward integrating local languages in primary education, there is no consensus on which grade the transition towards the colonial language happens, as witnessed in Figure A.5.⁴ We observe "policy reversals", meaning the introduction of a colonial language as the main medium of instruction after a first restriction on its use in only four countries (Ghana, Guinea, Malawi, and Rwanda) and for very short periods.⁵

²Available at https://www.axl.cefan.ulaval.ca/

 $^{^{3}}$ I did additional crosschecks with the work of Brown (2023) and the EhnicGoods project hosted by the Institut Barcelona d'Estudis Internacionals.

⁴On this matter, UNESCO linguistic experts recommend a late-exit transition model if the objective is to enhance student test scores (Trudell, 2023). A late-exit transition model is an educational model in which students keep a familiar language as the main medium of instruction until the end of the primary cycle. The "exit" transition grade to a foreign language is then called "late".

⁵Throughout the Sections 3 and 4, I do not consider these policy reversals. Indeed, except for Guinea (after the death of Sekou Toure, the bilingual education system was replaced by a French-only curriculum



Figure 1: Country and time coverage of the linguistic reform dataset

Notes: All data are hand-coded by the author. One dot corresponds to one observation in the dataset presented in Section 2, i.e., one linguistic reform. Red dots indicate the year of independence for every country. When the country was not colonized during the 20th century (such as Ethiopia, Egypt, and South Africa), the data compilation work begins in 1900. Triangles show reforms affecting the choice of Language of Instruction (LoI) or the transition grade for the colonial languages. Grey squares and black crosses indicate, respectively, reforms affecting the choice of national or official languages (mainly through constitutional changes) and other linguistic reforms related to education (such as a change in the second languages taught in primary education). The last $b\vec{q}$ ingual education law in Senegal does not appear on this graph as it is planned to be scaled up in 2027.

3 Underlying determinants of LoI policy change

Using the dataset previously detailed, I test in this section three main determinants explaining why some countries experienced a change in the languages used in primary education. First, I look at the colonial legacy, and especially the difference between the French and British colonial empires. Second, I consider ethnolinguistic diversity because of the usual emphasis on diversity as the main challenge to introducing local languages in education in Africa (Laitin and Ramachandran, 2022). Lastly, I focus on less studied post-colonial political features such as communism.

3.1 Colonial legacy: France vs Great Britain

Existing work in comparative development pointed to the positive role of the British education policy features in explaining long-term development trends compared to the French administration (Bolt and Bezemer, 2009; Cogneau and Moradi, 2014). Recent work by Bekkouche and Dupraz (2023) shows that students in the French part of Cameroon score better in math than students in the British-speaking area due to differences in teaching practices. All of these studies highlight a colonial legacy in education policies and practices. I test here whether this legacy expands to the medium of instruction choice.

Simple mean comparison. Precisely, I test whether the identity of the ex-colonizer (France vs Great Britain) can predict whether a country is more willing to experience a change in the languages used in primary public schools after its independence. I hypothesize that the British ex-colonies exhibit a higher likelihood of such a change, as the French education system was more under regulation by the colonial administration than the British one during the twentieth century (Cogneau and Moradi, 2014). As early as 1857, the French administration in Senegal enacted a law to limit the expansion of Kuranic schools that used Arabic as the main language of instruction (Calvet, 2010). French was the only language of instruction allowed in public schools, and this rule was enforced. One in 1984), they did not mark a significant reversal. In Ghana, English was introduced back officially in 2002, and then replaced again two years later. The law was passed in Malawi in 2013 but has not yet been implemented ten years later. Finally, in Rwanda, English was officially used as the main medium of instruction in primary schools in 2019 only.

example of punishment used is the so-called symbol, inherited from the intensive linguistic unification campaign in France during the nineteenth century: the student who dared to speak an African language at school, even during the break, has to wear a disgusting item such as a necklace made of rabbit bones (De Gaston, 2011). In the British colonial empire, the extent of regulation that the administration could implement was limited by the importance of missionary schools compared to state-ruled ones (Gifford and Weiskel, 1971). The administration was also less reluctant to use vernacular languages if it could fasten the emergence of a semi-skilled African labor force ready to be integrated into the colonial administration.⁶ For example, Swahili, which is nowadays the most widely spoken language in Africa, was partly used and spread by the British colonial administration for communication purposes (Chanson, 2012). Using a novel dataset on reforms previously detailed in Section 2, I regress naively being part of a former colonial empire on the contemporary linguistic policy change. Empirically, I find in Table 1 that British ex-colonies are 50 percentage points (pp) more likely to introduce local languages in primary education compared to French ex-colonies.⁷

Confounders. However, this naive comparison is likely to be biased. Indeed, countries were not colonized at random: Frankema (2012) shows that British colonies are associated with higher educational outcomes because the controlled areas were less prone to Muslim presence and more suitable for agriculture. The small Muslim presence led to a more extensive spread of Christian missions and schools in the British Empire compared to French territories. Previous results are robust to adding these controls, i.e., the share of Muslims in the population in 2000 and geographical variables (Column 2 of Table 1).

Additional controls are related to ethnolinguistic fragmentation, shown to be a potential confounder of the French-British colonial differences (Cogneau, 2003). Indeed, with many different languages and ethnic groups, the optimal decision for the government

⁶"The first task of education is to raise the standard alike of character and efficiency of the bulk of people, but provisions must also be made for the training of those who are required to fill posts in the administrative and technical services, as well as those who as chiefs will occupy positions of exceptional trust and responsibility" Advisory Committee on Native Education in the British Tropical Dependencies, Education British Tropical Africa (London, 1925), pp. 4-5

⁷All specifications in Table 1 are linear models; logistic regressions can be found in Table A.3.

Dependent Variable:	Use of local languages in education $(0/1)$				
Model:	(1)	(2)	(3)	(4)	(5)
Colonizer dummy:					
France	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Great Britain	0.505^{***}	0.551^{***}	0.436***	0.350^{**}	0.348**
	(0.130)	(0.128)	(0.136)	(0.145)	(0.149)
Other coefs: Other colonizer & Not colonized	Yes	Yes	Yes	Yes	Yes
Controls: Differential endowments		Yes	Yes	Yes	Yes
Controls: Ethnic + Language			Yes	Yes	Yes
Controls: Mission + Documentation				Yes	Yes
Controls: Pre-colonial institutions					Yes
Fit statistics					
Observations	54	53	51	51	48
\mathbb{R}^2	0.258	0.464	0.551	0.589	0.650

IID standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: The dependent variable is a dummy that is equal to 1 if the country uses a local language as the language of instruction instead of a colonial language (0). The model estimated is a linear probability regression model. In every specification, the regression contains a dummy for countries colonized by non-French or British colonizers, and a dummy for never-colonized countries. Being part of the French colonial empire stands as the reference point. Pre-colonial institutions control stands for the average number of levels (0 to 4) beyond the village across all ethnic groups being comprised into the current national boundaries (Gennaioli and Rainer, 2007). Differential endowments controls stand for the log of the population at the independence, the population density, the population share of Muslims in 2000, latitude, longitude, and a dummy for landlocked countries. Ethnic and language controls stand for the number of ethnic groups (EPR dataset) and the number of languages (Glottolog) in the country in 2000. Mission and documentation controls stand for the number of Catholic and Protestant missions in 1925 (Becker, 2022) and the share of fully documented languages at the independence (1900 as a reference for non-colonized countries). One observation corresponds to one country. The difference of observations from Column (1) to Column (5) is explained by data scarcity for the pre-colonial institutions variables.

Table 1: Colonial legacy on the bilingual education policy choice

could be to keep the colonial language as the language used at school for two main reasons (Laitin, 1994): (i) not choosing a language is similar to not promoting one ethnic group above the others, and (ii) in some cases, the colonial language acts as a *lingua franca* i.e., a communication language as in Côte d'Ivoire (Calvet, 2010). ⁸ Results when controlling for the number of languages in the country and the number of ethnic groups are shown in the third column of Table 1. They are robust to these additional control variables, comforting that French ex-colonies are likelier to keep the linguistic *status quo* in education.

Mechanisms. I investigate a few mechanisms underlying the colonial legacy on contemporary linguistic policy choices. The first channel is the crucial role of precolonial missions in the spread, documentation, and early use of local languages in education. Cogneau and Moradi (2014) highlighted the role of Christian (Protestant mainly) missionary expansion as a key mechanism explaining the literacy differences between the French and British empire in the German Togoland. Table A.2 shows the unequal distribution of missions across colonial empires: on average, the number of Protestant missions per country in 1925 was 53 in British-controlled countries and 9 in French territories. Even if the first bilingual school was created under French administration, standardized use of local languages at school started with the missionaries (Berman, 1974; Johnson, 1967). Indeed, using the vernacular language and providing education were rapid vectors of conversion.⁹ The Protestant missions particularly emphasized the use of African languages by contributing actively to the writing development of these languages (Cagé and Rueda, 2016; Woodberry, 2012), as their final objective was translating the Bible into the local languages to spread God's words more easily (Eisenstein, 1980).¹⁰ ¹¹

⁸Knutsen (2007) studies the linguistic complexity existing in Abidjan. She shows that people generally do not speak only French or a local language. They are located on a *continuum* between the use of only Standard French or the local language, where the *nouchi* can be found. *Nouchi* is a Creole-like language taking vocabulary and linguistic structures from French and different local languages spoken in the city of Abidjan.

⁹Jean Dard opened the first bilingual primary school in Wolof and French at the beginning of the nineteenth century in Saint Louis, Senegal (Calvet, 2010).

 $^{^{10}}$ Groves (1958) list 394 Bible translations into African languages made between 1805 and 1954 by Protestant missionaries.

¹¹Nowadays, this legacy on documentation of African languages is still visible: in 1934, William Townsend created SIL (Summer Institute of Linguistics), an evangelical Christian NGO that promote language de-

Another channel is the language documentation that happened under colonial rule. Documentation of a language encompasses a large corpus of materials such as grammar textbooks, dictionaries, etc. Documented languages are more likely to be used in schools as they can be written and taught easily by teachers to students. Under French colonial rule, the French-only educational system translated into less effort in documenting African languages (Manning, 1999).¹² Albaugh (2014) estimates that in 1950, less than 6 people out of 10 in French colonies had their mother tongue fully documented compared to 8 individuals in other colonies. Using data on the publication year of language documentation (see Appendix B for more details), I observe in Figure 2 a differential trend in the number of fully documented languages among the French and British colonial empires besides the role of precolonial missions. Taking 1900 as a base 100 (controlling for linguistic development due to precolonial missions), this graph shows a systematically higher rate of linguistic documentation in the British colonial empire, even after the independence. For instance, Côte d'Ivoire, colonized by France, and Ghana, under British rule, have the same number of languages (76 and 73, respectively, according to Ethnologue (Lewis, Simons, and Fennig, 2016)). However, the number of documented languages and their evolution differs, as it is much higher in Ghana than in Côte d'Ivoire (see Figure A.2).

To isolate only the contemporary colonial legacy, I control for the number of missions in 1925 per country using Becker (2022)'s newly published data distinguishing between Catholic and Protestant missions, and the share of fully documented languages at the independence.¹³ Column (4) of Table 1 shows the result. I still find a positive effect of being under British colonial rule compared to the French administration on introducing local languages in education. However, the coefficient is reduced by 10pp when introducing, acknowledging the importance of the two channels highlighted above.

velopment for minority languages and translate the Christian Bible into these languages. *Ethnologue*, a well-know dataset providing rich information on language development and status, is published by SIL International since 1951. Its very first objective was to provide information about Bible translation needs into minority languages.

¹²"Hausa was written in Nigeria but not in Niger. Yoruba was written in Nigeria but not in Dahomey, Ewe was written in Gold Coast but not in Togo, Mandingo was written in Gambia but not in Senegal or Sudan. In Central Africa, Kikongo and Lingala were written in the Belgian Congo but not in French Congo" Manning (1999), p.165.

¹³For countries that were never colonized, I take 1900 as the reference year.



Figure 2: Linguistic production rate in the French and British colonial empires in Africa between 1900 and 1960

Notes: Data on languages and documentation of these languages come from Glottolog 5.0. I consider a language fully documented (or developed) in a year i if a complete grammar reference was published in the given year (see Section B for more information). 1900 is taken as a base 100, controlling for linguistic development due to precolonial missions. Similar results are found when 1890 is taken as base 100. The first black vertical line highlights the year when the two lines diverge, and the dashed line indicates the beginning of the global independence movement in Africa. The results of the Kolmogorov-Smirnov test, that tests for differences in density, are indicated on the graph: the first one tests the differences of the densities from 1900 to 1970, while the second performs the same test from 1910 to 1970.

Finally, some studies in political economy highlighted the role of pre-colonial institutions on modern growth in Africa (Michalopoulos and Papaioannou, 2013). In particular, the level of centralization before the colonial period has been shown to be a predictor of contemporary development. I use the original measure of political centralization, the number of jurisdictions beyond the local level (Gennaioli and Rainer, 2007). This number is averaged at the country level, using ethnic groups comprised in modern national borders and weighted according to their respective size. When controlling for it, the differential effect of the colonial legacy on the LoI choice remains stable (Column (5) in Table 1), with countries that were part of the British colonial empire being 35pp more likely to use a local language in primary education officially.

3.2 Ethnolinguistic diversity

One precolonial feature which has received a lot of attention in the literature is ethnolinguistic diversity. Alesina and La Ferrara (2005) review channels linking ethnolinguistic fractionalization to poor economic growth, like the provision of public goods and productivity. These channels might also be relevant when analyzing the language of instruction choices, as promoting one (or more) local languages as a medium of instruction is equal to promoting the associated ethnolinguistic group(s). The fear of increasing ethnic salience is a solid political motive that could prevent the introduction of national languages in education (Ramachandran and Rauh, 2022). In a recent study, Laitin and Ramachandran (2022) provide empirical evidence on the correlation between ethnolinguistic diversity and the likelihood of retaining the colonial language as official or co-official in administration, using different definitions of ethnolinguistic diversity. In this subsection, I investigate the same correlation for the linguistic choices made by African governments regarding the medium of instruction, narrowing the scope from administration to education.

Measures. Ethnolinguistic diversity is a concept encompassing very diverse definitions. I use and compare different definitions used in the literature (Desmet, Gomes, and Ortuño-Ortín, 2020; Desmet, Weber, and Ortuño-Ortín, 2009; Esteban and Ray, 1994; Greenberg, 1956; Laitin and Ramachandran, 2022; Reynal-Querol, 2002): ethnolinguistic fractionalization (ELF), Greenberg Index, polarization (with and without distance between languages included), peripheral heterogeneity, and number of languages (as given in the Glottolog database). Finally, I also consider other measures related to ethnicity and not only languages, using the Ethnic Power Relationship dataset (Vogt et al., 2015).¹⁴ Indeed, even if the linguistic map in Africa is very similar to the distribution of ethnic groups, we observe significant differences between the two: in Rwanda, Hutus and Tutsis share the same language, Kinyarwanda, but belong to different ethnic groups. More details about the construction and source of these variables and how they are correlated are given in Appendix (Section B and Table A.1). I expect two features to matter, and infer hypotheses from them: (i) the distance between languages is more predictive of a change in the LoI than the raw number of linguistic groups, as it is more salient when choosing a school medium everyone can understand, and (ii) the size of the ethnolinguistic groups matter, as a large group can impose its language as a *lingua franca* throughout the country, like in Senegal with wolof.

Results. I add in the initial regression presented in Table 1 the different variables defining ethnolinguistic diversity, one at a time. Table 2 shows the estimates associated.¹⁵ We see that overall, ethnolinguistic diversity is a poor predictor of whether a country decides to introduce local languages in education after its independence. The only definition of linguistic fractionalization that seems to matter is the one used in Desmet, Weber, and Ortuño-Ortín (2009). Using data from Ethnologue, they compile a simple ethnolinguistic index that integrates the distance between languages by adding information on the number of nodes between two languages in a language tree.¹⁶ A country like the Central African Republic (with an ELF index of 0.96) is expected to be 46pp less likely to use local languages for primary instruction than a country like Burundi (with an ELF index of 0.04). All the other definitions of ELF that focus on the size or the number of the groups

¹⁴Among the various datasets on the number of ethnic groups (in particular, the Murdoch atlas), I prefer the EPR dataset because it captures the "politically relevant ethnic groups".

¹⁵The coefficients for colonial legacy are not reported for clarity, but adding ethnolinguistic diversity does not affect previous findings.

¹⁶In their following work Desmet, Gomes, and Ortuño-Ortín (2020), the languages are aggregated in larger groups, decreasing the salience of the linguistic distance. That explains why we do not observe a significant correlation between the use of local languages in education and ethnolinguistic diversity anymore.

fail to predict accurately the outcome of interest. Hence, the distance between languages matters, but not the size of the ethnolinguistic groups. These results are aligned with previous findings: Laitin and Ramachandran (2022) also show that linguistic diversity is a better predictor of a policy change towards more integration of local languages as official or co-official than the existence of a large linguistic group (Table 2 p.7).

3.3 Contemporary political features

3.3.1 Socialism

Limiting the analysis to the pre-colonial or colonial era would be discarding all political changes that have taken place since the 1960s. One feature of the post-colonial political area in Africa that is majorly understudied in applied economic history is socialism. The spread of the socialist thought throughout the continent started right after WWII, with the beginning of the Cold War. The independence movements partly matched the Soviet anti-imperialism doctrine at that time; Sékou Touré for Guinea, Modibo Keïta in Mali, and Kwame Nkrumah in Ghana were even awarded a Lenin Peace Prize. These so-called socialist countries, very close to the USSR, promoted the use and development of national languages in all domains. Sékou Touré is a significant example of how communism led to the promotion of national languages: he believed that a socialist economy and society could emerge only through the deep decolonization of the entire administrative system, including education (Benson and Lynd, 2011). In the 1960s, he actively participated in the creation of the National Language Program, which was intended to promote national language use at every administrative level. At the end of the decade, eight Guinean languages were officially introduced as languages of instruction, replacing English, in primary education. To answer the growing demand for textbooks and curricula, the government created its own publishing house, Imprimerie Patrice Lumumba, and an institution dedicated to language documentation, the Institute of Applied Research on Language (Institut de Recherche Linguistique Appliquée [IRLA]).

Measures. Using different data sources, I examine the association between socialism and linguistic reforms promoting bilingual education. Specifically, I test whether the probability of replacing colonial languages in education is correlated with a socialist regime.

Dependent Variable:	Use of local languages in education today $(0/1)$									
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables										
Ethnolinguistic diversity variables:										
ELF (EPR)	0.135									
	(0.222)									
ELF (Desmet at al., 2009)		-0.508**								
		(0.248)								
ELF (Desmet et al., 2020)			-0.159							
			(0.276)							
Greenberg Index (GI)				-0.082						
				(0.363)						
Polarization index (RQ)					-1.840					
					(1.154)					
Polarization index with distance (ER)						0.533				
						(1.723)				
Peripheral heterogeneity index (DWO)							0.068			
							(0.571)			
Number of languages (Glottolog)								-0.001		
								(0.001)		
Number of ethnic groups (EPR)									0.000	
									(0.020)	
Size of the largest ethnic group (EPR)									. ,	0.118
										(0.228)
Controls: Colonizer dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls: Differential endowments	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls: Mission + Documentation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls: Pre-colonial institutions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics										
Observations	51	53	50	53	53	53	52	53	51	51
Deer vacions	0.611	0.625	0.542	0.541	0.540	0.527	0.529	0.549	0.604	0.605
11	0.011	0.020	0.342	0.341	0.549	0.327	0.008	0.048	0.004	0.005

IID standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: The dependent variable is a dummy that is equal to 1 if the country uses a local language as the language of instruction instead of a colonial language (0). The model estimated is a linear probability regression model. Colonizer dummies stand for Great Britain dummy, other colonizer dummy and non-colonized dummy (French as a reference). The other control variables are already detailed in Table 1. All the variables on ethnicity are computed from the EPR dataset. The number of languages for each country is computed using the Glottolog database. All the other variables on ethnolinguistic diversity are taken from datasets used for papers published by Desmet, Weber, and Ortuño-Ortín (2009) and Desmet, Gomes, and Ortuño-Ortín (2020). One observation corresponds to one country.

 Table 2:
 Ethnolinguistic diversity on the bilingual education policy choice

I first use the United Nations votes: for every vote since the independence, I look at whether the vote of the country was similar to the USSR or its ex-colonizer, or none of the two, from 1960 to 1991 (more information can be found in Section B of the Appendix). Finally, I aggregate at the country-year level every vote to get the proportion of votes similar to the USSR for a country c in year t. I derive from this share a second index of socialism: I consider a country socialist if it has a fraction of UN votes similar to the USSR higher than 50% in the same period, and assigns a value of 1 to this country. The third measure is a dummy indicating if a country c is declared as a communist country for the year t in the Bjørnskov-Rhode dataset (Bjørnskov and Rode, 2020).¹⁷

Results. I first estimate the regressions presented in Table 1 with the ELF index from Desmet, Weber, and Ortuño-Ortín (2009) as additional control, and add the three measures of socialism. Table A.4 shows the results: being communist as defined by Bjørnskov and Rode (2020) only is predictive of a higher likelihood of using local languages in education today when controlling for all determinants that have been shown to matter in the previous subsections.

However, contrary to the channels studied previously, being socialist highly varies over time, according to different factors such as leaders, the period. In particular, the number of socialist countries was higher before the 1990s. Leveraging the variation of the two measures of socialism over time, I use another specification, in which I consider the introduction of local languages in education at the country c and year t level. In this set of regressions, where one observation is now one country at a given year, I rule out every country feature that could create a potential variable omitted bias by adding country-level fixed effects.¹⁸ Results are shown in Table 3 and confirm the initial prediction: countries that voted exactly like the USSR have 44 percentage points more chances of transitioning to education in a regional language than countries that differed entirely from the USSR on UN ballots. However, we do not observe similar results when looking at communism as defined by Bjørnskov and Rode (2020). This discrepancy can be explained by the nature of

¹⁷The two measures are positively and significantly correlated: the correlation coefficient at the countryyear level is 0.21 and the p-value is below 0.01.

¹⁸Consequently, I only consider in this set of regressions countries that switched the LoI at some point in the time period considered.

the variable, a dummy indicator, smoothing different levels of engagement in the socialist movement.

3.3.2 Democracy

To investigate the role of contemporary political institutions more in-depth, I do the same work using the Political Regime Characteristic Database (PolityV). I explore whether the country's autocratic or democratic features are correlated with policymakers' decisions regarding the languages spoken in public schools. I use the polity score, which ranges from -10 (very autocratic) to +10 (very democratic).¹⁹

Again, I start by looking at the country level by averaging the policy score over the period considered. Results are shown in Table A.4 and show no correlation between the democracy scores and the promotion of local languages. However, political institutions have not been perfectly stable since the independence years in Africa. Hence, I add the time dimension by regressing the democracy score on whether the country c officially used local languages in education in the year t. Table 3 displays the results: more democratic countries are associated with higher local language promotion in education. Further work is required to understand the potential channels underneath this result, but anecdotal evidence points to the fact that democratic regimes might value more minority rights through the promotion of local languages in education (Albaugh, 2016; Biseth, 2009).

3.4 Testing for the most meaningful determinants

Now that a few determinants have been highlighted to be key in explaining why some countries use local languages as teaching languages, I investigate which ones matter the most.

Using a Lasso procedure, I present in Table A.5 the variables that are selected as explanatory among all potential variables. Again, being under British indirect rule and ethnolinguistically very diverse as defined by Desmet, Weber, and Ortuño-Ortín (2009) seem to be key characteristics of reforming countries. The only political characteristics that matter are related to pre-colonial institutions, as measured by Gennaioli and Rainer

¹⁹The polity score is a composite score of two scores: the democratic score and the autocratic one. Both are computed aggregating sub-indicators. More information can be found in the online manual.

Dependent Variable:	Use of LL in education in year t (0/1)			
Model:	(1)	(2)	(3)	(4)
Variables				
Share of UN votes similar to USSR	0.440**			
	(0.162)			
Communist dummy		0.030		
		(0.114)		
PolityV score			0.012^{**}	
			(0.005)	
Democracy dummy (= 1 if PolicyV score ≥ 0)				0.104^{*}
				(0.055)
Fixed-effects				
Country	Yes	Yes	Yes	Yes
Fit statistics				
Observations	956	$2,\!135$	$1,\!923$	1,923
\mathbf{R}^2	0.636	0.467	0.537	0.531

Clustered (Country & Year) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: LL stands for local languages. The dependent variable is a dummy that is equal to 1 if the country replaced the use of the colonial language in education by a local language during this year. The model estimated is a linear probability regression model. I use country fixed effects for all specifications, to capture any omitted variable fixed at the country level. One observation corresponds to one year for one country. The communist dummy is equal to 1 if the government is communist according to the Bjørnskov-Rhode. The share of UN votes similar to USSR is the fraction of votes taken during the UN assembly that are similar to USSR. The democracy score is the Polity V score, and the democracy dummy is equal to one when the Policy V score is higher or equal to zero (see Section B for more information).

 Table 3:
 Salience of contemporary political outcomes on the bilingual education policy

 choice
 Image: Salience of contemporary political outcomes on the bilingual education policy

(2007). This result is confirmed when using a random forest model on the dataset at the country and year level previously exploited in this subsection. Figure A.3 presents the ranking of the most predictive variables and shows that the findings using a Lasso procedure are robust.

One variable that has not been commented on previously and seems highly predictive of a shift in primary education from the colonial to a local language is the population. The rationale behind it is unclear, but one motive could be that it is less politically costly for large countries to officially replace colonial languages in their primary education system.

Different pre-colonial, colonial, and post-colonial features seem to matter in explaining whether a country replaced the colonial language in education with a local one. Consequently, simply comparing countries that underwent such reforms and countries which did not would lead to a substantial omitted variable bias, when estimating the effects of bilingual education on education outcomes. In the next Section, I investigate this impact at the aggregated level and overcome the selection problem by relying on rich microdata and multilevel fixed effect models.

4 Long-term effects on education

Leveraging DHS and census micro datasets covering eighteen countries (almost 3 million observations), I accurately estimate the effects of replacing officially the colonial language with a local one on education outcomes in adulthood. I use a high-dimensional fixed-effects model to isolate the reform impact and rule out potential confounders.

4.1 Data

Coverage. In this study, I use data on eighteen countries that use local languages as a medium of instruction in primary education and for which data on education were available on IPUMS (Ruggles et al., 2024).²⁰ I primarily use census data and DHS data when the

²⁰I exclude Sudan from this analysis because of the civil war that was happening at the time of the reform and impeded greatly the state capacity generally. I also exclude Eswatini because of the very small sample size.

former is missing. The sample taken from the censuses is restricted to people from 15 to 49 years old to match the DHS sample age range. For every country in the analysis, I include only birth cohorts that started primary school 10 years before the implementation of the bilingual education reform up to 10 years after the reform. The ten-year range is motivated by two conflicting reasons: (i) limiting the fact that the estimation captures the effects of other reforms happening close to our reform of interest, but (ii) at-scale education reforms take time to be implemented and focusing only on birth cohorts too close to the reform would not be enough to capture the effect. I end up with a sample of three million people from eighteen countries born from 1942 to 2005. Figure A.4 details the survey type, time coverage, and the countries covered. The reweighting strategy, described below, makes the whole sample representative at the continent level.

Treatment definition. I consider a birth cohort as treated when individuals born in a given year started primary education in a local language. I cross the entry age in primary school given by UNESCO for every country with the dataset on reform years on language use in primary education (see Section 2) to infer the treatment status of every birth cohort. For example, in Mali, primary school starts at seven, and the bilingual education law was passed in 1999. Individuals born before 1992, who started primary education before 1999, are not considered as treated, while individuals born after 1992, who started school after 1999 when local languages were already introduced as medium of instruction, are considered as treated.²¹

Outcomes. I use education outcomes that are comparable across the different surveys. I expect bilingual education to expand the education coverage and to increase the level of schooling (Laitin, Ramachandran, and Walter, 2019; Piper, Zuilkowski, and Ong'ele, 2016). I also expect a positive impact on literacy and test scores (Benson, 2000, 2002). Hence, I focus on three outcomes for this study: school attendance, years of education, and literacy. Literacy is usually assessed in the local language or the colonial language. Still, there are a few exceptions where reading or writing in only the colonial language is

²¹The main caveat is related to the effective age at which the children started school, which might differ from the official age. However, I expect the difference between the official and effective ages to have a limited impact on the results, as I use a large sample and time period.

considered to be literate. Table A.6 gives the details of which languages are considered for every census survey.

Descriptive statistics. Table 4 provides more information about the sample considered in the following analysis. Women are overrepresented, as I include in the full sample DHS data that are available only for women.²² Half of the sample is illiterate, and about the same proportion did not go to school. Consequently, the average number of years spent in school is low (less than 4), and only one-quarter of the sample completed an entire primary cycle.

4.2 Aggregated effects

Estimation strategy. I estimate the long-term aggregated effects of the linguistic reform on education using the following regression:

$$Y_{i,s,c,t,j,k} = \alpha + \beta T_{t,c} + \omega_s + \tau_t + \rho_j + \psi_k + \epsilon_{i,s,c,t,j,k} \tag{1}$$

 $Y_{i,s,c,t,j,k}$ is the education outcome for the individual *i*, at year *t*, in the strata *s*, surveyed in year *k* in a survey of type *j*. Strata are either the strata given in the DHS or the lowest geographical level provided in the census; in either case, they are below the country *c* level. *T* is an indicator variable equal to one for birth cohorts considered as treated, i.e., who started primary education with a local language of instruction and zero otherwise.

I use year-of-birth and strata fixed effects, captured by ω_t and ρ_s . It allows to rule out all potential confounders at the country or region level, highlighted in Section 3, but also all time-varying shocks. In particular, the time-fixed effects capture the global trend of increasing education outcomes from the 1960s to the 2000s. I also use survey-type fixedeffects (DHS or census) and survey-year fixed-effects captured by ρ_j and ψ_k , respectively.

Standard errors are clustered at the lowest geographical level.²³ To improve on the external validity side, I reweight all observations so that the sample is representative at the

²²Even though DHS data give information about literacy and schooling status for men, they do not provide the information about their year of birth or age that allows me to assign them to a treatment status.

²³The lowest geographical level represents the PSU (Primary Sampling Unit) level for DHS data and the strata for census data. This strata variable is equivalent to the sampling unit used by IPUMS to create a random sample of 10% of the original census for all samples publicly available, and capture the lowest

		<u> </u>	
Characteristics	Mean	SD	Ν
A. General			
Age	36.7	7.09	$2,\!961,\!639$
Female $(0/1)$	0.68	0.46	$2,\!961,\!639$
Married $(0/1)$	0.88	0.32	$2,\!952,\!952$
Muslim $(0/1)$	0.28	0.45	1,775,146
Christian $(0/1)$	0.65	0.48	1,775,146
B. Education			
Literate $(0/1)$	0.47	0.5	2,907,241
Number of schooling years	3.68	4.61	$2,\!958,\!913$
Attended school $(0/1)$	0.49	0.5	$2,\!958,\!913$
Completed primary education $(0/1)$	0.39	0.49	$2,\!959,\!024$
Completed secondary education $(0/1)$	0.16	0.37	$2,\!959,\!024$
Completed tertiary education $(0/1)$	0.03	0.18	$2,\!959,\!024$

Notes: (0/1) indicates a dummy variable. SD stands for standard deviation. N stands for the number of non-missing variables. All descriptive statistics are computed using weights provided in the surveys, corrected to be representative at the continent level for every year.

Table 4: Description of the sample

continent level for every year.²⁴ For interpretation purposes, the main estimated model is a linear probability model. However, I also provide odd-ratios from estimations using a binomial logistic probability model.

Aggregated results. Table 5 shows the results for all education outcomes. Introducing local languages in education induces higher literacy, by around two percentage points (pp) (Column 1). School attendance is also positively affected: the probability of going to school is increased by 1.2 pp (Column 2), and the number of schooling years by 0.12. All estimates are small but accurately estimated. The coverage of this study, which includes eighteen countries, explains the discrepancies with other studies' findings that focused on particularly successful reforms (Ramachandran, 2017; Seid, 2016).

geographical level for census data. When the strata was missing for census data, I used instead the lowest geographical level provided.

 $^{^{24}}$ Each observation are reweighted according to the relative size to the country compared to the other countries in the sample for the given year.

Model:		OLS	Logit		
Dependent Variables:	Literacy $(0/1)$	School attendance $(0/1)$	Years of schooling	Literacy $(0/1)$	School attendance $(0/1)$
	(1)	(2)	(3)	(4)	(5)
Variables					
Exposed to BE	0.018^{***}	0.012^{**}	0.123^{**}	1.10^{***}	1.07^{***}
	(0.005)	(0.005)	(0.050)	(0.026)	(0.027)
Fixed-effects					
Strata	Yes	Yes	Yes	Yes	Yes
Year of birth	Yes	Yes	Yes	Yes	Yes
Survey type	Yes	Yes	Yes	Yes	Yes
Survey year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	2,909,992	$2,\!961,\!661$	$2,\!961,\!661$	2,909,992	2,961,584
\mathbb{R}^2	0.24069	0.32785	0.32423		
Adjusted \mathbb{R}^2	0.24059	0.32776	0.32414		

Clustered (at the cluster level) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: The model estimated is a linear model for the first three columns, and a binomial logistic probability model for the last two columns. The coefficients in Columns (4) and (5) are odd-ratios. I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. The re-weighting procedure uses weights given in the different surveys, corrected to be representative at the continent level for every year of birth. All dependent variables are dummies, except for years of schooling. Years of schooling are capped at 13, which corresponds roughly to the end of a secondary education cycle. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

Table 5: Long-term aggregated effects of bilingual education on education

Individual heterogeneity. Literature in linguistics documents that girls benefit more from the introduction of local languages in primary schools than boys, due to the fact that they are less exposed to the colonial language as they are more restricted to the home environment (Benson and Wong, 2019). I decompose the bilingual education effect by gender in Table A.9. Women benefit the most from the introduction of bilingual education, with an increase of 3.2 pp in literacy, 2.5 pp in school attendance, and 0.24 in years of schooling. Expanding bilingual education appears to be an effective way to reduce gender inequalities in education. Indeed, recent descriptive evidence in Sub-Saharan Africa showed that gender gaps in educational attainment worsened for most countries at the end of the last century because boys benefited more from the large increase in school supply (Evans, Akmal, and Jakiela, 2021).

Among individuals who went to school, not everyone benefited equally from the bilingual education reform. Figure A.6 details its effect on literacy skills by years of schooling completed: the lower the grade, the higher the impact. It is aligned with the linguistic experts' recommendation for a late transition to the foreign language in education (Ball, 2011; Trudell, 2023). However, as results shown in Table 5 show that bilingual education seems to impact the number of years of education, the reading of these results is not straightforward.

Reform heterogeneity. So far, I considered all bilingual education reforms as identical and comparable. However, they differ in many dimensions, e.g., grades covered and language introduced. Figure A.5 shows the wide range of grades of transition between the local language and the foreign language as the medium of instruction. Reforms also differ regarding the languages introduced: some countries have introduced only one language in education, like Tanzania with Swahili, while in other countries, education is officially given in the student's mother tongue, as in Nigeria or Kenya. Table A.7 summarizes for every country the teaching languages and the grade at which a foreign language replaces them. I look at heterogeneity that could emerge from these two specific components in Tables A.10 and A.11. Linguistic policies integrating the mother tongue of the student rather than a few languages, and transitioning later to the foreign language, appears to be more beneficial for the students on school attendance: positive impacts on going to school

and years of schooling are concentrated in countries that implemented a mother-tongue policy with a late-exit transition model. The simple mechanism behind this is that these reforms are more inclusive and do not leave behind linguistic minority students.

Another difference between the reforms is the timing at which they have been implemented. In particular, the impact of these new languages of instruction could be proportional to the gap in educational attainment at the time the reform was implemented. Indeed, if schooling was already universal, we might expect bilingual education to have no impact on this outcome. I test this formally in Table A.8 by dividing my sample between countries where schooling attendance was low vs high at the time of their reform.²⁵ Results confirm the prediction: bilingual education impacts literacy school attendance when the initial level is low.

4.3 Country level

Fixed-effect. As illustrated in the previous subsections, linguistic reforms are heterogeneous in many aspects, and these differences motivate differential impacts of bilingual education. To overcome this caveat, I look at each country individually and estimate the effect of bilingual education using a variation of the Equation 1 with geographical fixedeffects only. As shown in Figure A.10, the effect is not uniform among all countries. While the effect seems null to very small or highly imprecise in most countries, a few specific nations stand out and confirm the existing studies about the success (or failure) of their respective bilingual education reforms.

On the negative side, Guinea, Madagascar, and Morocco stand out as countries which experienced negative returns of the introduction of local languages in education. There is extensive literature about the failures of the linguistic reforms in Guinea and Madagascar. Both countries share a similar reform history: the local languages were introduced in primary education during the Cold War by a socialist leader (Sekou Toure for Guinea and Didier Ratsiraka for Madagascar), and the linguistic reform was the core of a global anticolonialist movement. The introduction of Malagasy in primary schools in Madagascar and eight national languages in Guinea suffered from the same limitations: lack of preparation,

 $^{^{25}\}mathrm{I}$ use the median school attendance as the threshold. In my sample, the median school attendance is 61%.

funding, textbooks, and training (Benson and Lynd, 2011; Rapanoël, 2008). In Morocco, Angrist and Lavy (1997) showed that the negative consequences of the replacement of French by Arabic as LoI in primary education were caused by the gap that has opened up between the job market, where French is still predominant, and the school environment, where French has disappeared.

A few countries have also successfully introduced bilingual education. In Ghana, much effort was put into the complete documentation of languages before and during the reform. In fact, vernacular languages were already partially used during the British colonial administration (Cogneau and Moradi, 2014). Recent qualitative studies show that local languages are still widely used in schools and that teachers have a good knowledge of them (Rauf, 2024). In Tanzania, Kiswahili was also used and documented during the colonial period (Chanson, 2012). Education benefits of introducing this language have already been documented in many qualitative studies, listed in Qorro (2013).

Difference-in-difference. To improve on the internal validity of the previous approach, I exploit at a difference-in-difference (DiD) setting, using other countries as controls.²⁶ To do so, I extend the time coverage of every country by incorporating additional survey rounds. The time coverage details can be found in Figure A.11. I prefer using individual DiD estimations rather than using a staggered-like design because this estimation strategy performs poorly in the case of heterogeneous treatment (Chaisemartin and D'Haultfœuille, 2020).²⁷

Results are presented in Figure A.12, and confirm my previous results. One of the main differences is about Ethiopia, which exhibits poor results on education outcomes. This can be explained by the nature of the reform: only Amharic was introduced in 1955 as the language of instruction in primary schools. Until 1991, no other local language

 $^{^{26}}$ For each country c, I use as a control group all the countries for which the linguistic reform introducing local languages in education already took place 10 years prior to the reform of the country c and countries for which it will happen more than 10 years after the reform of the country c.

 $^{^{27}}$ When performing the first stage of weight assessment proposed by Chaisemartin and D'Haultfœuille (2020), I find than 1/3 of the ATTs have a negative weight. Moreover, the sum of these negative weights accounts for 0.44. Hence, using a staggered design is not the first-best estimation strategy in this specific case.

was officially authorized, reducing the initial scope of bilingual education. Analysis at the country level confirms the known successes and failures of reforms introducing local languages into education, which can be explained by the specific characteristics of these reforms, consistent with the recommendations derived from our previous heterogeneity analysis.

4.4 Robustness checks

Partially-treated cohorts. In the treatment definition, I consider as treated the birth cohorts that started primary education in the local languages. Indeed, anecdotal evidence suggests that the linguistic reform is usually scaled up starting with only grade 1 in the first year; in the second year, these children would pass to grade 2 still with a local language of instruction, and the new cohort that entered grade 1 would be taught in the local language as well, and so on (Traoré, 2001). Consequently, children that were already enrolled at the time of the reform should not benefit at all in theory from the introduction of local languages. However, as multigrading is a common feature of African education systems (Bold et al., 2017), I might expect that these older children were still partially affected by the reform. I test it by removing these intermediate birth cohorts from the analysis. These "partially-treated" individuals entered school up to 5 years before the implementation of the bilingual education reform. As expected, I find stronger results when dropping this subsample from the analysis: Table A.13 shows that coefficient estimates almost doubled compared to the initial results presented in Table 5.

Schooling attendance status. I also expect using the local languages in education to improve the literacy skills for the sample of people who attended school. Table A.8 shows that positive effects on literacy skills are concentrated among individuals who went to school and are closer to 3pp. A reduction in the proportion of literate individuals among those who have never attended school results from a distribution effect. As bilingual education improves school attendance, as seen in Table 5, the pool of individuals who did not go to school changes before and after the introduction of the linguistic reform. These results, therefore, suggest that people who were attracted to school by the use of local languages are likely to be among the most literate of those who did not attend school before.

Placebo tests. I perform a series of placebo tests on characteristics that are not supposed to be affected by the reform: religion. Table A.14 displays the result for being Muslim and being Christian. I do not observe any impact of the bilingual education reforms on the probability of being more religious.

5 Conclusion

Very little is known about the choice of the official languages of instruction in Africa. This paper has highlighted determinants explaining why some African countries replaced the colonial language with a local one in primary education after the independence. Using a novel dataset detailing linguistic reforms since independence, I provide data-driven evidence on colonial legacy and present-day characteristics that drive policymakers regarding the language of instruction choice.

Turning to the effects of these reforms, I provide new evidence of the positive longterm impacts of at-scale bilingual education on learning and school attendance using large micro datasets. Using a high dimensional fixed-effect model, I show that these effects are small but significant. Heterogeneity analysis pinpoints that more inclusive reforms perform better. Further research is needed to investigate the extent to which official linguistic policies translate into actual classroom practices and their subsequent impact on educational outcomes.²⁸

 $^{^{28}\}mathrm{In}$ the Supplementary Appendix in Section E, I initiate a discussion of this topic.

References

- Albaugh, Ericka A. (Apr. 2014). State-Building and Multilingual Education in Africa. 1st ed. Cambridge University Press. DOI: 10.1017/CB09781107323735.
- Albaugh, Ericka A (2016). "Language, education, and citizenship in Africa". en. In.
- Alesina, Alberto and Eliana La Ferrara (Sept. 2005). "Ethnic Diversity and Economic Performance". en. In: Journal of Economic Literature 43.3, pp. 762–800. DOI: 10. 1257/002205105774431243.
- Angrist, Joshua D. and Victor Lavy (Jan. 1997). "The Effect of a Change in Language of Instruction on the Returns to Schooling in Morocco". en. In: *Journal of Labor Economics* 15.1, Part 2, S48–S76. DOI: 10.1086/209856.
- Angrist, Noam and Rachael Meager (2023). "Implementation Matters: Generalizing Treatment Effects in Education". en. In: SSRN Electronic Journal. DOI: 10.2139/ssrn. 4487496.
- Bailey, Michael A., Anton Strezhnev, and Erik Voeten (2017). "Estimating Dynamic State Preferences from United Nations Voting Data". In: *Journal of Conflict Resolution* 61.2.
 Publisher: Peace Science Society (International), pp. 430–456.
- Ball, Jessica (2011). Enhancing learning of children from diverse language backgrounds: Mother tongue-based bilingual or multilingual education in the early years. Tech. rep. UNESCO.
- Becker, Bastian (2022). "The Empire Within: Longitudinal Evidence on the Expansion of Christian Missions in Colonial Africa". en. In: Journal of Historical Political Economy 2.2, pp. 333–362. DOI: 10.1561/115.00000032.
- Bekkouche, Yasmine and Yannick Dupraz (Oct. 2023). "Colonial origins and quality of education evidence from cameroon". en. In: World Development 170, p. 106245. DOI: 10.1016/j.worlddev.2023.106245.
- Benson, Carol (2005). *Girls, educational equity and mother tongue-based teaching*. Tech. rep. UNESCO Office Bangkok, Regional Bureau for Education in Asia, and the Pacific.
- Benson, Carol and Mark Lynd (Jan. 2011). "National languages in education in Guinea-Conakry: re-emancipation in progress?" en. In: International Journal of the Sociology of Language 2011.209. DOI: 10.1515/ijsl.2011.024.

- Benson, Carol and Kevin M. Wong (Feb. 2019). "Effectiveness of policy development and implementation of L1-based multilingual education in Cambodia". en. In: International Journal of Bilingual Education and Bilingualism 22.2, pp. 250–265. DOI: 10.1080/ 13670050.2017.1313191.
- Benson, Carolyn J. (Sept. 2000). "The Primary Bilingual Education Experiment in Mozambique, 1993 to 1997". In: International Journal of Bilingual Education and Bilingualism 3.3. Publisher: Routledge __eprint: https://doi.org/10.1080/13670050008667704, pp. 149–166. DOI: 10.1080/13670050008667704.
- (Dec. 2002). "Real and Potential Benefits of Bilingual Programmes in Developing Countries". In: International Journal of Bilingual Education and Bilingualism 5.6.
 Publisher: Routledge __eprint: https://doi.org/10.1080/13670050208667764, pp. 303– 317. DOI: 10.1080/13670050208667764.
- Berman, Edward H. (Dec. 1974). "African Responses to Christian Mission Education".
 en. In: African Studies Review 17.3, pp. 527–540. DOI: 10.2307/523799.
- Biseth, Heidi (2009). "Multilingualism and Education for Democracy". In: International Review of Education / Internationale Zeitschrift für Erziehungswissenschaft / Revue Internationale de l'Education 55.1. Publisher: Springer, pp. 5–20.
- Bjørnskov, Christian and Martin Rode (Apr. 2020). "Regime types and regime change: A new dataset on democracy, coups, and political institutions". en. In: *The Review of International Organizations* 15.2, pp. 531–551. DOI: 10.1007/s11558-019-09345-1.
- Blum, Françoise (2011). "Madagascar 1972 : l'autre indépendance: Une révolution contre les accords de coopération". fr. In: Le Mouvement Social 236.3, p. 61. DOI: 10.3917/ lms.236.0061.
- Bold, Tessa et al. (Jan. 2017). What Do Teachers Know and Do? Does It Matter? Evidence from Primary Schools in Africa. en. World Bank, Washington, DC. DOI: 10.1596/ 1813-9450-7956.
- Bolt, Jutta and Dirk Bezemer (Jan. 2009). "Understanding Long-Run African Growth: Colonial Institutions or Colonial Education?" en. In: *The Journal of Development Studies* 45.1, pp. 24–54. DOI: 10.1080/00220380802468603.
- Brown, Gabriel (2023). "The Persistent Effects of Bible Translations in Africa". In: *Work-ing paper*.

- Cagé, Julia and Valeria Rueda (July 2016). "The Long-Term Effects of the Printing Press in Sub-Saharan Africa". en. In: American Economic Journal: Applied Economics 8.3, pp. 69–99. DOI: 10.1257/app.20140379.
- Calvet, Louis-Jean (2010). Histoire du français en Afrique. Une langue en copropriété ?. Organisation internationale de la francophonie. fr. Editions Ecriture.
- Chaisemartin, Clément de and Xavier D'Haultfœuille (Sept. 2020). "Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects". en. In: American Economic Review 110.9, pp. 2964–2996. DOI: 10.1257/aer.20181169.
- Chanson, Aude (July 2012). "Le kiswahili : une politique linguistique d'exception au Tanganyika". fr. In: Les Cahiers d'Afrique de l'Est / The East African Review 45. Number: 45 Publisher: IFRA - Institut Français de Recherche en Afrique, pp. 49–65. DOI: 10.4000/eastafrica.492.
- Cogneau, Denis (2003). "Colonisation, School and Development in Africa: An empirical analysis". In: *Working paper*.
- Cogneau, Denis and Alexander Moradi (Sept. 2014). "Borders That Divide: Education and Religion in Ghana and Togo Since Colonial Times". fr. In: *The Journal of Economic History* 74.3. Publisher: Cambridge University Press, pp. 694–729. DOI: 10.1017/ S0022050714000576.
- Cummins, Jim (2000). Language, power, and pedagogy: bilingual children in the crossfire. en. Bilingual education and bilingualism 23. Clevedon [England]; Buffalo [N.Y.]: Multilingual Matters.
- De Gaston, William (Oct. 2011). "Le signal communicationnel français face à la langue Evé
 : Pour une phénoménologie de la communication". fr. In: Communiquer. Revue de communication sociale et publique 6. Number: 6, pp. 57–70. DOI: 10.4000/communiquer.
 452.
- Desmet, Klaus, Joseph Flavian Gomes, and Ignacio Ortuño-Ortín (Mar. 2020). "The geography of linguistic diversity and the provision of public goods". en. In: *Journal of Development Economics* 143, p. 102384. DOI: 10.1016/j.jdeveco.2019.102384.
- Desmet, Klaus, Shlomo Weber, and Ignacio Ortuño-Ortín (Dec. 2009). "Linguistic Diversity and Redistribution". In: Journal of the European Economic Association 7.6.

Publisher: Oxford University Press / USA, pp. 1291–1318. DOI: 10.1162/JEEA.2009. 7.6.1291.

- Duflo, Annie, Jessica Kiessel, and Adrienne Lucas (June 2020). Experimental Evidence on Alternative Policies to Increase Learning at Scale. en. Tech. rep. w27298. Cambridge, MA: National Bureau of Economic Research, w27298. DOI: 10.3386/w27298.
- Dupraz, Yannick (Sept. 2019). "French and British Colonial Legacies in Education: Evidence from the Partition of Cameroon". en. In: *The Journal of Economic History* 79.3, pp. 628–668. DOI: 10.1017/S0022050719000299.
- Eisenstein, Elizabeth L. (1980). The Printing Press as an Agent of Change. Cambridge: Cambridge University Press. DOI: 10.1017/CB09781107049963.
- Esteban, Joan and Debraj Ray (1994). "On the Measurement of Polarization". In: Econometrica 62.4, pp. 819–51.
- Evans, David K., Maryam Akmal, and Pamela Jakiela (Jan. 2021). "Gender gaps in education: The long view¹". en. In: *IZA Journal of Development and Migration* 12.1, p. 20210001. DOI: 10.2478/izajodm-2021-0001.
- Evans, David K and Amina Mendez Acosta (Jan. 2021). "Education in Africa: What Are We Learning?" In: Journal of African Economies 30.1, pp. 13–54. DOI: 10.1093/jae/ ejaa009.
- Frankema, Ewout H.P. (Nov. 2012). "The origins of formal education in sub-Saharan Africa: was British rule more benign?" In: *European Review of Economic History* 16.4, pp. 335–355. DOI: 10.1093/ereh/hes009.
- Gennaioli, Nicola and Ilia Rainer (Sept. 2007). "The modern impact of precolonial centralization in Africa". en. In: Journal of Economic Growth 12.3, pp. 185–234. DOI: 10.1007/s10887-007-9017-z.
- Gifford, Prosser and Timothy C. Weiskel (1971). "African education in a colonial context: French and British styles". In: France and Britain in Africa : imperial rivalry and colonial rule. New Haven [u.a.] : Yale Univ. Press.
- Greenberg, Joseph H. (Jan. 1956). "The Measurement of Linguistic Diversity". In: Language 32.1, p. 109. DOI: 10.2307/410659.
- Groves, C. P. (Oct. 1958). "The Planting of Christianity in Africa. Vol. IV, 1914–1954." en. In: London: Lutterworth Press. 28.4, pp. 372–374. DOI: 10.2307/1157645.

- Hovens, Mart (Oct. 2002). "Bilingual Education in West Africa: Does It Work?" en. In: International Journal of Bilingual Education and Bilingualism 5.5, pp. 249–266. DOI: 10.1080/13670050208667760.
- Johnson, Hildegard Binder (Apr. 1967). "The Location of Christian Missions in Africa".In: Geographical Review 57.2, p. 168. DOI: 10.2307/213158.
- Knutsen, Anne Moseng (2007). "Variation du français à Abidjan (Côte d'Ivoire). Étude d'un continuum linguistique et social". PhD thesis. University of Oslo: Acta Humaniora.
- Laitin, David D. (1994). "The Tower of Babel as a Coordination Game: Political Linguistics in Ghana". In: *The American Political Science Review* 88.3. Publisher: [American Political Science Association, Cambridge University Press], pp. 622–634. DOI: 10.2307/2944799.
- Laitin, David D. and Rajesh Ramachandran (May 2022). "Linguistic diversity, official language choice and human capital". In: Journal of Development Economics 156, p. 102811. DOI: 10.1016/j.jdeveco.2021.102811.
- Laitin, David D., Rajesh Ramachandran, and Stephen L. Walter (Oct. 2019). "The Legacy of Colonial Language Policies and Their Impact on Student Learning: Evidence from an Experimental Program in Cameroon". en. In: *Economic Development and Cultural Change* 68.1, pp. 239–272. DOI: 10.1086/700617.
- Lewis, Paul M., Gary F. Simons, and Charles D. (eds) Fennig (2016). *Ethnologue Global Dataset (19th ed)*. Section: 2016-03-22 16:44:43.547. DOI: 10.7910/DVN/PAHSBF.
- Manning, Patrick (Apr. 1999). Francophone Sub-Saharan Africa 1880–1995. 2nd ed. Cambridge University Press. DOI: 10.1017/CB09780511612282.
- Mbiti, Isaac et al. (Aug. 2019). "Inputs, Incentives, and Complementarities in Education: Experimental Evidence from Tanzania*". en. In: The Quarterly Journal of Economics 134.3, pp. 1627–1673. DOI: 10.1093/qje/qjz010.
- Michalopoulos, Stelios and Elias Papaioannou (2013). "Pre-Colonial Ethnic Institutions and Contemporary African Development". en. In: *Econometrica* 81.1. __eprint: https://onlinelibrary.wiley.com/doi/pdf/10.3982/ECTA9613, pp. 113–152. DOI: 10.3982/ECTA9613.
- Mohohlwane, Nompumelelo et al. (2023). "Reading Skills Transfer Best from Home Language to a Second Language". en. In: CGD Working Paper. Washington, DC: Center for Global Development 647.
- Obiakor, Thelma Ebube (Sept. 2024). "Language of instruction policy in Nigeria: Assessing implementation and literacy achievement in a multilingual environment". en. In: International Journal of Educational Development 109, p. 103108. DOI: 10.1016/j. ijedudev.2024.103108.
- Piper, Benjamin, Stephanie S. Zuilkowski, and Salome Ong'ele (Nov. 2016). "Implementing Mother Tongue Instruction in the Real World: Results from a Medium-Scale Randomized Controlled Trial in Kenya". en. In: Comparative Education Review 60.4, pp. 776– 807. DOI: 10.1086/688493.
- Qorro, Martha A. S. (June 2013). "Language of instruction in Tanzania: Why are research findings not heeded?" en. In: International Review of Education 59.1, pp. 29–45. DOI: 10.1007/s11159-013-9329-5.
- Ramachandran, Rajesh (Oct. 2017). "Language use in education and human capital formation: Evidence from the Ethiopian educational reform". en. In: World Development 98, pp. 195–213. DOI: 10.1016/j.worlddev.2017.04.029.
- Ramachandran, Rajesh and Christopher Rauh (Dec. 2022). "The Imperium of the Colonial Tongue? Evidence on Language Policy Preferences in Zambia". en. In: Journal of African Economies 32.1, pp. 52–80. DOI: 10.1093/jae/ejac002.
- Rapanoël, Allain Bruno Solofomiarana (2008). "Les problèmes de la langue d'enseignement à Madagascar: les dysfonctionnements de la loi 94-033". fr. In: Kabaro, revue internationale des Sciences de l'Homme et des Sociétés. L'Harmattan ; Université de La Réunion, Interethnicité et Interculturalité à l'île Maurice, pp. 153–171.
- Rauf, Abudulai (Aug. 2024). "A Study of the Implementation of the Language-In-Education Policy in Three Primary Schools in Ghana". en. In: Open Journal of Educational Research, pp. 197–212.
- Reynal-Querol, Marta (Jan. 2002). "Political systems, stability and civil wars". en. In: Defence and Peace Economics 13.6, pp. 465–483. DOI: 10.1080/10242690214332.
- Ruggles, Steven et al. (2024). Integrated Public Use Microdata Series, International: Version 7.5. en. DOI: 10.18128/D020.V7.5.

- Seid, Yared (Dec. 2016). "Does learning in mother tongue matter? Evidence from a natural experiment in Ethiopia". In: *Economics of Education Review* 55, pp. 21–38. DOI: 10. 1016/j.econedurev.2016.08.006.
- Sharp, Lesley A. (2002). The Sacrificed Generation. University of California Press.
- Traoré, Samba (2001). "La Pédagogie Convergente : son expérimentation au Mali et son impact sur le système éducatif". fr. In: UNESCO, Bureau International d'Education. Monographies-Innodata.
- Trudell, Barbara (2023). Early-exit language transitioning programming: The rationale, the benefits and the limitations. Tech. rep. UNESCO.
- UNESCO (2013). THE GLOBAL LEARNING CRISIS. Why every child deserves a quality education. Tech. rep. UNESCO.
- UNICEF (2016). The impact of language policy and practice on children's learning: Evidence from Eastern and Southern Africa. Tech. rep. United Nations Children's Fund (UNICEF).
- Vogt, Manuel et al. (Oct. 2015). "Integrating Data on Ethnicity, Geography, and Conflict: The Ethnic Power Relations Data Set Family". en. In: Journal of Conflict Resolution 59.7, pp. 1327–1342. DOI: 10.1177/0022002715591215.
- Woodberry, Robert D. (May 2012). "The Missionary Roots of Liberal Democracy". en. In: American Political Science Review 106.2, pp. 244–274. DOI: 10.1017/ S0003055412000093.
- World Bank (2018). Effective Language of Instruction Policies for Learning. Tech. rep.

Appendix

A Additional information on the dataset on languages of instruction presented in Section 2

A.1 Variables

The dataset contains additional details only for education reforms:

- The grade in which teachers theoretically switch back from the newly introduced local language to the colonial one.
- The second language(s) taught at school.
- The grade at which the second language(s) class starts officially.

Except for Tanzania, where Swahili is spoken in schools until the end of secondary education, and in North African countries, most countries require teachers to switch back to the colonial language during primary or secondary education. Appendix A.5 provides details about the transition grades.

This dataset is a compilation of laws that were passed about linguistic policy and does not provide information about the *de facto* aspect, i.e., the extent to which the reform has been implemented. Adding the implementation component would be valuable but also more prone to coding errors and systematic bias. Indeed, we expect rationally that the linguistic policies that are less successful to be less covered by scientific coverage or policy reports.

A.2 Sources

I used various sources to build this new dataset, ranging from newspapers to official policy briefs. As much as possible, I relied on high-quality policy reports, such as UNICEF reports on language policy in Eastern and Southern African countries (UNICEF, 2016). The country profiles on languages of instruction published by USAID on almost all English-speaking African countries were also extensively used.²⁹ For the other countries, I exploited official reports from the International Office of the Francophonie. In total, out of 137, 115

 $^{^{29} \}rm https://www.edu-links.org/resources?keywords=language+of+instruction$

reforms are coded from various official reports, 13 from academic articles or books, and 4 from newspapers. Many reforms were listed from at least two sources (official reports and articles, for instance). The source(s) used for every reform are given in the dataset.



A.3 Comparison with Albaugh (2014)'s dataset

Figure A.1: Comparison between ILLED index (Albaugh, 2014) and the year of local languages introduction in education

Notes: I digitized the ILLED indexes computed by Albaugh (2014) to get a visual representation of its evolution for every country. I also added on each graph the year for which I observe a switch in the official language of instruction from a foreign to a local language, taken from the dataset I hand-coded described in Section 2.

A.4 List of pilot programs

Additionally, I built a companion dataset listing the pilot programs anticipating the countrywide reform replacing the colonial language with a local one. Indeed, changing the medium used by teachers requires some preliminary work such as developing a new curriculum, printing updated textbooks, training teachers. In addition to the variables collected in the primary dataset, the dataset contains details about the number of schools concerned by the pilot program, the start and end year of the program, and whether an evaluation officially took place. Crossing this dataset with the one presented above allows to investigate how much preparation was put before scaling up a national bilingual reform.

Contrary to the main dataset, the listing of pilot programs was not intended to be comprehensive. Indeed, many pilot programs were not covered by scientific studies, national newspapers or policy reports, making them extremely difficult to track. Consequently, I expect a systematic under-reporting of unsuccessful pilots, as the most visible programs are those which receive positive feedback. I also expect an over-reporting of evaluated pilot programs, as they were usually used in academic papers or policy reports.

B Data work for Section 3

To investigate underlying motives behind the choices of languages of instruction in Africa, I merged different datasets and aggregated some variables at the country level. Here is a summary of the different variables and datasets used in this section:

Language: most papers use Ethnologue (Lewis, Simons, and Fennig, 2016) as the main source for language documentation. I preferred using Glottolog 5.0 because it provides more information about the corpus type and the publication year for every document.³⁰ As there is no clean dataset that can be exported from the website, I did an important work on cleaning the language, corpus details, and publication years to be able to use it for the analysis. Using geocoded location of languages, I aggregated indexes and variables at the country level.

Language documentation is one of them: I retrieved all the published documentation listed for every language and categorized it following the Glottolog classification to create a measure of language documentation: 4 if a complete grammar was published for a given language, 3 if only a grammar sketch, 2 if only a phonology text or a New Testament, 1 if only a wordlist, and 0 for nothing. Specifically, I consider a language fully documented (or developed) in a year t if a complete grammar reference was published in the given year.

- Ethnic diversity: I detail here the construction and source of every ethnolinguistic diversity variables used in the analysis in Section 3:
 - 1. An ethnolinguistic fractionalization (ELF) index:
 - I compute an index of pure ethnic fractionalization using the number of politically relevant groups (EPR). This index is simply the Herfindahl-Hirschman index: $1 \sum_{i} s_{i}^{2}$ with s_{i} the population share at the country level represented by the ethnic group i.
 - The index of ethnic fractionalization taken from previous work done by Desmet, Weber, and Ortuño-Ortín (2009), that integrates the linguistic

³⁰Hammarström, Harald & Forkel, Robert & Haspelmath, Martin & Bank, Sebastian. 2024. Glottolog 5.0. Leipzig: Max Planck Institute for Evolutionary Anthropology.

distance, characterized as the number of nodes in Ethnologue between two languages.

- I consider another measure of this index derived from the recent work of Desmet, Gomes, and Ortuño-Ortín (2020). The main difference with their previous work is that in this recent study, they aggregate languages at a higher level, which leads to substantial differences.³¹
- 2. Greenberg Index (GI): this measure was introduced by Greenberg (1956). It is widely seen as a generalization of the ELF, because it takes into account distance between languages, but with outdated and less accurate data on ethnicity and language.
- A polarization index that does not consider distance between languages (Reynal-Querol, 2002). Compared to the other diversity indexes, it gives more weight to the relative size of each group.
- 4. The same polarization index, but with distance between languages included (Esteban and Ray, 1994).
- A peripheral heterogeneity index (Desmet, Weber, and Ortuño-Ortín, 2009), which is a variant of the GI that takes into account polarization.³²
- 6. The number of languages, as given in the Glottolog database.
- 7. The number of politically relevant ethnic groups (EPR). An ethnic group is called "politically relevant if either at least one significant political actor claims to represent the interests of that group in the national political arena or if group members are systematically and intentionally discriminated against in the domain of public politics" (Vogt et al., 2015's codebook).
- 8. The population share at the country level of the largest ethnic group (EPR).

Correlation coefficients of the different variables defining ethnic diversity are displayed in Table A.1.

³¹"in Tanzania 104 out of the 129 languages are aggregated into the same group (Niger-Congo/Atlantic-Congo/Volta-Congo/Benue-Congo/Bantoid/Southern)" p. 7.

 $^{^{32}}$ For more details on these different measures and computations, see the work of Desmet, Weber, and Ortuño-Ortín (2009)

- Other variables:
 - Population at the independence from Our World in Data.³³
 - Muslim population in 2000 was retrieved from the Pew Research Center.
 - Mission locations in 1925 from the work of Becker (2022).
 - Communist leadership was given in the Bjornskov Rode dataset (Bjørnskov and Rode, 2020).
 - For the alternative measure on socialism, I use the United Nations votes (Bailey, Strezhnev, and Voeten, 2017). For every vote since the independence until 1991, I look at whether the vote of each African country was similar to the USSR or its ex-colonizer. If the votes from the USSR and the former colonizer were the same for one poll, I dropped this poll from the sample (it represents 9% of the votes). If the USSR did not vote at one poll, I also removed it from the universe of votes considered.

³³HYDE (2023); Gapminder (2022); UN WPP (2024) – with major processing by Our World in Data. "Population" [dataset]. PBL Netherlands Environmental Assessment Agency, "History Database of the Global Environment 3.3"; Gapminder, "Population v7"; United Nations, "World Population Prospects"; Gapminder, "Systema Globalis" [original data]. Retrieved March 31, 2025 from https://ourworldindata.org/grapher/population

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	0.28**	-0.34**	-0.15	0.44***	0.41***	0.37***	-0.24*	0	0.04
(2)		-0.6***	-0.08	0.46***	0.3**	0.62***	0.01	0.41***	0.45***
(3)			0.26^{*}	-0.7***	-0.56***	-0.5***	-0.02	-0.23*	-0.29**
(4)				-0.1	-0.17	-0.15	0.25^{*}	-0.02	-0.09
(5)					0.62^{***}	0.45***	0.07	0	0.12
(6)						0.57***	0.03	0.29**	0.34**
(7)							-0.01	0.71***	0.81***
(8)								0.32**	0.21
(9)									0.94***

Notes: Estimates are obtained from simple correlation tests, with the following variables: (1) Number of languages (Glottolog), (2) Number of politically relevant ethnic groups (EPR), (3) Population share of the largest ethnic group (EPR), (4) Ethnolinguistic fractionalization index-ELF (EPR), (5) ELF (Desmet, Weber, and Ortuño-Ortín, 2009), (6) ELF (Desmet, Gomes, and Ortuño-Ortín, 2020), (7) Greenberg index (Greenberg, 1956), (8) Polarization index (Reynal-Querol, 2002), (9) Polarization index with distance between languages included (Esteban and Ray, 1994), (10) A peripheral heterogeneity index (Desmet, Weber, and Ortuño-Ortín, 2009). Stars indicate the level of statistical significance of the correlation tests: one for 10%, two for 5%, and three for 1% confidence level.

Table A.1: Correlation matrix for ethnic diversity variables

- C Additional figures, tables and regressions of Section 3
- C.1 Figures



Figure A.2: Linguistic development in Côte d'Ivoire and Ghana

Notes: Data on linguistic development come from Glottolog 5.0. I consider a language fully documented (or developed) in a year t if a complete grammar reference was published in the given year (see Section B for more information).



Figure A.3: Random forest model - Ranking of variables based on the importance assessment

Notes: Points are obtained through a random forest procedure, and are ranked according to their importance. I use the dataset for which one observation is one year in one country. I divide the sample randomly with 80% dedicated for training of the model, and 20% testing. The random forest model used allows for a maximum of 1000 trees. The accuracy of the model oscillates between 97% and 99%. Compared to the Table A.5, I do not display here the coefficients for latitude and longitude, as they are not meaningful for economic interpretation. The description of these variables can be found in Tables 1, 2 and 3.

Colonizer	Catholic	Protestant
Portugal	9	14
France	10	10
Great Britain	17	52
Other	22	28

Notes: The number of missions is computed using data from Becker (2022). I represent here the average number of missions per country for every colonizer, without specific weighting procedure.

Table A.2: Average number of missions in 1925 per country, by colonial empire

Dependent Variable:	Use of local languages in education $(0/1)$			
Model:	(1)	(2)	(3)	(4)
Colonizer dummy:				
France	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Great Britain	3.245^{***}	5.208**	4.498**	3.537^{*}
	(1.151)	(2.045)	(2.013)	(2.144)
Controls: Other colonizer & Not colonized	Yes	Yes	Yes	Yes
Controls: Differential endowments		Yes	Yes	Yes
Controls: Ethnic + Language			Yes	Yes
Controls: Mission				Yes
Fit statistics				
Observations	54	53	51	51

IID standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: The dependent variable is a dummy that is equal to 1 if the country replaced the use of the colonial language in education by a local language. The model estimated is a binomial logistic regression model. In every specification, the regression contains a dummy for countries colonized by non-French or British colonizers, and a dummy for never-colonized countries. Being part of the French colonial empire stands as the reference point. Differential endowments controls stand for the log of the population at the independence, the population density, the population share of Muslims in 2000, latitude, longitude, and a dummy for landlocked countries. Ethnic and language controls stand for the number of ethnic groups (EPR dataset) and the number of languages (Glottolog) in the country in 2000. Mission controls stand for the number of Catholic and Protestant missions in 1925 (Becker, 2022) One observation corresponds to one country. Compared to Table 1, the last regression with pre-colonial institutions is missing here as convergence was not obtained.

Table A.3: Colonial legacy on the bilingual education policy choice - Logit

Dependent Variable:	Use of lo	ocal langu	ages in ed	ucation to	day $(0/1)$
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Share of UN votes similar to USSR	-0.117				
	(0.789)				
Majority of UN votes similar to USSR		0.083			
		(0.360)			
Communist dummy			0.226^{*}		
			(0.129)		
Average PolityV score				0.026	
				(0.020)	
Average Democracy score					0.241
					(0.244)
Controls: Colonizer dummy	Yes	Yes	Yes	Yes	Yes
Controls: Differential endowments	Yes	Yes	Yes	Yes	Yes
Controls: Ethnic + Language	Yes	Yes	Yes	Yes	Yes
Controls: Mission + Documentation	Yes	Yes	Yes	Yes	Yes
Controls: Pre-colonial institutions	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	47	47	48	48	48
\mathbb{R}^2	0.675	0.675	0.698	0.685	0.679

IID standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: The dependent variable is a dummy that is equal to 1 if the country replaced the use of the colonial language in education by a local language. The model estimated is a linear probability regression model. See Table 1 for a precise description of the control variables. One observation corresponds to one country. The communist dummy is equal to 1 if the government is communist at least on year after the independence until 2023, according to the Bjørnskov-Rhode. The share of UN votes similar to USSR is the average fraction of votes taken during the UN assembly that are similar to USSR over the time period from the independence to 1991 (end of USSR); if this share is higher than 50%, I consider that this country has a majority of UN votes similar to USSR and assign a value of 1 to this country. The Polity V score is the average of a dummy that is equal to one when the Policy V score is higher or equal to zero (see Section B for more information). 51

Table A.4:Salience of contemporary political outcomes on the bilingual education policychoice - Country level

Lasso selected variables:	
Population at the independence (in log)	0.096
Colonized by France	
Colonized by other colonizers	
Not colonized	
Colonized by UK	0.348
ELF (Desmet, Weber, and Ortuño-Ortín, 2009)	-0.236
Population density	
Population share of Muslims	0.001
Landlocked	
Nb of ethnic groups (EPR)	
Number of languages (Glottolog)	
Number of Protestant missions in 1925 (Becker, 2022)	
Number of Catholic Missions in 1925 (Becker, 2022)	
Share of documented languages (Glottolog)	
Precolonial institutions (Gennaioli and Rainer, 2007)	0.432
Communist (Bjørnskov and Rode, 2020)	
Polity V score	
Fraction of UN votes similar to the USSR	•
N	54

Dependent variable: Use of local languages in education today (0/1)

expected to be good predictors of the dependent variable from the universe of variables used in the specifications presented in Table 3, without latitude and longitude as they lead to no meaningful interpretation. Points indicate variables shrunk to zero during the Lasso procedure. The dependent variable is a dummy equal to 1 if the country replaced the use of the colonial language in education by a local language. The description of the other variables can be found in Tables 1, 2 and 3.

Notes: Results are obtained through a Lasso procedure, selecting the variables

Table A.5: Best predictors for bilingual education reforms - Lasso regression results

D Additional figures, tables and regressions for Section 4

D.1 Figures



Figure A.4: Time and data coverage for the analysis presented in Section 4

Notes: Each dot is a year of birth for a given country (indicated on the y-axis) included in the analysis. Treatment status is indicated with colors. Circle dots represent countries for which census data were publicly available. Triangle dots represent countries for which no census data were publicly available and for which I used DHS data instead.

Somalia -	• • •	
Senegal -	Primary education	Secondary education
Ghana -	•••••••••••••••••••••••••••••••••••••••	
Seychelles -	•••••••••••••••••••••••••••••••••••••••	
Mali -	•••••••••••••••••••••••••••••••••••••••	1
Gambia -	•••••••••••••••••••••••••••••••••••••••	i
DRC -	• • • • • • • • • • • • • • • • • • • •	1
Zimbabwe -	• • • • • • • • • • • • • • • • • • • •	1
Uganda -	• • • • • • • • • • • • • • • • • • • •	,
South Sudan -	• • • • • • • • • • • • • • • • • • • •	1
Rwanda -	• • • • • • • • • • • • • • • • • • • •	, , ,
Nigeria -	• • • • • • • • • • • • • • • • • • • •	1
Namibia -	• • • • • • • • • • • • • • • • • • • •	, ,
Mozambique -	• • • • • • • • • • • • • • • • • • • •	1
Mauritius -	• • • • • • • • • • • • • • • • • • • •	
Lesotho -	• • • • • • • • • • • • • • • • • • • •	1
Kenya -	• • • • • • • • • • • • • • • • • • • •	
Zambia -	•••••••••••••••••••••••••••••••••••••••	1
Guinea -	•••••••••••••••••••••••••••••••••••••••	
Eswatini -	• • • • • • • • • • • • • • • • • • • •	1
Burundi -	•••••••••••••••••••••••••••••••••••••••	j
Botswana -	•••••••••••••••••••••••••••••••••••••••	
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Tunisia -		· · · · · · · · · · · · · · · · · · ·
	2 3 4 5 6 Introduction grade for the colo	7 8 9 10 nial language

Figure A.5: Official grade of transition from the use of a local language towards the use of the colonial language

Notes: Author's computation. The transition grade corresponds to the one depicted in the first law that enacted the introduction of a local language in instruction. Hence, the figure does not display the current linguistic status of all countries. The black dashed line represents the transition between primary and secondary education (around 7 years of education for most countries).



Figure A.6: Differential effects of bilingual education on literacy by years of schooling completed

Notes: Point estimates are obtained through the same linear regression presented in Table 5, with the exposure to bilingual education interacted by the number of schooling years completed by the respondent. Obtained point estimates are indicated with dots, and shadowed areas represent 95% confidence intervals. The black line represents the limit of the primary cycle in most African educational systems. Note that this limit can vary across countries.



Figure A.7: Heterogeneous effects of bilingual education on literacy

Notes: This graph is a visual representation of the heterogeneity results presented in Tables A.9, A.10 and A.11.



Figure A.8: Heterogeneous effects of bilingual education on school attendance

Notes: This graph is a visual representation of the heterogeneity results presented in Tables A.9, A.10 and A.11.



Figure A.9: Heterogeneous effects of bilingual education on years of schooling

Notes: This graph is a visual representation of the heterogeneity results presented in Tables A.9, A.10 and A.11.



Figure A.10: Effect of bilingual education disaggregated at the country level

Notes: This graphic shows the effects of bilingual education on literacy, school attendance, and years of schooling at the country level. For each country, it provides point estimate along with 95% confidence intervals.



Figure A.11: Time and data coverage for the DiD analysis presented in Section 4.3



Figure A.12: Effect of bilingual education disaggregated at the country level - DiD

D.2 Tables

Ethiopia (1984)	Ghana (2000)	Guinea (1996)
0 = Illiterate	1 = Not literate	1 = Illiterate
1 = Grade 1 and able to read and write 2 = Grade 2 and able to read and write 3 = Grade 3 and able to read and write 4 = Grade 4 5 = Level of education higher than Grade 4 26 = Able to read and write but no education	2 = English 3 = Ghanaian language 4 = English and Ghanaian language 5 = Other	 2 = National language 3 = French 4 = National language and French 5 = English 6 = National language and English 7 = French and English 8 = National language, French, and English 9 = Arabic
	Ethiopia (1984) 0 = Illiterate 1 = Grade 1 and able to read and write 2 = Grade 2 and able to read and write 3 = Grade 3 and able to read and write 4 = Grade 4 5 = Level of education higher than Grade 4 26 = Able to read and write but no education	Ethiopia (1984)Ghana (2000) $0 = Illiterate$ $1 = Not literate$ $1 = Grade 1 and able to read and write2 = English2 = Grade 2 and able to read and write3 = Ghanaian language3 = Grade 3 and able to read and write4 = English and Ghanaian language4 = Grade 45 = Other5 = Level of education higher than Grade 426 = Able to read and write but no education$

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LabelKenya (1989)Morocco (1994)Mauritius (2000)Malawi (1998)Rwanda (2002)TaNo, illiterate $2 = No$ $0 = Illiterate$ $0 = None$ $2 = No$ $3 = None$ $2 = Reading only$ $2 = Reading only$ Yes, literate $1 = Yes$ $1 = Arabic only$ $1 = Creole only$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $1 = Reading and writing$ $1 = Yes, in English$ $Yes, in English$ <th></th> <th></th>		
No, illiterate2 = No0 = Illiterate0 = None2 = No3 = None2 = NoNo, illiterate1 = Yes1 = Arabic only1 = Creole only1 = Yes, in English1 = Reading and writing1 = Yes, in English1 = Yes, in EnglishYes,	Label	Tanzania (1988)
Yes, literate1 = Arabic only1 = Creole only1 = Yes, in English1 = Reading and writing1 =Yes, literate2 = Arabic and French2 = Bhojpuri only2 = Bhojpuri onlyYes, literate3 = Arabic, French and other3 = Creole and Bhojpuri onlyYes, literate4 = Arabic and other4 = Oriental languagesYes, literate5 = Other cases5 = European languages	No, illiterate No, illiterate	2 = No
Yes, literate $6 = European$ and Oriental languages Yes, literate $7 = Other$	Yes, literate Yes, literate Yes, literate Yes, literate Yes, literate Yes, literate	1 = Yes

Table A.6: Description of the literacy variable in the census data used in Section 4

Notes: This table details for every census which exact cases are encompassed in the literacy variable. In particular, they provide information about which languages are used to assess the literacy status of an individual.

Country	Teaching language(s)	Transition grade
Botswana	Tswana	Grade 5
Burundi	Rundi	Grade 5
DRC	Kinshasa Lingala, Congo Swahili	Grade 3
	Luba-Lulua, Eastern Kikongo	
Eswatini	English, Swati	Grade 5
Ethiopia	Amharic	Secondary education
Ghana	Fante, Akuapem Twi, Asante Twi, Ewe, Dagbani,	Grade 2
	Adangme, Ga, Kasem, Nzima	
Guinea	Eastern Maninkakan, Susu, Pulaar, Northern Kissi,	Grade 5
	Bassari-Tanda, Loma (Liberia), Wamey, Guinea Kpelle	
Kenya	Mother tongue	Grade 4
Madagascar	Plateau Malagasy	Secondary education
Malawi	Nyanja	Secondary education
Mali	Bambara, Soninke, Pulaar, Western Maninkakan,	Grade 3
	Supyire Senoufo, Mamara Senoufo, Bomu, Donno So Dogon,	
	Koyraboro Senni Songhai, Hainyaxo Bozo, Tamasheq, French	
Mauritius	Mother tongue	Grade 4
Morocco	Standard Arabic	Secondary education
Namibia	Mother tongue	Grade 4
Nigeria	Mother tongue	Grade 4
Rwanda	Kinyarwanda	Grade 4
Tanzania	Swahili	Grade 8
Zimbabwe	Shona, Zimbabwean Ndebele	Grade 4

Table A.7: Characteristic of the bilingual education reforms

Note: Information about languages are taken from Glottolog 5.0. Transition grade refers to the official grade at which the teachers switch from the local language(s) to a foreign one, when teaching a class.

Dependent Variable:	Literacy $(0/1)$
Model:	(1)
Variables	
Exposed to bilingual education x Went to school	0.026***
	(0.005)
Exposed to bilingual education x Never went to school	-0.013***
	(0.004)
Went to school $(0/1)$	0.813^{***}
	(0.009)
Fixed-effects	
Strata	Yes
Year of birth	Yes
Survey type	Yes
Survey year	Yes
Fit statistics	
Observations	$2,\!907,\!261$
R^2	0.70565
Adjusted \mathbb{R}^2	0.70561

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. The dependent variable, literacy, is a dummy. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

 Table A.8:
 Long-term aggregated effects of bilingual education on education - Heterogeneity by school attendance

Dependent Variables:	Literacy $(0/1)$	School attendance $(0/1)$	Years of schooling
Model:	(1)	(2)	(3)
Variables			
Exposed to BE x Men	0.006	0.007^{*}	-0.004
	(0.005)	(0.004)	(0.018)
Exposed to BE x Women	0.032^{***}	0.025^{***}	0.242^{***}
	(0.002)	(0.002)	(0.019)
Women $(0/1)$	-0.247***	-0.203***	-1.72^{***}
	(0.007)	(0.005)	(0.037)
Fixed-effects			
Strata	Yes	Yes	Yes
Year of birth	Yes	Yes	Yes
Survey year	Yes	Yes	Yes
Fit statistics			
Observations	2,800,843	$2,\!849,\!857$	$2,\!849,\!857$
R^2	0.29191	0.31685	0.32046
Adjusted \mathbb{R}^2	0.29184	0.31678	0.32039

Clustered (at the country level) standard-errors in parentheses Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: BE stands for Bilingual Education. The model estimated is a linear model. I use year of birth, strata and survey year fixed-effects. The sample is restricted to individuals surveyed in census only, as DHS data do not provide education outcomes on men. Strata fixed effects stand for the lowest geographical level. Clusters at the country level stand for the lowest geographical level. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. All dependent variables are dummies, except for years of schooling. Years of schooling is capped at 13, which corresponds to the end of a secondary education cycle. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

 Table A.9:
 Long-term aggregated effects of bilingual education on education - Heterogeneity by gender

Dependent Variables:	Literacy $(0/1)$	School attendance $(0/1)$	Years of schooling
Model:	(1)	(2)	(3)
Variables			
Exposed to BE x No mother tongue education	0.018^{***}	0.009^{*}	0.067
	(0.005)	(0.005)	(0.053)
Exposed to BE x Mother tongue education	0.019^{*}	0.028^{***}	0.366***
	(0.011)	(0.010)	(0.100)
Mother-tongue policy $(0/1)$	1.69	1.01	2.27
	(29.1)	(24.2)	(318.4)
Fixed-effects			
Strata	Yes	Yes	Yes
Year of birth	Yes	Yes	Yes
Survey type	Yes	Yes	Yes
Survey year	Yes	Yes	Yes
Fit statistics			
Observations	2,909,992	2,961,661	$2,\!961,\!661$
\mathbf{R}^2	0.24069	0.32787	0.32431
Adjusted R^2	0.24059	0.32779	0.32422

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: BE stands for Bilingual Education. The model estimated is a linear model. I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. All dependent variables are dummies, except for years of schooling. Years of schooling is capped at 13, which corresponds to the end of a secondary education cycle. The mother tongue policy variable indicates whether the country included all languages spoken in the country in the bilingual education reform officially. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

 Table A.10:
 Long-term aggregated effects of bilingual education - Heterogeneity by

 languages used at school

Dependent Variables:	Literacy $(0/1)$	School attendance $(0/1)$	Years of schooling
Model:	(1)	(2)	(3)
Variables			
Exposed to BE x Transition during prim educ	-0.008	-0.020***	-0.233***
	(0.007)	(0.007)	(0.061)
Exposed to BE x Transition during sec educ	0.045^{***}	0.046***	0.483^{***}
	(0.005)	(0.005)	(0.041)
Transition during sec educ policy $(0/1)$	-4.73	-1.41	-3.90
	(86.0)	(31.7)	(415.7)
Fixed-effects			
Strata	Yes	Yes	Yes
Year of birth	Yes	Yes	Yes
Survey type	Yes	Yes	Yes
Survey year	Yes	Yes	Yes
Fit statistics			
Observations	$2,\!909,\!992$	$2,\!961,\!661$	2,961,661
\mathbb{R}^2	0.24098	0.32830	0.32486

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: BE stands for Bilingual Education, and sec educ for Secondary Education. The model estimated is a linear model. I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. All dependent variables are dummies, except for years of schooling. Years of schooling is capped at 13, which corresponds to the end of a secondary education cycle. The transition during secondary education policy dummy indicates whether the country included in the bilingual education reform a transition to a foreign language during the secondary education cycle. If this dummy is equal to zero, it means that the reform implemented a transition during the primary cycle. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

 Table A.11:
 Long-term aggregated effects of bilingual education - Heterogeneity by grades

 of transition

Dependent Variables:	Literacy $(0/1)$	School attendance $(0/1)$	Years of schooling
Model:	(1)	(2)	(3)
Variables			
Exposed to BE x High school attendance	0.019	0.012	0.396^{***}
	(0.013)	(0.012)	(0.103)
Exposed to BE x Low school attendance	0.018^{***}	0.013^{***}	-0.002
	(0.005)	(0.004)	(0.052)
High school attendance $(0/1)$	-1.40	-1.46	-3.45
	(23.9)	(36.6)	(476.5)
Fixed-effects			
Strata	Yes	Yes	Yes
Year of birth	Yes	Yes	Yes
Survey type	Yes	Yes	Yes
Survey year	Yes	Yes	Yes
Fit statistics			
Observations	$2,\!909,\!992$	$2,\!961,\!661$	2,961,661
R^2	0.24069	0.32785	0.32433

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: BE stands for Bilingual Education. The model estimated is a linear model. I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. All dependent variables are dummies, except for years of schooling. Years of schooling is capped at 13, which corresponds to the end of a secondary education cycle. The variable indicating a high school attendance is a dummy indicating whether the school attendance in the country at the time of the reform was above the median. If the school attendance is below the median, this variable is equal to zero. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

 Table A.12:
 Long-term aggregated effects of bilingual education - Heterogeneity by school

 attendance at the time of the reform

Dependent Variables:	Literacy $(0/1)$	School attendance $(0/1)$	Years of schooling
Model:	(1)	(2)	(3)
Variables			
Exposed to BE	0.030^{***}	0.026^{***}	0.350^{***}
	(0.007)	(0.007)	(0.051)
Fixed-effects			
Strata	Yes	Yes	Yes
Year of birth	Yes	Yes	Yes
Survey type	Yes	Yes	Yes
Survey year	Yes	Yes	Yes
Fit statistics			
Observations	$2,\!321,\!304$	2,364,324	$2,\!364,\!324$
\mathbb{R}^2	0.23233	0.31799	0.31533
Adjusted \mathbb{R}^2	0.23221	0.31788	0.31522

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: BE stands for Bilingual Education. The model estimated is a linear model. I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. All dependent variables are dummies, except for years of schooling. Years of schooling is capped at 13, which corresponds to the end of a secondary education cycle. An individual is considered as exposed to bilingual education when he/she started primary education using a local language. Compared to previous estimations, I remove the five birth cohorts preceeding the reform introduction, as they were already in schools when the reform passed but were partially treated.

 Table A.13:
 Long-term aggregated effects of bilingual education removing partiallytreated cohorts

Dependent Variables:	Muslim $(0/1)$	Christian $(0/1)$
Model:	(1)	(2)
Variables		
Exposed to Bilingual Education	0.004	-0.010
	(0.005)	(0.008)
Fixed-effects		
Strata	Yes	Yes
Year of birth	Yes	Yes
Survey type	Yes	Yes
Survey year	Yes	Yes
Fit statistics		
Observations	1,775,146	1,775,146
R^2	0.55370	0.46896
Adjusted \mathbb{R}^2	0.55361	0.46886

Clustered (at the country level) standard-errors in parentheses Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: BE stands for Bilingual Education. The model estimated is a linear model. I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. All dependent variables are dummies. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

Table A.14: Placebo tests on religion

E Implementation

Using micro-data on eighteen countries, I showed previously that reforming the teaching languages to introduce local ones had small but positive aggregated effects on learning and school attendance. However, little is said about the implementation of these policies, ranging from the coverage of the law to the quality of the newly introduced bilingual curriculum. Some recent papers point to the salience of taking into account implementation when studying education policies (Angrist and Meager, 2023). In the context of Kenya, Piper, Zuilkowski, and Ong'ele (2016) provide anecdotal evidence of specific issues related to bilingual education in terms of implementation: difficult teacher recruitment and lack of demand from parents.³⁴ In Nigeria, where Ethnologue counts 520 living languages, the official policy from 2004 states that primary education in the student's mother-tongue. Recent research shows the implementation limitations of such policy (Obiakor, 2024).

Piloting. Because implementation is essential, piloting a policy before its scale-up is a must-have for policymakers. However, I do not see such a pattern when exploiting the companion database (see Section A.4). Figure A.13 shows that pilot programs do not precede reforms. Moreover, less than half of them were evaluated (42%). Both are indicative of unpreparedness in the reforms.

Linguistic composition. Collecting accurate qualitative evidence about implementation quality on many reforms and countries is costly and challenging. Therefore, I use the change in the linguistic composition here as a proxy for the quality of implementing the linguistic reform of interest. The linguistic composition of one country is characterized here as the fraction of the population that speaks a language for every language spoken within the country. If one language is promoted at school, I expect the fraction of people using this language to increase. I investigate this correlation visually in Figures A.14 and A.15, and estimating Equation 1 in Table A.15 (with the outcome being an indicator variable for whether the individual speaks the language(s) used in primary schools). I do

³⁴"Implementation of the MT[mother-tongue] program faced challenges because many educators were not speakers of the languages, some communities resisted mother tongue instruction, and some areas were more language heterogeneous" (Piper, Zuilkowski, and Ong'ele (2016), p.1)

not find any evidence of a change in the linguistic composition for the five countries where data on spoken languages are available (Botswana, Mali, Mauritius, Morocco, Zimbabwe).

Therefore, all these results suggest that the general lack of preparation could have hindered the true impact of bilingual curriculum on education outcomes.


Figure A.13: Piloting of bilingual reforms, by country

Notes: This graph presents the data hand-coded in the dataset presented in Section 2.

Dependent Variable:	Primary language is a LoI $(0/1)$
Model:	(1)
Variables	
Exposed to Bilingual Education	-0.004
	(0.009)
Fixed-effects	
Strata	Yes
Year of birth	Yes
Survey type	Yes
Survey year	Yes
Fit statistics	
Observations	443,966
R^2	0.22516
Adjusted \mathbb{R}^2	0.22498

Clustered (at the country level) standard-errors in parentheses Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Notes: The model estimated is a linear model. I use year of birth, strata, survey type and survey year fixed-effects. Strata fixed effects stand for the strata given in the DHS surveys and the lowest geographical level for the censuses. Clusters at the country level stand for DHS enumeration area for the DHS surveys and the lowest geographical level for the censuses. Weights used are weights given in the different surveys, corrected to be representative at the continent level for every year of birth. The dependent variable is a dummy equal to one if the individual uses as primary language a language used in instruction. An individual is considered as exposed to bilingual education when he/she started primary education using a local language.

Table A.15: Long-term aggregated effects of bilingual education on the probability of speaking a language of instruction



Figure A.14: Linguistic composition of Botswana, Mali, Mauritius, Morocco, and Zimbabwe around the bilingual education reforms

Note: Each colored bar indicates the fraction of the population speaking the language corresponding to the color in the legend, disaggregated at the birth year level. I use the same weights as for the regression 1.



Figure A.15: Population share speaking the language(s) used in primary schools in Botswana, Mali, Morocco and Zimbabwe

Note: Compared to Figure A.14, Mauritius is absent as they implemented a mother-tongue policy (allowing no variation in the languages used or not used). For more information, Table A.7 gives details about the languages introduced.