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EVIDENCE FROM A NATURAL EXPERIMENT IN ETHIOPIA

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**ABSTRACT:** The extensive use of foreign languages in schooling might have an important role to play in the poor educational outcomes observed on the African continent. Exploiting the language policy change of 1994 in Ethiopia as a natural experiment, we estimate the effects of provision of mother tongue instruction on the largest ethnic group in the country. Our results suggest that provision of mother tongue education led to an increase of 0.75 to 1 year of primary schooling in the affected cohort. Moreover the entire increase in the years of schooling can be attributed to the intensive margin of education. The language policy change, conditional on enrolment, increased the percentage of people completing 6 years or more of schooling by 31%. Applying our findings to a set of African countries shows that even after accounting for the costs of provision, introduction of mother tongue instruction imply potentially large benefits and increases the percentage of population completing primary schooling by as much as 15% points. These findings have important policy implications at a time when surging enrolment rates and already stretched educational budgets in the African continent imply need for solutions which can increase the quality of education without requiring huge capital or infrastructural outlays.

JEL Codes: I24, I25, I28, Z18

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# 1 Introduction

The African continent is characterised by the extensive use of the former colonial languages as the medium of instruction at all levels of schooling and higher education. With the exception of Tanzania, which offers the entire duration of primary schooling in Swahili, and Ethiopia which offers mother tongue instruction to all major ethnic groups during primary schooling, no Sub-Saharan African country provides the entire span of primary schooling in a local language let alone the mother tongue. Moreover in all of Sub-Saharan Africa education from the secondary level onwards is characterised by the exclusive use of the former colonial languages. The African continent at the same time has some of the highest repetition and drop out rates in the world<sup>1</sup> and the only continent in which the out of school children are increasing. The mismatch between the language used in schooling and spoken at home might have important implications for educational attainment.

The choice of language to be used as a medium of instruction presents some interesting tradeoffs that have to be accounted for while designing language policy. On the one hand in linguistically diverse and newly formed nation states as in the case of the African continent, having a common language might assist in nation building purposes. Secondly, global languages like the former colonial languages provide a gateway to be able to interact and integrate with the global economy and along with it bring its concomitant benefits. Moreover introduction of local languages might entail orthography and curriculum development costs putting additional strains on already stretched educational budgets. On the other hand the literature on child development and bilingual education stresses on how learning in a language, which is hardly used outside the classroom may inhibit cognitive development in young children and consequently affect the level of human capital in society (Cummins 1978b, 1979, 1981, 1984, Verhoeven 1987, 1990, 1994). Also excluding local languages from use in the formal realm (education, bureaucracy) might have consequences for civic and political participation and self-confidence of individuals. This paper addresses a specific part of the debate and tries to quantify the impact of medium of instruction policies on human capital formation or more precisely on years of schooling.

The paper uses a change in the medium of instruction policy<sup>2</sup> in Ethiopia to estimate the

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<sup>1</sup>Sabates, R., Akyeampong, K., Westbrook, J., Hunt, F. (2010), "School Dropout: Patterns, Causes, Changes and Policies," Vienna: Paper commissioned for the EFA Global Monitoring Report 2011, The Hidden Crisis: Armed Conflict and Education.

<sup>2</sup>We use the terms language use in education, language policy and medium of instruction policy interchangeably in the paper. For our purpose they should be understood as the language used to teach children

effects of the policy change on the years of schooling. This work is different from the few other existing papers exploiting changes in the medium of instruction policy as the outcomes we are interested in are distinct. Angrist and Lavy (1999) look at how the change from French to Arabic medium, from the 6th grade onwards, affected labour market and not educational outcomes in Morocco. Moreover the change in language policy they consider happens at the secondary schooling level whereas in our setting the change happens at the primary level. Angrist, Chin and Godoy (2008) look at policy shifts that resulted in change from English to Spanish as a medium of instruction in Puerto Rico. Their main focus is however on the effect of the policy change on English skills rather than on the educational attainment of the individuals affected and again the change considered takes place at the secondary and not the primary schooling level.

The language policy in Ethiopia, before 1994, was characterised by the exclusive use of Amharic in primary schooling and the exclusive use of English as a medium of instruction from secondary schooling onwards. Amharic is the language of the second largest ethnic group, Amharas, for whom mother tongue instruction has existed since 1962. In 1994 mother tongue instruction in primary schooling was also introduced for the Oromo people, the largest ethnic group in the country. In order to estimate the effect of the language policy change, we use the fact that an individual's exposure to the new language policy differed by the language group, date of birth and region of residence in the country. We use a difference in difference estimator that controls for systematic variation in education both across language groups and cohorts. Difference in difference strategies have been widely used in the literature to estimate the effect of policy changes (Pischke 2007, Duflo 2001, Card and Krueger 1994). As Duflo (2001) notes difference in difference estimators are especially well suited to evaluate policy changes when the reform comes from a variation in a well defined input; in our case the input being a change in the language used to teach children in primary schooling. The design of the empirical exercise allows us to explicitly test for the validity of the identifying assumption, namely, there would have been no systematic divergences in the educational attainment of the treated and control group in the absence of the policy change. We through tests of pre-program cohorts (Duflo 2001, Heckman and Hotz 1989, Rosenbaum 1987) show that the educational attainment of the earlier cohorts, who did not benefit from the language policy change as they had already finished primary schooling, the increase in educational attainment from one cohort to the

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in schools.

other is uncorrelated to the language policy change in the country. The primary focus is on the effect of the language policy change on years of primary schooling and years of schooling. The results suggest that the provision of mother tongue instruction led to an increase of around 0.75 to 1 year of primary schooling in the affected cohort. The policy also has a positive effect on overall years of schooling, where from secondary schooling on English is employed as a medium of instruction, providing evidence that mother tongue education might in fact assist in second language acquisition.

The finding of strong positive effects in the Ethiopian context is in general at odds with the literature which exploits the presence of bilingual programs to estimate the effects of provision of mother tongue education. Most studies such as Matsudaira (2005), Chin et.al (2011), Slavin et.al (2011) find little or weak positive effects of bilingual education on student achievement. However the studies exploiting bilingual education programs differ from our work in two crucial aspects. One, bilingual education programs that have been studied look at the effect of provision of mother tongue instruction on language minority students, primarily in the context of the United States. In these settings the exposure to the majority language for the language minority students, on a day to day basis, is much higher as compared to the situation in Africa. In Africa the students often learn in a language which is hardly used for interaction outside the classroom. The difference in exposure to the language at the community level might be an important explanation for why the results from bilingual studies based in the United States might not be applicable to the African context. The other important feature of these studies is that the outcomes of most bilingual programs have been measured after a period of just 3 to 4 years. As Thomas and Collier (1997) note in their study that often the benefits of bilingual schooling only appear after as late as the 5th grade and long term rather than short term outcomes should be the main concern of the policy maker.

Our analysis identifies the channel of increase in the years of primary schooling to be the lower dropout and higher completion rates. The estimates show that the change in language policy did not have any significant effect on the enrolment rates and hence the increase in years of schooling is primarily due to the intensive margin of education. The provision of mother tongue instruction, conditional on enrolment, increased the percentage of the sample completing 6 years or more of schooling by 31%. The analysis shows that the provision of mother tongue instruction had a positive effect at all levels of schooling. The results hence are in line with the literature on mother tongue instruction and cognitive development, which suggests that mother tongue instruction results in improving cognitive

skills and hence educational performance.

Our paper is the first in the context of Sub-Saharan Africa, part of the world characterised by the extensive use of foreign languages in schooling, to quantify the impact of provision of mother tongue instruction on educational attainment. Our findings have important policy implications for the African continent where the percentage of children aged 10-19 dropping out before finishing primary schooling is as high as 50%. Applying our findings, of the effect of provision of mother tongue instruction on completion rates, to a set of five African countries suggest potentially large benefits. Estimates suggest that the percentage of population, aged 15 to 49, which completes primary schooling could increase by around 10% points from 29% to 39% in Benin, from 59% to 65% in Cameroon and from around 70% to 84% in Ghana. Moreover although the task of estimating the costs of producing learning materials through standardised methodology is highly problematic because this cost depends on a variety of factors such as the state of development of languages to be used, population sizes, attitudes towards use of local languages etc. the existing cost estimates suggest that even when these are taken into account the potential gains from the introduction of mother tongue instruction remain large. Increasing budget constraints coupled with surging enrolment rates in Africa imply that there is need for remedial tools which do not require large capital and infrastructural outlays but at the same time can increase the quality of education provided and this is where language policy may have a crucial role in the future.

The rest of the paper is organized as follows. In the next section we describe the language policy change and education trends in the country. The section III outlines the identification strategy and presents the data. The section IV presents the main results and section V provides the robustness checks. Section VI identifies the channel through which language policy works. Section VII discusses the implications of providing mother tongue instruction to other African countries and section VIII concludes.

## **2 Language and education policy in Ethiopia**

Ethiopia situated in the horn of Africa with a population of around 80 million is the second most populous nation in the continent. The population is highly diverse containing more than 80 different ethnic groups. There are more than 90 different languages spoken in Ethiopia and most belong to the Afro-Asiatic language phylum of which three branches are represented, namely, Semitic, Cushtic and Omotic.

The “Oromo” are the largest ethnic group in the country comprising around 33% of the population. Though the most numerous in the country, Oromo however can be considered as a minority in terms of political and economic influence they wield as a group when looked at currently or over the course of Ethiopian history. The “Amhara” comprising around 27% of the population are the second largest ethnic group in the country. The other major ethnic groups in the country are the Somali, Tigray, Sidama and Wolaita comprising 6.2%, 6%, 4% and 2.3% of the population, respectively.

## 2.1 Language policy

Ethiopia had been a monarchy for most of its modern history and was under the imperial rule of Haile Selassie between 1916 and 1974. The medium of instruction policy under the imperial rule involved the sole use of Amharic in primary schooling followed by the use of English as the medium of instruction for secondary schooling and higher education.<sup>3</sup>

The emperor was replaced by a Soviet-backed Marxist-Leninist military junta, the “Derg” (meaning council in Amharic), which came to power in 1974. The medium of instruction policy during the “Derg” regime between 1974-1991 was identical to the one in place during the imperial time. Amharic continued to be the sole medium of instruction in primary schooling followed by the use of English from secondary schooling onwards.

Growing discontent against the “Derg” regime<sup>4</sup> led to the establishment of the Tigray People’s Liberation Front (TPLF) in 1975, which merged with other ethnically based opposition parties such as the Oromo Liberation Front (OLF) and the South Ethiopian People’s Democratic Coalition (SEPDC) to form the Ethiopia’s People’s Revolutionary Democratic Front (EPRDF).

The movement against the Junta government reached its crescendo in May 1991 when the ERPDF forces stormed Addis Ababa and the “Derg” regime was toppled. The vision of political and cultural autonomy for all ethnic groups, the banner under which the coalition forces had come together, meant that the transitional constitution of 1991 and the one voted in 1994 resulted in the creation of a federal republic. The country was divided into nine regions and two city administrative units along ethnic and linguistic lines. The 9

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<sup>3</sup>Haile Selassie decided to adopt his Amharian heritage as the banner under which the centralization of Ethiopia was undertaken. The policy of centralization resulted in the choice of Amhara as the official language.

<sup>4</sup>The “Derg” period was characterized by strong state control. This period has been referred to as the Red terror campaign as wide scale human rights abuses were carried out by the establishment in power against any protesting voices.

regions were Afar, Tigray, Oromo, Amhara, Somalia, Benishangul-Gumuz, Southern Nations, Nationalities, and People's Region (SNNPR), Gambella and Harari. The two city administrative units were Addis Ababa and Dire-Dawa, respectively.

The vision of the rights to self-determination led to the introduction of mother tongue instruction in primary schooling for the four major ethnic groups Oromo, Tigray, Sidama and Wolaita starting 1994. Mother tongue instruction in primary schooling for the remaining smaller ethnic groups was to be slowly introduced in the course of the next years. The language policy post 1994 is still characterized by the exclusive use of English as the medium of instruction for secondary schooling and higher education. The children, from the ethnic group besides the Amhara, learn Amharic and English as a subject during the course of primary schooling. On the other hand children from the Amhara group only learn English as a subject during primary schooling.

[Insert Table 2]

The table 2 above shows the implementation of language policy by the languages introduced as a medium of instruction in the nine regions and two city administrative units in the country. As can be seen in table 2 the Oromo people entering primary schooling after 1994 gained access to mother tongue instruction in the regions of Amhara, Dire-Dawa, Harari and Oromia.

## **2.2 Education policy and trends**

During the imperial time formal schooling remained mostly an urban/semi-urban phenomenon with little or no schools in the rural areas. In the period after the imperial rule, between 1975 and 1989, enrolment increased by around 12%. However lack of investment in education meant that the schooling remained out of reach of most rural people.

Post 1994 the education sector was given renewed importance by the EPRDF. The budget for education increased steadily since 1996/97 and in real terms by around 50% in the five year period after 1995/96. The focus on expanding access to education resulted in almost doubling primary schooling enrolment from 4.5 million in 1996/97 to 8.1 million students in 2001/02. In 2001/02 the total education spending stood at US\$ 333 million and was 14% of total public expenditure. Two-thirds is spent on primary and secondary schooling, and the balance on technical and university education.

A closer analysis however shows that in per capita terms there has been little increase in

education spending. The total expenditure per student increased only by around 5% in the period between 1995/96 to 2001/02. Moreover when total expenditure is broken down by the components of recurrent and capital expenditure, the main picture that emerges in the words of the public expenditure review of Ethiopia by the World Bank in 2004 is the “insufficiency of spending at all levels” (pg. 15). The recurrent expenditure per student at the primary level has decreased by around 20% in real terms over the five year period of 1996/97 to 2001/02. 97% of the recurrent budget is directed towards the payment of wages and salaries. Despite the disproportionately large share of recurrent expenditure on payment of wages and salaries, the pupil teacher ratios (PTR) have steadily deteriorated over the past 5 years. The PTR have increased from 32:1 and 33:1 in 1995/96 to around 73:1 and 80:1 in primary and secondary schooling in 2001/02, respectively. 29% of the enrolled population drop out by grade 1 and 55% of the enrolled population by grade 3, implying for these children little effective education is taking place.

### **3 Identification strategy and data**

#### **3.1 Identification strategy**

The main problem in estimating the effect of the provision of mother tongue schooling on education attainment arises due to the problem of the missing counterfactual. Individuals are exposed to either mother tongue instruction or attend schooling in a foreign language and are not observed in both states of the world, implying a with-without comparison is not possible. Directly comparing two groups exposed to different languages could lead to biased estimates as the two groups could differ on various other dimensions besides the language they attend schooling in. To circumvent this problem the paper employs what is termed in the literature as a difference in difference approach exploiting the language policy change of 1994 as a natural experiment.

The main experiment involves comparing the mean years of primary schooling/years of schooling of the Amhara and Oromo group for the older and younger cohorts. For our purpose we define the older and younger cohort as comprised of individuals who attend primary schooling before and after the language policy change, respectively. The older and younger Amhara cohorts had access to mother tongue instruction both before and after 1994 and are unaffected by the policy change and form our control group of interest. The younger Oromo cohort however gained access to mother tongue instruction after 1994,

and comprise our treated individuals. The difference in mean years of primary schooling between the two language groups, for the older cohort is compared with the difference of the younger cohort. This difference in difference can be interpreted as the causal effect of the policy change on the Oromo people.

The above causal interpretation crucially depends on the assumption that in the absence of the change in the medium of instruction policy for the Oromo people, there would have been no systematic differences in the educational attainment of the two groups. As Duflo (2001) and Strauss and Thomas (1995) note when a fixed effects estimator is being used to assess the effect of a policy change, the investigator should pay close attention to the validity of the identifying assumption. The estimate may be capturing something, not related to the policy change, due to the pre-existing differential trends for the two groups. Also if the increase in education of the two groups was negatively correlated with the initial levels, then a treatment effect might be observed even if the program had no real effect.

We however explicitly test for the validity of our identifying assumption. The test of our identifying assumption exploits the presence of multiple groups formed by successive cohorts not exposed to the policy change (Duflo 2001, Heckman and Hotz 1989, Rosenbaum 1987). The individuals belonging to the Oromo group who went to primary school before 1994 were not affected by the change in the medium of instruction policy and hence we should not expect the educational attainment to vary systematically across the Amharic and the Oromo group for the older cohorts. Figure 1 plots the trend in mean years of primary schooling for the two groups, before the policy change in 1994. The years of primary schooling for three older cohorts is depicted in the figure. The fixed effects estimator allows for the levels across the two comparison groups to be different as long as the trend or the shape of the curve remains the same. We see that the two groups over the 30 period, of 1964 to 1994, follow parallel trajectories and have very similar trends in primary schooling attainment. In the results section using a difference in difference estimator we provide a formal test of our identifying assumption.

The data allows for other potential experimental designs to estimate the effect of provision of mother tongue education, though for reasons discussed below we believe the strategy of comparing the Amhara to the Oromo might be the best way to minimize potential estimation bias. The Oromo people gained access to mother tongue education in 4 of the 11 regions in the country. An alternative estimation strategy could involve comparing the older and younger cohorts of the Oromo group in the treated and untreated regions of the country. This would involve comparing the same language group in different regions

whereas our main experiment compares different language groups but in the same regions. There exist disparities in access and schooling infrastructure across regions with the southwestern and northern parts of the country being the least developed. In order to minimize the concerns that our results are driven by differential access to schooling infrastructure, we prefer our main experiment to the one comparing the Oromo group in the treated and untreated regions of the country. This said in the section titled robustness tests, we do carry out the exercise of comparing the Oromo's in the treated and untreated regions and show that the results obtained are very similar to the ones obtained with our preferred identification strategy.

As noted before the language policy change involved the introduction of mother tongue instruction for the four major ethnic groups, namely, Oromo, Tigray, Sidama and Wolaita starting 1994. The Tigray people gained access to mother tongue instruction in only the Tigray region of the country. There exist ranging from a minimum of 4 to a maximum of 10 observations from the control group Amhara in the Tigray region, implying a difference in difference strategy comparing the Amhara and Tigray groups is not implementable.

The DHS data only allows us to distinguish the population of Ethiopia into four distinct language groups. These are namely the Amhara, Oromo, Tigray and the "Others". The "Others" category includes all the remaining language groups clubbed together. As mother tongue instruction for the language groups besides the Oromo, Tigray, Sidama and Wolaita was introduced over the next years after 1994, most individuals who have finished schooling by 2011 from the language group besides the Sidama and Wolaita in the "Others" category are untreated in our data. As the data does not allow us to uniquely identify these individuals, comparing the "Others" category to the Amhara would provide a lower bound of the real effect of the language policy change. We however in the section titled robustness tests create a group called the Non-Amhara comprising of individuals from all other language groups besides the Amhara and carry out a difference in difference strategy comparing the Non-Amhara to the Amhara group.

### **3.2 Data**

The data comes from the Development and Health Surveys (DHS), which are nationally representative data on health, education and demographic trends in developing countries. The data for Ethiopia are from the year 2011 and include information on a nationally

representative sample from the 9 regions and two city administrative areas of Ethiopia. Figure 2 shows a map of Ethiopia, where the regions and city administrative borders are demarcated. The number of observations in our experiments of interest and control range from a minimum of 3210 to a maximum of 11,918 observations.

The schooling system in Ethiopia involves 8 years of primary schooling followed by 4 years of secondary schooling. The children in Ethiopia go to primary school normally between 7 and 14 years of age. A child born before 1980 and speaking Oromo as her mother tongue was 14 years old in 1994, and had already finished primary schooling, and was unaffected by the change in the medium of instruction policy. The data being from the year 2011 implies that the youngest individual who could finish schooling by 2011 was 2 years old in 1994 and similarly the oldest individual who could have been affected by the policy change was 7 years old in 1994. We hence consider the individuals aged 2 to 7 years in 1994 as the younger cohort and the Oromo cohort aged 2 to 7 years in 1994 as the treated individuals. The older cohort is chosen to be the individuals aged 13 to 20 in 1994.<sup>5</sup> The children speaking Oromo as their mother tongue and who were aged 8 to 14 in 1994 were already in primary school before the policy change was implemented. As the policy involved a change in the medium of instruction to be used, the policy in general was implemented only for children who entered primary schooling from 1994 and thereafter. Grade repetition and delayed school entry could lead to some of the children aged 8 to 14 in 1994 to benefit from the program, this however would only provide a lower bound of the true effect of the program. We use the information on age of the individual in 1994, along with his language background i.e. the language spoken as the mother tongue and their region of residence to match it with data on medium of instruction policy implemented in various regions of the country (shown in table 2) to ascertain the impact of provision of mother tongue instruction on the Oromo language group.<sup>6</sup>

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<sup>5</sup>The results are not sensitive to the choice of ages of the younger and older cohorts. Expanding the definition of the younger and older cohort to range from -2 to 7 and 13 to 36, respectively, leaves our results essentially unchanged.

<sup>6</sup>A potential problem is that the data only lets us identify the current region of residence and not the actual region where education was obtained. In case the current region of residence is one of the four regions of the country where mother tongue instruction was introduced but the actual region of education was different from the current region of residence, then our estimates would provide a lower bound of the true effect as we wrongly consider untreated individuals as treated. The 2011 DHS data provides no information on childhood place of residence or for how long the individual has resided in the current region. Data on how long the individual has resided in the current region was however collected for the 2005 round of the DHS. Looking at the 2005 DHS round, we see that around 85% of the Oromo men have always lived in the current region of residence and around 70% of the women have always lived in the current region of

## 4 Results

In this section we present the results of the main experiment of comparing the Amhara and Oromo groups in the regions where the Oromo gained access to mother tongue instruction. We first present a comparison of means of the older and younger cohorts from both groups to calculate the difference in difference. This is followed by a formal evaluation of the difference in difference estimator to check for the significance and to control for other potential confounding factors. Both the results are accompanied by placebo tests or control experiments which provide a test of the validity of the identifying assumption i.e. in the absence of the change in the medium of instruction policy for the Oromo people, there would have been no systematic differences in the educational attainment of the two groups.

### 4.1 Comparison of means

The panel A labelled experiment of interest in table 3 presents the main experiment. There are a total of 5,364 observations with the treated comprising 1,327 observations. Comparing the two groups, for the older cohort aged 13-20 in 1994, shows that the average Amhara and Oromo individual had 2.89 and 1.82 years of primary schooling, respectively. The 1.07 years advantage, for the average Amhara, is due to the Amhara group having had access to mother tongue instruction before 1994 and having been the economic and politically dominant group in the country for the larger part of the 20th century. We observe that the mean years of primary schooling of the younger cohort, aged 2 to 7 in 1994, increases for both the groups due to the spurt in enrolment post 1994. The average years of primary schooling for an Amhara and Oromo individual of the younger cohort stands at 4.16 and 3.81 years, respectively. After gaining access to mother tongue instruction the difference between the average Amhara and Oromo reduces from 1.07 to 0.35 years of primary schooling. The difference in difference or reduction in gap of 0.72 years of primary schooling can be considered as the causal effect of the language policy change. In the next subsection we will check for the statistical significance of the difference in difference calculated.

The causal interpretation as noted before depends on the identifying assumption of similar trends in primary schooling for the two groups in the absence of the policy change. The

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residence. Internal migration moreover does not bias our estimates if it takes place within the four treated regions of the country. Given that nearly 90% of the Oromo population does indeed live within these four regions further reduces the possibility of potential bias due to internal migration.

panel B in table 3 formally presents our control experiment. We consider two cohorts, aged 13-20 and 21-28 in 1994, not exposed to the policy change from the two groups. The identifying assumption of similar trends should imply that the difference in difference should be equal to zero. The panel B indicates that the difference in difference is equal to -0.07 and very close to zero. In the next subsection we show that the difference in difference calculated is indeed statistically insignificantly different from zero.

## 4.2 Difference in difference regressions

In order to evaluate the difference in difference estimator we run the following reduced form regression:

$$S_{ijkn} = \delta_0 + \delta_1 * D_j * C_k + \delta_2 D_j + \delta_3 C_k + \delta_4 B_k + \delta_5 R_n + \epsilon_{ijk} \quad (1)$$

$S_{ijkn}$  refers to the years of primary schooling of individual  $i$  from language group  $j$  of cohort  $k$  in region  $n$ .  $D_j$  is a dummy variable taking the value 1 if the individual belongs to the Oromo language group and zero otherwise.  $C_k$  is a dummy variable which takes the value 1 if the individual belongs to the cohort which was aged 2 to 7 in 1994 and zero otherwise.  $B_k$  is a vector of year of birth dummies for the individuals aged 2 to 7 and 13 to 20 in 1994 for each year of birth and  $R_n$  is a vector of region dummies.

The results of the main experiment are shown in panel A of table 4. Column (1) does not control for year of birth or region dummies. The language group dummy which captures the difference in level between the two language groups is seen to be negative and significant at the 1% level. It captures the fact that the average Amhara has 1.07 more years of primary schooling as compared to the average Oromo. The cohort dummy captures the time trend of increasing years of primary schooling in the country and is positive and significant at the 1% level. The coefficient suggests that on an average the younger cohort has 1.27 years more of primary schooling due to the increased enrolment post 1994. The main coefficient of interest is  $\delta_1$ , the one associated with the interaction term between the language and the cohort dummy and captures the effect of provision of mother tongue instruction. The calculated difference in difference of 0.72 years is seen to be statistically significant at the 1% level. Column (2) additionally controls for year of birth and region dummies. Additionally controlling for these does not change the significance and in fact increases the value of the point estimate of  $\delta_1$  and suggests that the provision of mother tongue instruction

increased years of primary schooling by 0.75 years in the affected cohort. In column (3) the dependent variable considered is the mean years of schooling instead of mean years of primary schooling and includes as controls the region and year of birth dummies. The coefficient capturing the effect of the provision of mother tongue instruction is positive and significant and suggest that provision of mother tongue instruction increased average years of schooling by around 0.80 years.

Figure 3 graphically depicts the effect of the provision of mother tongue instruction. It shows the similar trends in average years of primary schooling for the two language groups up until the cohorts aged 13 to 20 in 1994 and then the rapid convergence of the two groups for the cohort aged 2 to 7 in 1994.

The panel B of table 4 presents the results of our control experiment or the placebo test. Column (1) does not control for year of birth or region dummies and shows that the difference in difference of -0.07 years is indeed insignificantly difference from zero. Column (2) controls for the year of birth and region dummies. Additionally controlling for these reduces the size of the point estimate to -0.009 and it remains statistically insignificant. The results of panel B in table 4 provide evidence in support of the assumption that in the absence of the policy change there would have been no divergence in trends between the Amhara and the Oromo people.

One of the problems arising from using a difference in difference approach, where individuals are grouped in clusters, is that the errors of individuals within the same group might be correlated. In order to deal with the problem, following Mackinnon and White (1985), we estimate heteroskedastic consistent covariance matrix. We use a  $HC_2$  estimator, which uses unbiased estimators of the sample variance of each group, since it makes the correct degrees-of-freedom correction.

Comparing the size of the coefficients of the two interactions terms in panel A and B of table 4 show that the coefficient in the experiment of interest is about 100 times the size of the coefficient in panel B. Moreover the associated standard errors are nearly identical implying that the insignificant coefficients found in the control experiment are not due to the issue of lower precision in the estimation of the placebo test. The identification strategy comparing the Amhara to the Oromo group suggests that the provision of mother tongue instruction increased years of primary schooling by around 0.75 years. The use of pre-program cohorts provides evidence of similar trends in primary education pre-1994.

In the next section to address the concern that it is not the differential response of a particular language group to the general emphasis given to education post 1994 that is driving

the result, we consider alternative language groups and regions and show that the results we obtain are very similar to the ones found in the this section. We additionally look at other confounding factors that could be affecting the result and try demonstrate that the estimate is indeed is capturing the effect of the language policy change.

## 5 Robustness tests

### 5.1 Comparing the Oromo's in the treated and untreated regions

Post 1994 the Oromo people gained access to mother tongue instruction in 4 of the 11 regions in the country. As a first robustness test we compare the Oromo's in the treated and untreated regions of the country. This exercise involves comparing the same language group in different regions whereas the main experiment involved comparing different language groups but in the same regions. There are a total of 3,210 observations with the treated comprising 1,327 observations.

Table 5 compares the mean years of primary schooling of the Oromo's for the older and the younger cohorts in the treated and untreated regions of the country. The older cohort in the untreated region have on an average 1.22 more years of primary schooling as compared to the older cohort in the treated regions. This is mainly due to the untreated regions including the capital Addis Ababa; the most developed part of the country. After gaining access to mother tongue education the gap between the average individual in the untreated and treated regions reduces to 0.47 years of primary schooling. The difference in difference suggests that the provision of mother tongue instruction increased average years of primary schooling by 0.75 years in the affected cohort, very similar to the increase of 0.72 years found in table 3. Looking at the Oromo untreated individuals, we see that the younger cohort gains around 1.24 years of primary education. The increase for the non-treated individuals from the Oromo group is very similar to the increase of 1.27 years observed for the untreated Amhara younger cohort in table 3, although we are looking at two different groups in different regions of the country. Table 6 shows the results of formally evaluating the difference in difference estimator. Column (1) does not control for year of birth or region dummies and shows that the difference in difference of 0.75 years found through comparison of means is statistically significant at the 1% level. Column (2) additionally controls for year of birth and region dummies. Additionally controlling for

these increases the size of the point estimate to 1.00 and it remains statistically significant. The above seems to suggest that the effect being captured by the interaction term in panel A of table 4 is indeed the effect of the language policy change and not due to the different groups reacting differently to the general expansionary trend in education that was taking place in Ethiopia. Moreover comparing the same language group also helps us rule out the concern that it is the effect of political changes such as recognition of language rights or creation of a federal state that is being captured by our estimate.

## 5.2 Comparing the Non-Amhara to the Amhara group

As a second robustness test we compare what we call the Non-Amharic group to the Amhara's. The Non-Amharic are composed of individuals from all language groups besides the Amhara. There are a total of 11,918 observations with the treated comprising 4,538 observation from 9 of the 11 regions of the country. This non-Amharic group as outlined in the identification strategy also contains the category called "Others". In the "Others" category the individuals from language groups other than Sidama and Wolaita are in fact non treated but as data does not allow us to uniquely identify these individuals, we wrongly consider them as treated. The others category comprise around 37% of the population and the Sidama and the Wolaita comprise around 16% of the others category. This implies that in the above exercise the effect of language policy will be a lower bound of the true effect.

In the appendix is shown the table comparing the mean years of primary schooling for the Non-Amhara and the Amhara people. Table 7 shows the results of formally estimating the difference in difference estimator. Column (1) shows that the difference in difference of 0.52 years, calculated through comparison of means, is statistically significant at the 1% level. Column (2) shows controlling for year of birth and region dummies slightly increases the value of the coefficient to 0.55 years and it remains statistically significant at the 1% level. The panel B in table 7, involving the placebo experiment, shows that the coefficient on the interaction term is insignificantly different from zero again providing support in favour of our identifying assumption of similar trends before the 1994 policy change.

### 5.3 Other potential confounding factors

A potential explanation driving the results could be that it is not the change in the language used to instruct children but the change in the composition of teachers. The existing literature has however found that race, gender and ethnic composition of teachers are likely to matter more for subjective evaluation rather than objective performance of students (Ehrenberg, Goldhaber and Brewer 1995). In our context, due to lack of data, we only provide some suggestive evidence as to why change in the composition of teachers is not likely to be affecting the result. As we noted in section II, the primary school enrolment rose from around 4.5 million to around 8.1 million and at the same time the pupil-teacher ratio (PTR) increased from around 32:1 to around 73:1. This seems at the face to suggest that as enrolment doubled so did PTR implying that no new teachers were hired. It is interesting to note in this regard that teachers in public schools in Ethiopia are government employees, making hiring and firing decisions quite rigid. This potentially seems to suggest that there were no major changes in the composition of public school teachers.

As we noted before, the enrolment rates surged in the country post 1994. Another potential confounding factor could be the differential access to schooling infrastructure. In this regard it should be noted that in the main experiment we are looking at the treated and untreated individuals in the same regions so differential access to infrastructure is not a real cause for concern and our results are robust to restricting our sample to any combination of the four treated regions. Moreover in the next section we show that there are no systematic differences in enrolment rates across the control and the treated group after the policy change and the increase in schooling primarily comes about due to higher completion and lower dropout rates.

The identification strategy and the accompanying robustness tests suggests that our identifying assumptions and the causal interpretation provided are reasonable and plausible.

## 6 Identifying the Channel of Increase in Educational Attainment

The estimates from the previous exercise suggest that the provision of mother tongue instruction led to an increase of about 0.75 to 1 year of primary schooling in the affected population. The question that we try to address in this section is how much of the increase is due to the extensive margin and the intensive margin of education, respectively. For our

purpose, we define the change in years of schooling associated with increased enrolment due to the change in the institution of language policy as the extensive margin. The intensive margin is the change in schooling associated with the people who would enrol irrespective of the choice of medium of instruction but choose different levels of schooling under the alternative scenarios.

The data allows us to identify whether the individual was ever enrolled in schooling or not. Using the same design as the main experiment in table 3 and 4, we continue to compare the Amhara and the Oromo's in the regions where the Oromo's gained access to mother tongue instruction. We create a dummy variable enrolment, which take the value 1 in case the individual was ever enrolled in schooling and zero otherwise. Table 9 compares the two groups for the cohorts aged 2 to 7 and 13 to 20 in 1994, where the dependent variable is the proportion of individuals from each group ever enrolled in schooling.

[Insert table 9 here]

Comparing the cohorts aged 13 to 20 in 1994, we see that the proportion of individuals ever enrolled are 43% and 48% for the Amhara and the Oromo group, respectively. The level of enrolment, as discussed in section 2, increases sharply for the younger cohort and stands at 70.9% and 71.1% for the Amhara and the Oromo, respectively. Calculating the difference in difference suggests that language policy resulted in increasing enrolment by around 5% points. We formally estimate the difference in difference estimator by using a Probit model <sup>7</sup> to implement equation (1), where however now the dependent variable is the dummy variable enrolment. The results are shown in column (1) of table 10.

[Insert table 10 here]

The interaction term capturing the increased probability of enrolment, due to provision of mother tongue instruction, is very close to zero and insignificant. The language policy seems to have had no significant effect on the probability of enrolment. The benefit of mother tongue instruction on cognitive development have not been well understood in most policy circles and by stakeholders such as parents, as can be seen with the widespread preference and continuing practice of using former colonial languages as a medium of instruction in most African countries. Moreover the knowledge of the former colonial language or the dominant language of the country are often seen as a prestigious mark of education and modernity in many countries in Africa, and is cultivated by many as a means to acquire

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<sup>7</sup>The results do not change if a Logit specification is used instead.

status.<sup>8</sup> Given the above two factors, it is not surprising that the provision of mother tongue instruction in the case of Ethiopia did not have any significant effect on the probability of enrolment of the Oromo group, as Amharic along with English still remains the working language of the bureaucracy and national government.

The above exercise suggests that the entire increase in years of primary schooling can be attributed to the intensive margin. The literature on language, bilingualism and child development has highlighted the role of mother tongue instruction on cognitive development of children (Cummins 1978b, 1979, 1981, 1984). Although measuring cognitive skills has been a tricky issue, the literature has been able to demonstrate that various measures of cognitive skills are positively correlated with schooling, wages and labour market outcomes (Heckman et.al 2006). The availability of mother tongue instruction resulted in assisting the cognitive development of children which resulted in reducing dropout and increasing completion.

The cumulative distribution function (CDF) showing the proportion of total students dropping out at each grade conditional on enrolment, for grades 1 to 8, is shown in figure 4. Panel A shows the CDF, for the cohorts aged 13 to 20 and 2 to 7 in 1994, for the Oromo group. We see that that the CDF of the younger cohort stochastically dominates the one of the older cohort. Comparing the younger with the older Oromo cohort shows that conditional on enrolment 58% of the population now finishes 6 years or more of schooling as compared to only 37% before. The panel B depicts the CDF for the two cohorts, aged 13 to 20 and 2 to 7 in 1994, for the Amhara group. We see that up until grade 5 the two curves almost overlap and after grade 5 in fact the CDF for the older cohort dominates the one of the younger cohort. This decrease in completion, conditional on enrolment, for the Amhara group can be attributed to the reduction in per capita recurrent expenditure per student. The panel C in figure 4 depicts the difference in difference in the CDFs. The dot on the 5th year of education, for instance, indicates that provision of mother tongue instruction induced 20% of the sample to complete 6 years of schooling or more as compared to 5 years or less. The curve indicates that the policy change had a positive effect at all levels of primary schooling.<sup>9</sup>

In order to formally estimate the effect of language policy on completion rates we construct a dummy called “completion”. The variable takes value 1 if the individual completed 6

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<sup>8</sup>Language and National Identity in Africa, Oxford University Press 2008.

<sup>9</sup>The policy in fact has a positive effect at all levels of schooling and not just all levels of primary schooling. Results available on request.

years or more of schooling and zero otherwise.<sup>10</sup> We hence estimate the regression given by equation (1), where now the dependent variable is the dummy completion. This regression is estimated both for the entire sample and only the individuals who ever enrolled in schooling. The results of the restricted and the entire sample are shown in column (b) and (c) of table 10, respectively. The coefficient on the interaction capturing the effect of provision of mother tongue instruction on probability of completing 6 years or more of schooling as compared to 5 or less is positive and significant. The estimate suggest that the change in language policy, conditional on enrolment, resulted in inducing 31% of the sample to complete 6 years of schooling or more as compared to 5 years or less whereas the estimate for the entire sample is 24%.

The increase in completion rates is similar to the one found by by Jackson (2000). He finds that the use of French in the first two years of primary schooling instead of Kirundi in Burundi led to an increase in the dropout rate from around 28% to 40%. Similarly Patrinos and Psacharopoulos (1995) based on a household survey in 1990 in Paraguay indicate that language strongly influences school attainment and performance. They find that language was the single best predictor of repetition and the cost of being a Guarani-only speaker is about one year of schooling attainment.

The World Bank (2004) study notes that one of the big problems facing Ethiopia is the large number of students dropping out before finishing grade 3. Dropping out at such early stages imply that for these children little or no effective education is taking place. The problem of high dropout remains prevalent throughout the African continent implying much resources are spent on educating people who never achieve effective education. The use of foreign languages as a medium of instruction might be an important factor driving such high dropout rates observed on the African continent.

The finding that the use of mother tongue as a medium of instruction primarily works through the intensive margin also has other important policy implications. In Ethiopia and other African countries the surge in enrolment rates has meant that per capita expenditure on students, especially recurrent education expenditure, has been declining. In such a context means of improving quality of education which do not require massive infrastructural or capital investments are crucial policy tools to ensure effective education

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<sup>10</sup>The choice of 6 years of education as the cutoff point is chosen as this is the number of years of required to finish primary schooling in most countries and completion of primary schooling by all by 2015 is an important objective in most African states. Using any other year as the cutoff does not change the essence of the result and as mentioned before the language policy changes has a positive effect at all levels of schooling.

for all. As we noted in section 2 in the years between 1995/96 and 2001/02, the recurrent education expenditure per student in Ethiopia declined by around 20% in real terms. Comparing the Oromo younger to the older cohort we see that the average years of education obtained, conditional on enrolment, increased from 4.27 years to 5.37 years. In the case of the Amhara the average years of education, conditional on enrolment, actually decreased marginally from 5.97 to 5.86 years. This small reduction as noted before can be attributed to the reduction in per capita recurrent expenditure per student. The fact the the Oromo people increased their educational attainment despite per capita recurrent expenditure going down highlights the fact that language policy might be an important policy tool to increase quality and years of education in countries with scarce resources.

## 7 Applications to the African Continent

In this section we intend to explore how provision of mother tongue instruction could affect the proportion of population completing primary schooling in the African context and the net benefits arising from an additional year of schooling.<sup>11</sup> First using data from the DHS, for other African countries, we calculate how the provision of mother tongue instruction to all ethnic groups which comprise 10% of the population or more would change the percentage of population completing primary schooling.

In the previous section we saw that the provision of mother tongue instruction induced 31% of the enrolled sample to complete 6 years or more of education as compared to 5 years or less. This is the key figure from the previous results that we will employ to generate the required counterfactuals. The procedure utilized to calculate the change in the proportion of population completing primary schooling is explained in the appendix. The same procedure is applied to a set of five African countries and the results are shown in table 11.

The results suggest that in Benin, where there exist three language groups with population shares greater than 10%, provision of mother tongue instruction to these groups could increase the percentage of population completing primary schooling for the people aged 15 to 49 from around 29% to 38.5%, an increase of nearly 10% points.

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<sup>11</sup>The problems associated with extrapolating results found in one specific context to other countries comes with its many associated pitfalls and problems. We do not seek to claim that our estimates do not suffer from these problems but look at the exercise as a way to shed some light and provide some benchmark estimates about potential benefits of mother tongue education.

In the case of Burkina Faso where there is only language group with a population share of greater than 10%, namely, the “Mossi”, who comprise 56% of the population. The estimate suggests that the provision of mother tongue instruction could increase the percentage of population aged 15 to 49 completing primary schooling from 16% to 23% points for the Mossi and from 15% to 20% for the country as a whole. In the case of Ghana provision of mother tongue instruction increases the percentage of population aged 15 to 49 completing primary schooling from 70% to 84% and finally in the case of Gabon and Cameroon the increase is from 66% to 80% and 59% to 65%, respectively. This application at the face of it suggests potentially large benefits where the percentage of population completing primary schooling increases by as much as 15% points. In what follows we calculate the net present value arising from the gain of one additional year of primary schooling due to the provision of mother tongue instruction.

In order to calculate the net present value of an additional year of schooling the associated costs of introducing mother tongue instruction have to be taken into account. The task of estimating the costs of producing learning materials through standardised methodology is highly problematic because this cost depends on a variety of factors such as the state of development of languages to be used, population sizes, attitudes towards use of local languages etc. In what follows we present some estimates of this cost based on existing studies. The main objective of the exercise is to show that even when these costs are taken into account the potential gains from the introduction of mother tongue instruction remain large.

Patrinos and Vadwa (1995) analyse the production costs of introducing local language material in the context of Guatemala and Senegal. The estimates for Guatemala are based on 500,000 textbooks developed by Direccion General de Educacion Bilingue Intercultural (DIGBI) for the four majority Mayan languages. The authors estimate that the introduction of Mayan curriculum increased the unit cost of primary education by 9 percent over the cost of Spanish-only curriculum. This however overestimates costs for the future years as this includes the curriculum development costs, accounting for 37% of the total cost, which would not have to be borne in the later years. In the case of Senegal the estimates suggest that whereas the cost of producing a French textbook is US\$ 0.35 this increases to US\$ 0.84 in the case of textbooks in Wolof. An important point to be noted is the estimates for cost per textbook for French is based on producing around 150,000 books whereas for Wolof the number of books produced were only 4,140. The authors point out that the per unit cost would decrease significantly as the number of books produced increase, as the

associated fixed cost per unit would decrease. They estimate that economies of scale in production can be achieved by printing around 10,000 books and in such a scenario there would be no difference in the cost of a French or a Wolof textbook. Using the above estimates we assume that in the first year there is an increase of 10% in per capita spending per pupil and from the year onwards there is no difference in the cost of provision of local or foreign language instruction.

In order to calculate the return to education, we use the latest estimates of the coefficient on years of schooling in the Mincerian wage equation from the work of Psacharopoulos and Patrinos (2004).<sup>12</sup> The figures on gross domestic product (GDP) per capita and expenditure per student as percentage of GDP per capita are taken from the World Bank indicators for the latest available year. The GDP per capita are measured in constant 2000 US\$.

The net present value of one additional year of education assuming an individual works for 30 years can be written as:

$$NPV_{ij} = \sum_{t=1}^{30} \frac{(m_j(GDP_{PCj}))}{(1+r)^t} - (0.10)(p_j GDP_{PCj}) - (p_j GDP_{PCj}) \quad (2)$$

where  $NPV_{ij}$  refers to the net present value from an additional year of education for individual  $i$  in country  $j$ .  $m_j$  refers to the coefficient on years of schooling from the Mincerian wage equation for country  $j$ ,  $GDP_{PCj}$  refers to the GDP per capita in country  $j$  and  $p_j$  is the percentage of GDP per capita spent per student in country  $j$ .  $r$  refers to the discount rate and is assumed to be equal to 10%. Here note that we assume that the entire increase in cost and the cost of an additional year of schooling are borne by the individual herself.

As an illustrative exercise we calculate the net present value for an individual from Burkina Faso, Ethiopia and Ghana, respectively. The results are shown in table 12. The calculation suggests that the net present value of such an investment is equal to about 60% of the per capita income in these countries. These moreover assume that the GDP per capita remains constant over the 30 year horizon and does not take into account any endogenous effects of

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<sup>12</sup>We are aware of the problems associated with using Mincerian wage regression such as the endogeneity of post-schooling human capital accumulation, the fact that schooling and training are treated symmetrically in calculating the rate of return to schooling and that the general equilibrium effects are not accounted for. This said most instrumental variable estimates are found to be larger than the ordinary least squares estimates suggesting if anything we are underestimating the benefits of the policy change.

increase in human capital on the growth rate or other externalities arising from an educated workforce. For instance Appleton (2000) estimates that a 1 year rise in the average primary schooling of neighbouring farmers is associated with a 4.3% rise in output compared with a 2.8% effect of own farmer primary education in Uganda. The above evidence seems to suggest that African educationalists and policy makers should reassess current language use in education policies and introduction of mother tongue instruction might involve sizeable gains and benefits for majority of the population.

## 8 Conclusion

The paper studies the role of the institution of language use in education on educational attainment. We analyse how provision of mother tongue instruction in Ethiopia to the ethnic group Oromo affected their years of primary schooling. Our estimates suggest that the policy change had a sizeable positive impact and increased mean years of primary schooling by around 0.75 to 1 year in the affected cohorts. The analysis shows that the language policy works primarily through the intensive margin of schooling. The estimate suggest that the change in language policy, conditional on enrolment, resulted in inducing 31% of the sample to complete 6 years or more of education as compared to 5 years or less. The importance of education to growth and development of nation states imply that the African continent, which is characterised by the extensive use of the former colonial language in primary schooling, could have potentially large benefits from rethinking its language use in education policy. Applying our findings to a set of African countries show that provision of mother tongue instruction could increase the percentage of population completing primary schooling by as much as 15% points. Even accounting for the costs of provision show there are still sizeable benefits from the introduction of mother tongue education. The implications of language choices in society extend beyond its effect on educational attainment. They have important implications on health, through language being a barrier to effective transmission of knowledge, political participation, and division of power in society. Today most post colonial countries like India, Cameroon, Ghana, South Africa, to name a few, are marked by socioeconomic inequality along linguistic lines. The wider socioeconomic impacts of the institution of language use in education in particular and language choices in society in general remain relatively unexplored and an important area for future research.

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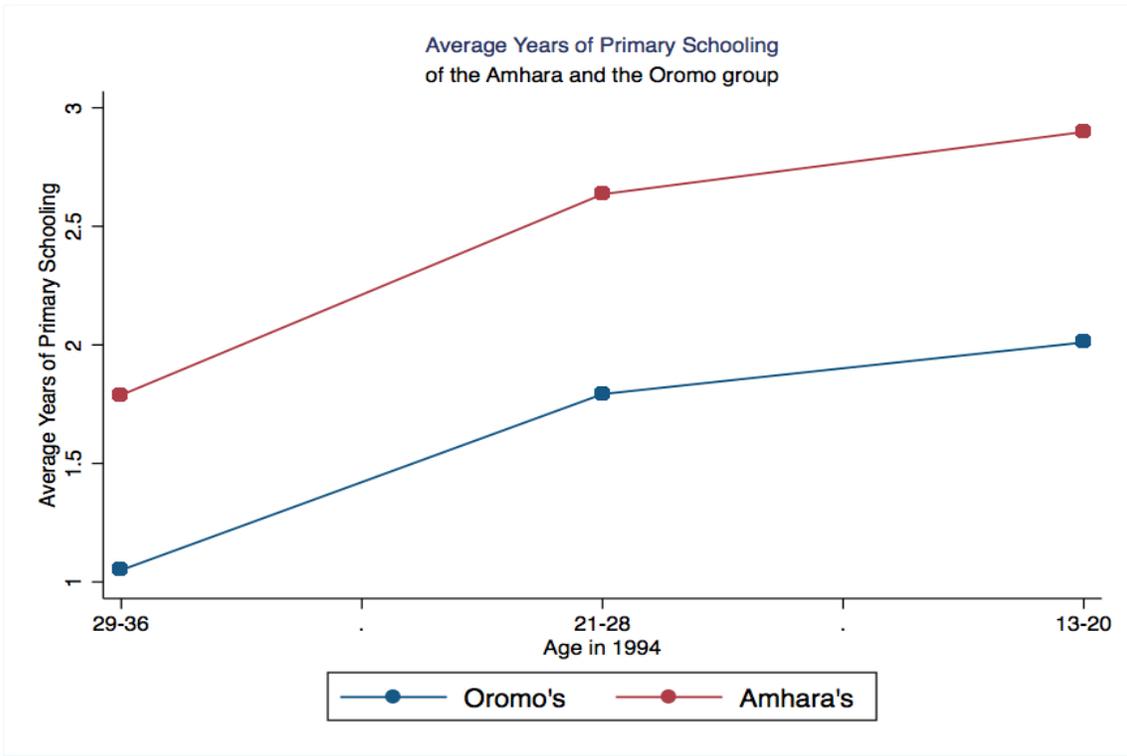


Fig. 1: Trends Pre-1994 for the Amhara and the Oromo Language Group

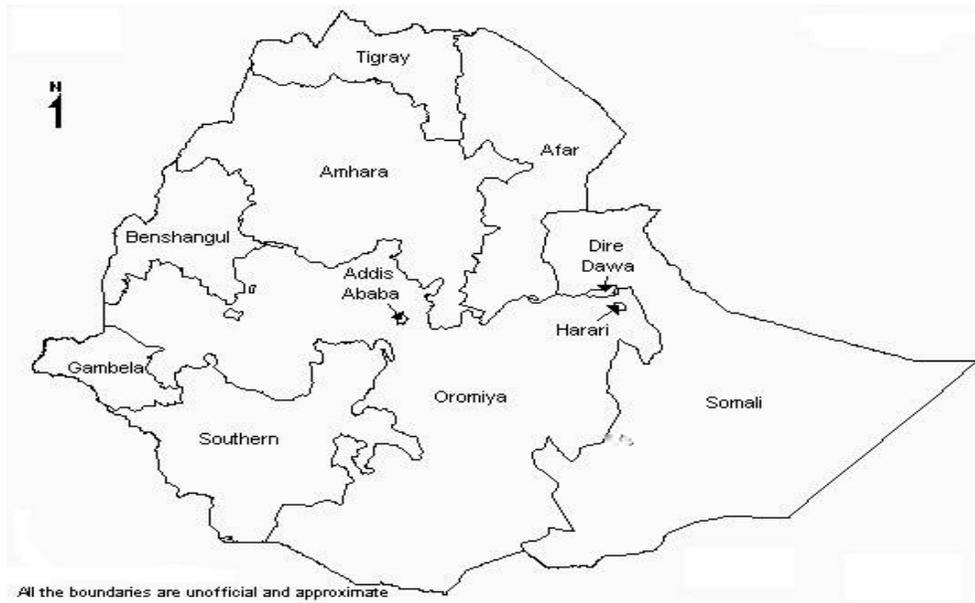


Fig. 2: Map showing the regions and city administrative units of Ethiopia

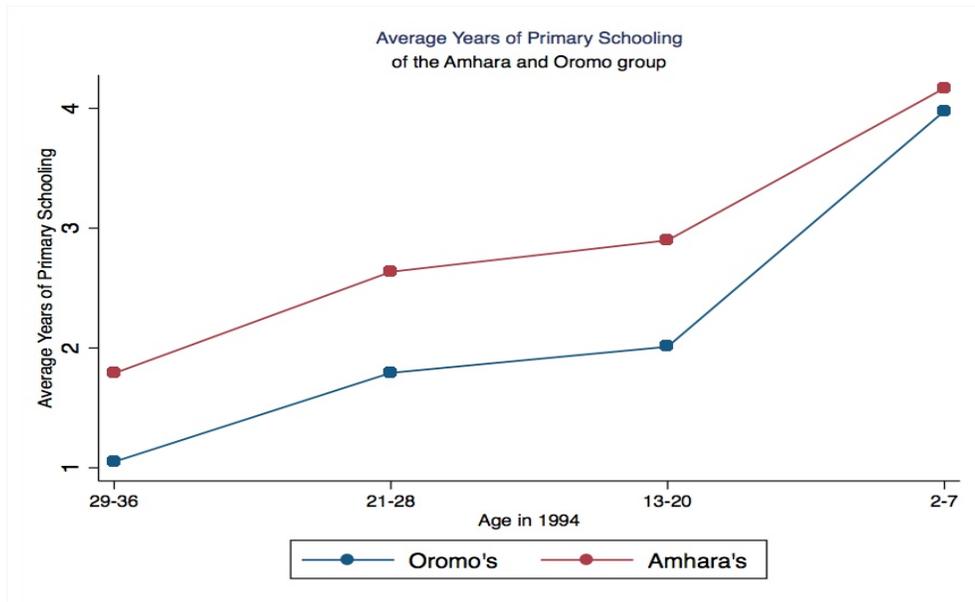


Fig. 3: Effect of the Policy change on the Oromo aged 2 to 7 in 1994

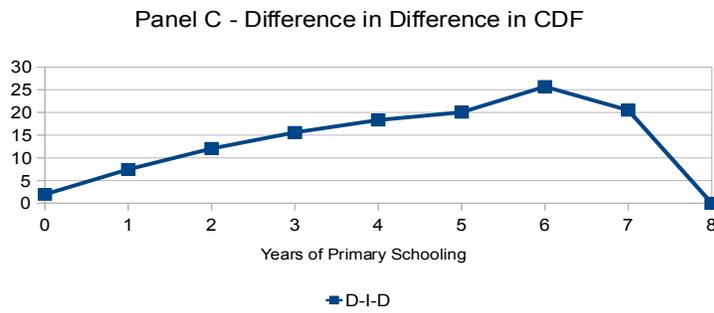
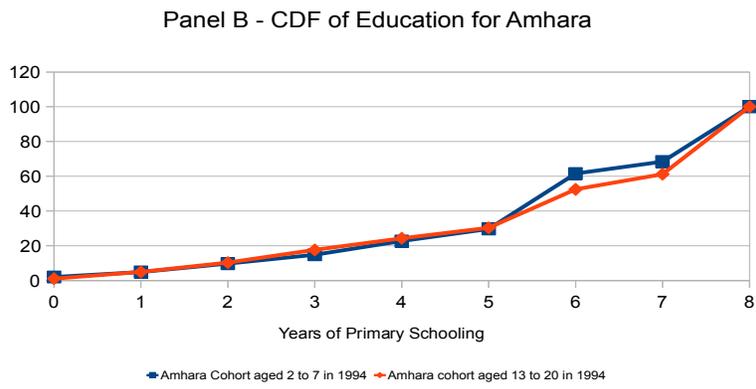
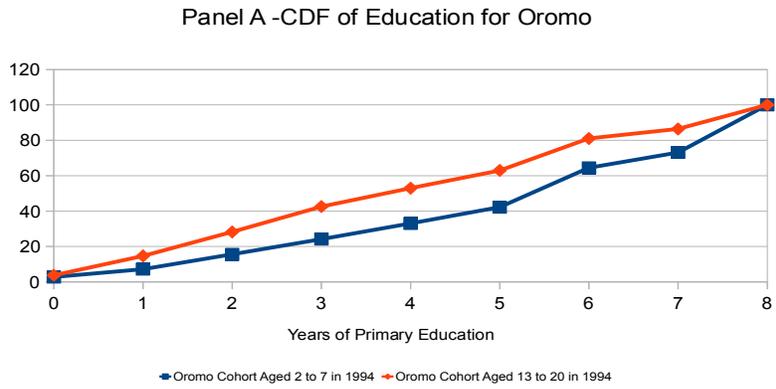


Fig. 4:

Table 1: Descriptive Statistics for Individuals aged 2 to 7 or 13 to 20 in 1994

Variable	Country Average	Amhara Group	Oromo	Non- Amhara Group
Mean Years of Schooling	4.35	6.27	3.76	3.39
Mean Years of Primary Schooling	3.04	4.31	2.98	2.76
% of Households classified as Middle Class and Below	53	30	47.29	57.43
Age of Household Head	40.44	41.16	39.21	39.72
% of Households with Male Head	80	73	84	79.9
% of Households with Bank Accounts	13	29	9	9.4

Table 2: Medium of Instruction (MOI) Policy in Ethiopia by Regions.

Region Name	Languages implemented as MOI in primary schooling
ADDIS ABABA	Amharic
DIRE DAWA	Amharic, Oromigna, Somali.
AFAR	Amharic and Afar.
AMHARA	Amharic, Awingi, Hamittlena and Oromigna.
BENISHANGUL GUMUZ	Amharic
GAMBELLA	Nuek, Anguak and Meshenger.
HARARI	Amharic, Harari and Oromigna.
OROMO	Amharic and Oromigna
SNNPR	Amharic, Dawro, Gamo, Gedeo, Gofa, Hadiya, Kembata, Kafinono, Kotigna, Sidama and Wolaita.
SOMALI	Amharic and Somali.
TIGARY	Tigrinya.

a. The medium of instruction in primary schooling was Amharic in all the regions prior to 1994.

b. Source: Heugh, K. and Benson, C. and Bogale, B and Gebre Yohannis, M.A. (2007). Final Report: Study on Medium of Instruction in Primary Schools in Ethiopia. Commissioned by the Ministry of Education, Ethiopia. September to December 2006.

Table 3: Average years of schooling by Language Group and Cohort

	Years of primary schooling of the Oromo Language Group	Years of primary schooling of the Amhara Language Group	Difference
<b>Panel A: Experiment of Interest</b>			
	(1)	(2)	(3)
2-7 Years old in 1994	3.81 (1327, 3.13)	4.16 (1430, 3.19)	-0.35
13-20 Years old in 1994	1.82 (1310, 2.62)	2.89 (1297, 3.35)	-1.07
Difference	1.99	1.27	0.72
<b>Panel B: Control Experiment</b>			
13-20 Years old in 1994	1.82 (1310, 2.62)	2.89 (1297, 3.35)	-1.07
21 - 28 Years olds in 1994	1.65 (108, 2.63)	2.65 (368, 1.99)	-1.00
Difference	0.17	0.24	-0.07

a. Number of observations and standard errors in parentheses.

b. The observations are from the regions where the Oromo younger cohort is treated, namely Amhara, Oromia, Harari and Dire-Dawa.

Table 4: Impact of provision of mother tongue instruction on Oromo people: Coefficient of interaction between cohort dummy and Oromo Language Group Dummy with the Amhara Language group as the control group.

	(1)	(2)	(3)
<b>Panel A: Experiment of Interest: Individuals Aged 2 to 7 or 13 to 20 in 1994.</b>			
<b>(Youngest cohort aged 2 to 7 in 1994)</b>			
Cohort Dummy*Oromo Language Group Dummy	0.721*** (0.169)	0.745*** (0.154)	0.797*** (0.206)
Cohort Dummy	1.270*** (0.126)	1.580*** (0.265)	2.342*** (0.353)
Oromo Language Group Dummy	-1.075*** (0.118)	-2.868*** (0.129)	-4.394*** (0.179)
Other Controls	No	Yes	Yes
Observations	5,364	5,364	5,364
R-squared	0.080	0.240	0.424

	(1)	(2)
<b>Panel B: Control Experiment: Individuals Aged 13 to 20 or 21 to 28 in 1994.</b>		
<b>(Youngest cohort aged 13 to 20 in 1994)</b>		
Cohort Dummy*Oromo Language Group Dummy	-0.095 (0.180)	-0.009 (0.153)
Cohort Dummy	0.263* (0.140)	0.495* (0.261)
Oromo Language Group Dummy	-0.979*** (0.136)	-3.373*** (0.146)
Other Controls	No	Yes
Observations	4,448	4,448
R-squared	0.030	0.309

a. The dependent variable in column (1) and (2) is years of primary schooling and in column (3) is years of schooling.

b. Other controls include year of birth and region dummies.

c.  $HC_2$  standard errors are in parentheses.

d. \*, \*\* and \*\*\* significant at 10, 5 and 1 % significance level respectively.

e. The Amhara are the control groups the regions are where the Oromo group is treated, namely, Amhara, Oromo, Harari and Dire-Dawa.

Table 5: Average years of Primary Schooling by Language Group and Cohort

Experiment of Interest	Years of primary schooling of the Oromo people in Treated Areas	Years of primary schooling of the Oromo people in the Untreated Areas	Difference
	(1)	(2)	
2-7 Years old in 1994	3.54 (1327, 3.13)	4.28 (305, 3.62)	-0.47
13-20 Years old in 1994	1.82 (1310, 2.62)	3.04 (268, 3.25)	-1.22
Difference	1.99	1.24	0.75

a. Number of observations and standard errors in parentheses

b. The Oromo Language group are treated in the regions of Amhara, Oromia, Harari and Dire-Dawa and untreated in the regions of Afar, Benishangul Gumuz, Gambella, SNNPR, Somali and Tigray.

Table 6: Comparing the Oromo in the treated and untreated regions

Dependent variable - Number of years of Primary Schooling	(1)	(2)
	Cohort Dummy*Region Dummy	0.751*** (0.287)
Cohort Dummy	1.240*** (0.264)	1.233*** (0.429)
Regional Dummy	-1.22*** (0.212)	-1.37 (1.65)
Other Controls	No	Yes
Observations	3,210	3,210
R-squared	0.104	0.154

a. Other controls include year of birth and region dummies.

b.  $HC_2$  standard errors are in parentheses.

c. \*, \*\* and \*\*\* significant at 10, 5 and 1 % significance level respectively.

**Table 7: Impact of provision of mother tongue instruction on non-Amharic language people: Coefficient of interaction between cohort dummy and non-Amharic Language Group Dummy**

Dependent variable - Number of years of Primary Schooling		
	(1)	(2)
<b>Panel A: Experiment of Interest: Individuals Aged 2 to 7 or 13 to 20 in 1994.</b>		
(Youngest cohort aged 2 to 7 in 1994)		
Cohort Dummy*Non-Amharic Language Group Dummy	0.577*** (0.130)	0.553*** (0.116)
Cohort Dummy	1.210*** (0.114)	1.578*** (0.191)
Non-Amharic Language Group Dummy	-1.31*** (0.094)	-2.40*** (0.102)
Other Controls	No	Yes
Observations	11,918	11,918
R-squared	0.091	0.207
Dependent variable - Number of years of Primary Schooling		
	(1)	(2)
<b>Panel B: Control Experiment: Individuals Aged 13 to 20 or 21 to 28 in 1994.</b>		
(Youngest cohort aged 13 to 20 in 1994)		
Cohort Dummy*Non-Amharic Language Group Dummy	-0.055 (0.143)	0.035 (0.117)
Cohort Dummy	0.358*** (0.130)	0.672*** (0.193)
Non-Amharic Language Group Dummy	-1.259*** (0.107)	-2.741*** (0.113)
Other Controls	No	Yes
Observations	10,281	10,281
R-squared	0.041	0.198

a. Other controls include year of birth and region dummies.

b.  $HC_2$  standard errors are in parentheses.

c. The sample includes all regions of the country where the Non-Amharic language group is treated, namely Afar, Amhara, Benishangul Gumuz, Dire-Dawa, Gambella, Harari, Oromo, SNNPR, Somali and Tigray.

d. \*, \*\* and \*\*\* significant at 10, 5 and 1 % significance level respectively.

Table 8: **Proportion Enrolled by Language Group and Cohort**

	Proportion Enrolled of the Oromo Language Group	Proportion Enrolled of the Amhara Language Group	Difference
	(1)	(2)	(3)
2-7 Years old in 1994	0.709 (1327, 0.45)	0.711 (1430, 0.45)	-0.002
13-20 Years old in 1994	0.426 (1310, 0.49)	0.484 (1297, 0.49)	-0.058
Difference	0.283	0.227	0.056

a. Number of observations and standard errors in parentheses.

b. The observations are from the regions where the Oromo younger cohort is treated, namely Amhara, Oromia, Harari and Dire-Dawa.

Table 9: **PROBIT regression: Impact of provision of mother tongue instruction on Oromo people: Coefficient of interaction between cohort dummy and Oromo Language Group Dummy with the Amhara Language group as the control group.**

	(1) Dependent variable Dummy - Enrolled	(2) Only Enrolled Sample Dependent variable Dummy -6 years of schooling or more	(3) Full Sample Dependent Variable Dummy -6 years of schooling or more
<b>Experiment of Interest: Individuals Aged 2 to 7 or 13 to 20 in 1994.</b>			
<b>(Youngest cohort aged 2 to 7 in 1994)</b>			
Cohort Dummy*Oromo Language Group Dummy	0.0466 (0.074)	0.318*** (0.100)	0.249*** (0.0780)
Cohort Dummy	0.375*** (0.125)	0.327* (0.172)	0.402*** (0.132)
Oromo Language Group Dummy	-0.951*** (0.065)	-1.090*** (0.0856)	-1.284*** (0.0664)
Observations	5,364	3,147	5,364

a. All specifications include year of birth and region dummies.

b. \*, \*\* and \*\*\* significant at 10, 5 and 1 % significance level respectively.

c. The Amhara are the control groups the regions are where the Oromo group is treated, namely, Amhara, Oromia, Harari and Dire-Dawa.

**Table 10: Impact of Provision of Mother Tongue Instruction for African Countries on Primary Schooling Attainment.**

(1)	(2)	(3)	(4)	(5)	(6)
Country	Current % of pop. completing Primary Schooling	% of pop. completing Primary Schooling with mother tongue provision	Ethnic groups with pop. shares of 10% and more	Share of the Ethnic groups completing Primary Schooling currently	Share of the Ethnic groups completing Primary Schooling with mother tongue provision
<b>BENIN</b>	29%	38.5%	Adja (11.96%), Bariba (9.67%) and Fon (42.66%)	Adja (25.83%), Bariba (11.14%) and Fon (26.98%)	Adja (41.07%), Bariba (17.95%) and Fon (43.18%)
<b>BURKINA FASO</b>	15%	20%	Mossi (56%)	Mossi (16%)	Mossi (23%)
<b>CAMEROON</b>	59.8%	65%	Bamblike (20%) and Beti (9.01%)	Bamblike (81%) and Beti (80%)	Bamblike(100%) and Beti (100%)
<b>GABON</b>	66%	80%	Fang (25%), Nzabi-duma (10.2%) and Shira-pun (21%)	Fang (82%), Nzabi-duma (58%) and Shira-pun (69%)	Fang (100%), Nzabi-duma (89%) Shira-pun (99%)
<b>GHANA</b>	70%	84%	Akan (47%), Ewe (13.7%) and Mole-dagiban (16%)	Akan (83.5%), Ewe (76.5%) and Mole-dagiban (40%)	Akan (100%), Ewe (100%) and Mole-dagiban (57.75%)

a. In column (4) in parenthesis are the population share of each group.

b. In column (5) in parenthesis are the % of population from each group completing primary schooling currently.

c. In column (6) in parenthesis are the % of population from each group completing primary schooling after provision of mother tongue instruction.

Table 11: Net Present Value arising for an Individual from Provision of Mother Tongue Instruction.

Country	Discount rate	GDP per capita	Coefficient on years of schooling	% of GDP per capita spent per student	NPV
BURKINA FASO	10%	212	9.6	30%	121
ETHIOPIA	10%	178	8.0	18%	99
GHANA	10%	360	7.1	12%	193

## 9 Appendix

Table A: **Average years of schooling by Language Group and Cohort**

	Years of primary schooling of the Non-Amhara Language Group	Years of primary schooling of the Amhara Language Group	Difference
<b>Panel A: Experiment of Interest</b>			
	(1)	(2)	(3)
2-7 Years old in 1994	3.54 (4538, 2.66)	4.31 (2001, 3.15)	-0.77
13-20 Years old in 1994	1.74 (4794, 2.66)	3.03 (1756, 3.32)	-1.29
Difference	1.80	1.28	0.52
<b>Panel B: Control Experiment</b>			
13-20 Years old in 1994	1.74 (4794, 2.66)	3.03 (1756, 3.32)	-1.29
21 - 28 Years olds in 1994	1.45 (3284, 2.37)	2.65 (1604, 2.84)	-1.20
Difference	0.29	0.38	-0.09

a. Number of observations and standard errors in parentheses

b. The sample includes all regions of the country where the Non-Amharic language group is treated, namely Afar, Amhara, Benishangul Gumuz, Dire-Dawa, Gambella, Harari, Oromia, SNNPR, Somali and Tigray.

### 9.1 Methodology applied to calculate effect of mother tongue instruction on a set of African countries

The procedure utilized to calculate the change in the proportion of population completing primary schooling, due to provision of mother tongue instruction, is best explained with the help of an example. The same procedure is then applied to a set of five African countries and the results are shown in table 11.

Benin is used as an example to outline the mechanics underlying the procedure. We consider the population aged 15 to 49 from the DHS data of 2006. The DHS data provides us with information on both the education attainment <sup>13</sup>, the language of the respondent and whether the individual was ever enrolled in schooling. Approximately 29% of the population aged 15 to 49 in our sample completes primary schooling or more. Looking at the population shares of the various language groups, there are three groups with population shares of 10% or more. The “Adja” people comprise about 11.96%, the “Bariba” people

<sup>13</sup>More specifically the CDF of education for all language groups as well as the overall CDF.

about 9.67%<sup>14</sup> and the “Fon” about 42.6% of the population. The percentage of population completing primary schooling for the three groups are 25.83%, 11.14% and 26.98%, respectively. We have information on the CDF of education for the three groups both conditional on enrolment and for the whole sample i.e. both individuals who enrolled and did not enrol. The estimate from the previous section suggests that the provision of primary schooling induced 31% of the enrolled sample to complete 6 years of schooling or more as compared to 5 years or less. The sample size of the enrolled population, for instance for the ethnic group Fon, is 7609 individuals. The calculated estimate implies that now 31% or 2419 additional individuals complete primary schooling as compared to before. Looking at the entire sample of individuals aged 15 to 49 from the Fon group, which includes 14935 individuals, we see that 10905 individuals were dropping out with 5 years of education or less. The provision of mother tongue, given our estimate, would reduce the number of individuals dropping out with 5 years of education or less from 10905 individuals to about 8485 individuals (i.e. 10905 minus 2419). This would imply that the proportion of population which now completes primary schooling or more increases from around 26.98% to 43.18%. Doing a similar exercise for the Adja and the Bariba people suggests that the proportion of people completing primary schooling or more would increase from 25.83% and 11.14% to 41.07% and 17.95% respectively. The percentage of population completing primary schooling for the other language group remains unchanged. We hence using the new values of the percentage of population completing primary schooling for the three groups along with their population shares calculate the overall change in the percentage of population completing primary schooling or more. The estimate suggests that the provision of mother tongue instruction to these three groups, which comprise about 64% of the population, would increase the percentage of population completing primary schooling, for the people aged 15 to 49, in the country from around 29% to 38.5%, an increase of nearly 10% points.

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<sup>14</sup>We also include groups which might be just below the 10% level

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