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**Quasi-experimental evidence on the effects of
mother tongue-based education on reading
skills and early labour market outcomes**

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Abstract: Prior to the introduction of mother tongue-based education in 1994, the language of instruction for most subjects in Ethiopia’s primary schools was the official language (Amharic)—the mother tongue of only one third of the population. This paper uses the variation in individual’s exposure to the policy change across birth cohorts and mother tongues to estimate the effects of language of instruction on reading skills and early labour market outcomes. The results indicate that the reading skills of birth cohorts that gained access to mother tongue-based primary education after 1994 improved significantly by about 11 percentage points. The provision of primary education in mother tongue halved the reading skills gap between Amharic and non-Amharic mother tongue users. The improved reading skills seem to translate into gains in the labour market in terms of the skill contents of jobs held and the type of payment individuals receive for their work. An increase in school enrolment and enhanced parental educational investment at home are identified as potential channels linking mother-tongue instruction and an improvement in reading skills.

Keywords: language of instruction, mother tongue, reading skills, labour market, policy evaluation

JEL classification: I24, I25, I28, J24

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The United Nations University World Institute for Development Economics Research provides economic analysis and policy advice with the aim of promoting sustainable and equitable development. The Institute began operations in 1985 in Helsinki, Finland, as the first research and training centre of the United Nations University. Today it is a unique blend of think tank, research institute, and UN agency – providing a range of services from policy advice to governments as well as freely available original research.

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1 Introduction

Mother tongue instruction, especially during the early grades of schooling, has been advocated as a silver bullet to increase educational attainment, to improve learning outcomes and to reduce educational inequality across groups (Bender et al., 2005; Smits et al., 2008). Proponents of mother tongue-based education point that school curricula are better communicated when students are taught in their mother tongue. The empirical evidence show that using mother tongue as the language of learning and teaching reduces grade repetition and dropout rates and increases school enrollment and academic achievements (Walter and Chou, 2012; Walter and Dekker, 2011; Heugh et al., 2012).

The main arguments put against mother tongue-based education is that it could reduce proficiency skills in the dominant language on the labour market thereby limiting employment and other economic opportunities in the long-term. The empirical evidence on the link between mother tongue instruction, proficiency in second language and long-term economic outcomes is rather mixed (Berman et al., 2003; Bleakley and Chin, 2004; Aldashev et al., 2009). This paper examines the relationship between mother tongue instruction, reading skills and early labour market outcomes.

It is empirically challenging to disentangle the impacts of language of instruction from other factors that influence schooling outcomes. Parents who value education could place their children in schools where education is provided in the child’s mother tongue. In addition, schools that provide instructions in mother tongue may have more engaged school directors, which may affect learning outcomes independently of the language of teaching. In such cases, the positive correlation between schooling outcomes and the language used for instruction is not necessarily caused by the language of instruction per se. Instead, unmeasured and/or unobserved school characteristics and parental value for education could cause the positive correlation. One could randomly allocate students or schools into a treatment mother-tongue based group and a control group. Any statistically significant differences in the learning outcomes of the two groups could be attributed to the language of instruction. However, this kind of experiment is costly and seldom.¹

School language policy reforms can serve as a “natural experiment” to examine the effects of language of instruction on reading skills and labour market outcomes. Ethiopia is one of the few African countries that introduced mother tongue-based primary education. Prior to 1994, the language of instruction for most subjects during primary education was the official language (Amharic), although only 30 percent of the population have Amharic as their mother tongue. As from 1994, mother tongue-based education in public schools was mandated throughout primary education. We use the quasi-exogenous variation in exposure to the language policy change in a difference-in-differences (DID) framework to identify the effects of language of instruction.

¹ Examples include small scale experiments in Cameroon (Walter and Chou, 2012), Vietnam (UNICEF, 2011) and the Philippines (Walter and Dekker, 2011).

Estimation results using the 2011 Ethiopian Demographic and Health Survey show that the reform has a positive influence on reading skills. Reading skills is measured by the ability to read sentences written on a card in one of the major languages spoken in Ethiopia (Amharic, Afan Oromo, Tigrinya, Afar and Somali). Accessing primary education in mother tongue increases the probability of non-Amharic speakers' ability to read by about 11 percentage points. The DID estimates also show that the provision of mother tongue-based education has reduced the reading skills gap between Amharic and non-Amharic mother tongue users by 50 percent. Household socio-economic status and non-random regional migration as a response to the reform do not confound the results.

The paper identifies two possible channels linking instruction based on mother tongue and an improvement in reading skills. First, school enrollment is significantly higher among birth cohorts that gained access to mother-tongue instruction after 1994. This implies that providing education in mother tongue increases the accessibility of schools. Second, parents are more likely to invest in their children's education outside schools when their children are taught in mother tongue. Parental investment takes the form of time investment where parents directly help children with homework and/or financial investment where parents hire a tutor to help their children with homework.

The improved reading skills and general human capital have translated into gains in the labour market. This is measured in terms of the skill contents of jobs held and the type of payment an individual receives for his/her work. Individuals whose mother tongue is different from Amharic and who gained access to mother tongue-based education after 1994 are more likely to work as skilled workers, mainly in the agriculture and service sector, as opposed to being unskilled agricultural or manual workers. They are also more likely to receive their payments in cash instead of informal means of payments such as in kind, a combination of cash and in kind or not receiving any payments for their work. This paper, hence, provides evidence against the view that mother tongue education hinders employment and other opportunities in the labour market. Rather, the findings underscore the importance of mother-tongue based education to reduce ethno-linguistic inequality with respect to human capital and labour market status.

This paper is closely related to few studies that use language policy reforms to examine the effects of language of instruction. Angrist and Lavy (1997) explore a policy change in Morocco which replaced French with Arabic as the language of instruction for post-primary education in 1984. Using the variation in exposure to the policy change across education groups, the authors find that individuals who undertook their education in Arabic have lower French writing skills and hence they experience lower wage returns to schooling. Puerto Rican public schools also introduced Spanish as the language of teaching replacing English in 1949. Contradictory to the Moroccan experience, Angrist et al. (2006) show that the use of Spanish for instruction in post-primary education has not contributed to the declining English proficiency of Puerto Ricans. Mother tongue instruction was

mandated in South Africa's primary schools in 1955 through the Bantu Education Act. Exploiting the regional variation in the duration of mother tongue instruction, Eriksson (2014) finds positive effects not only on literacy skills in mother tongue, but also on English speaking skills, educational attainment and labour market outcomes.²

To the best of my knowledge, Ramachandran (2012) is the only paper that uses the 1994 language policy change in Ethiopia as a "natural experiment" to examine the effects of language of instruction. The author show that the years of education of birth cohorts affected by the language reform increased on average by one year. The author also identifies the intensive margin of education, measured by higher completion rate of grade six and above, as the mechanism at work. The effects that Ramachandran (2012) find is partly due to another reform that took place in 1994 to abolish an Amharic language based central examination that students were required to pass at the end of grade six. The main differences between Ramachandran (2012) and this paper are the following: i) we estimate the effects of language of instruction on learning and labour market outcomes ii) we isolate the effects of language of instruction from the effects of the central examination abolition by restricting the analysis to individuals whose maximum years of education is six years, since these individuals were not affected by the central examination abolition and iii) we identify parental educational investment at home as one channel linking mother tongue education and learning outcomes.

This paper's contributions to the existing literature on language of instruction are the following. First, the paper explores, for the first time, the effect of the language of instruction on reading skills within the context of the 1994 language reform in Ethiopia. It, therefore, complements the existing literature by identifying one mechanism linking language of instruction and educational attainment. Methodologically, the 1994 language reform offers an advantage since it allows us to exploit the variation across language groups over birth cohorts for identification. Previous studies that rely on variation across education groups for identification could introduce bias due to an endogenous schooling response to the policy change. Second, the paper tests, for the first time, whether or not parents engage more in their child's education outside of schools when formal education is provided in mother tongue. Parental educational engagement is hypothesized to be one of the potential channel through which mother tongue education affects schooling outcomes (Eriksson, 2014). Finally, the paper contributes to the scarce evidence on the long-term effects of mother tongue-based education.

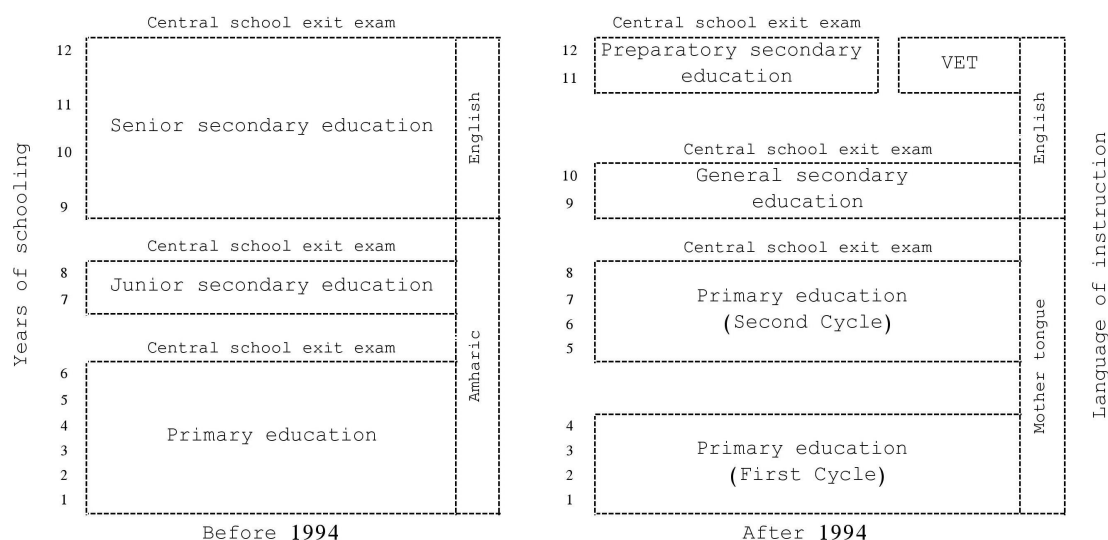
The rest of the paper is structured as follows. Section 2 provides background information on education in Ethiopia and the 1994 educational reform. In Section 3, the identification strategy is outlined whereas Section 4 describes the data. Estimation results are presented and discussed in Section 5 and Section 6 concludes.

² Using a fixed effect approach to control for sorting of students between and within South African schools, Taylor and Coetzee (2013) also finds an improvement in the English language skills of pupils in middle schools when taught in mother tongue in early grades of primary education.

2 Background

Formal education is a recent phenomenon in Ethiopia. Prior to the 1950s, education was provided through the Ethiopian Orthodox Church which predominantly uses the Amharic language and an ancient language called Ge'ez. Literacy skill and educational attainment remained quite poor despite the policies implemented in the country since then. Some of the major policies were the 1974 Education Sector Review and the National Literacy Campaign which was implemented between 1979 and 1983. With the aim of improving the "relevance, quality, accessibility and equity" of the education system, the Ethiopian People's Revolutionary Democratic Front (EPRDF) undertook a major educational reform in 1994. Through the Education and Training Policy (ETP), the organizational structure of the education system was reformed. Figure 1 shows the structure of the Ethiopian education system before and after 1994.

Figure 1: Ethiopian education system before and after 1994.



Source: Author's illustration

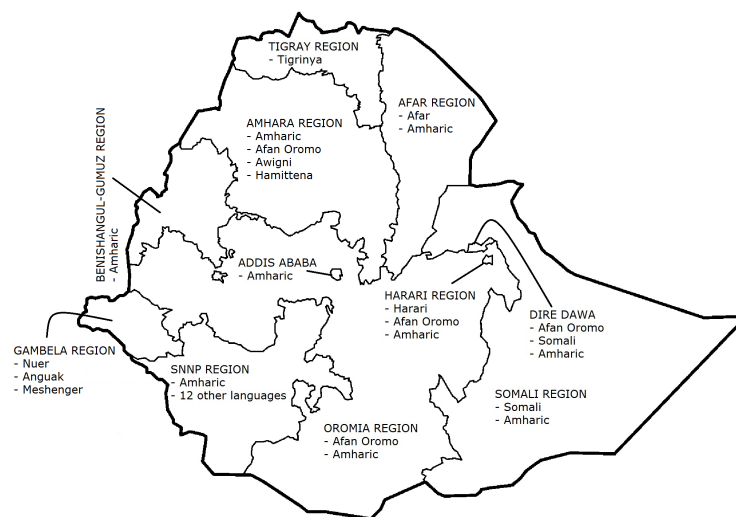
Prior to 1994, the education system consisted of primary education (grades 1-6), junior secondary education (grades 7-8) and senior secondary education (grades 9-12). Primary education in the current education system lasts from grade one to eight and is divided into a first cycle (grades 1-4) and a second cycle (grades 5-8). Secondary education consists of a general secondary education (grades 9-10) and a preparatory secondary education (grades 11-12). Central school exit examinations are administered at the end of each level of education. In the old system, students were required to pass national examinations at the end of grade six, eight and twelve. In the current system, national examinations are administered at the end of grade eight, ten and twelve. The national examination at the end of grade six used to be administered exclusively in Amharic language except for language

subjects. This has, very likely, contributed to the poor performance of the non-Amharic mother tongue users, and hence its abolition benefits individuals whose mother tongue language is different from Amharic more than Amharic speakers.³

The major part of the 1994 education reform, and one that is considered a milestone in Ethiopian education, is the introduction of mother tongue-based education in primary schools. Before 1994, the language of instruction for most subjects in primary schools was Amharic.⁴ The introduction of mother tongue instruction in primary schools came as a result of the 1994 Constitution of Ethiopia. The Constitution recognized the rights of nations and nationalities to learn in their language and gave equal state recognition to the more than 80 languages spoken in the country. Given the diversity of the Ethiopian population, using Amharic as the sole language of instruction in primary education is claimed to be the root cause of educational inequality across ethno-linguistic groups (MoE, 1994; Heugh et al., 2007).

Ethiopia is divided into nine ethno-linguistic based federal regions and two administrative cities. The language(s) mandated to be used as medium of instruction in each region therefore differs depending on the region’s linguistic composition. Figure 2 shows the regions of Ethiopia along with the languages used in their respective primary schools.

Figure 2: Language of instruction in primary schools across regions.



Source: Author’s illustration based on Heugh et al. (2007). Map of Ethiopia with regional demarcation from commons.wikimedia.org “Ethiopia regions blank.png” accessed on 10/06/2015.

³ Students who drop out of secondary education have now the option to join vocational education and training (VET) programs. Vocational training on basic skills lasting up to a year is provided for primary education drop outs. No major changes occurred in pre-primary education. Pre-primary education is largely left for the private sector and the government plays indirect role by providing support in preparing curriculum and training of kindergarten teachers (MoE, 2001). Enrollment in pre-primary education is quite low in Ethiopia with a gross enrollment rate of less than three percent (<http://data.uis.unesco.org/>).

⁴ After 1994, Amharic is taught as a second language starting from grade three or four depending on the region. English was and still remains the medium of instruction in secondary and higher education and it is taught as a subject starting from grade one.

The policy reform mandated the use of mother tongue throughout primary education in all regions. However, the policy's implementation varies across regions. Some regions (e.g. Tigray and Oromia) provide mother tongue instruction from grade one to eight whereas other regions (e.g., Afar and Somali) only in the first cycle of primary education (Grade 1-4).⁵ When enough speakers of a given language exist within a region, pupils are sorted into different language-specific schools. In other cases, students are sorted into different sections within schools depending on their mother tongue. The implementation of the language reform was made possible partly because the management and administration of the education system was decentralized at the regional level. The federal government remains in charge of setting curriculum standards and national examinations and also financing the education system (MoE, 1994).

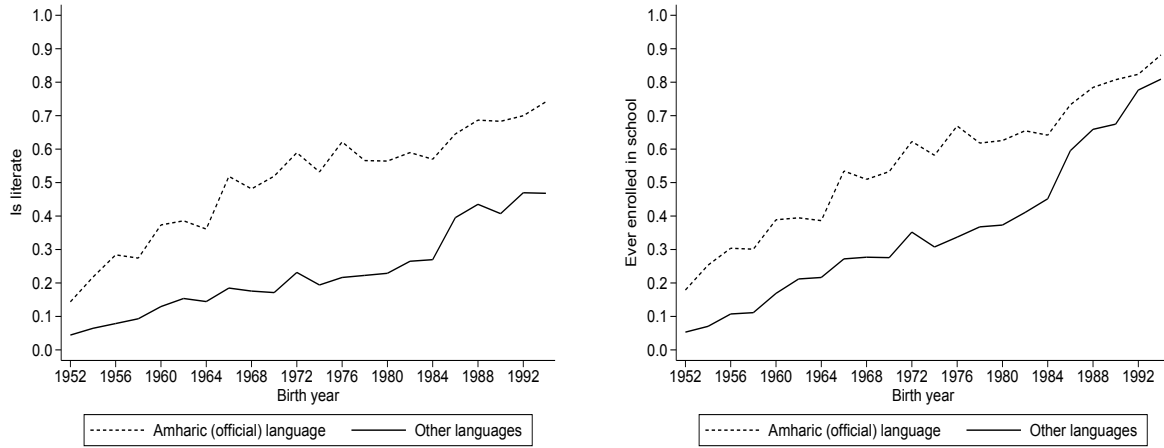
The 1994 education reform also involved changes to the curriculum content at all levels of education. In primary education, more focus is now given to science, mathematics and languages. In addition, the first cycle of primary education is provided in a self-contained unit where one teacher teaches all subjects. Textbooks are also made to reflect conditions of the specific regions. In general secondary education, new subjects such as civic education were introduced and the curriculum in preparatory secondary education is replaced with subjects which used to be provided in the first year of higher education in the old system. Furthermore, more schools were constructed especially in rural areas, fees in primary and general secondary schools were abolished whereas cost-sharing was introduced in upper secondary education and higher education (MoE, 1994, 2001). Since none of these reforms are conditional on the language spoken by individuals, they are very much likely to affect Amharic and non-Amharic mother tongue speakers equally.

Figure 3 shows the trend in various measures of educational outcomes across age groups. Separate trends are shown for individuals who use Amharic as their mother tongue and those whose mother tongue is different from Amharic.⁶ Panel (a) shows the average reading literacy of the population across birth cohorts measured using an objective assessment of individuals' ability to read simple sentences written in one of the major languages. The share of birth cohorts that have completed at least one year of education and at least four years of education are displayed in Panel (b) and (c) respectively.

⁵ For a detailed discussion on the implementation of mother tongue education and the challenges faced across regions, see Bogale (2009); Gemechu (2010); Akalu (2011); Gobana (2013).

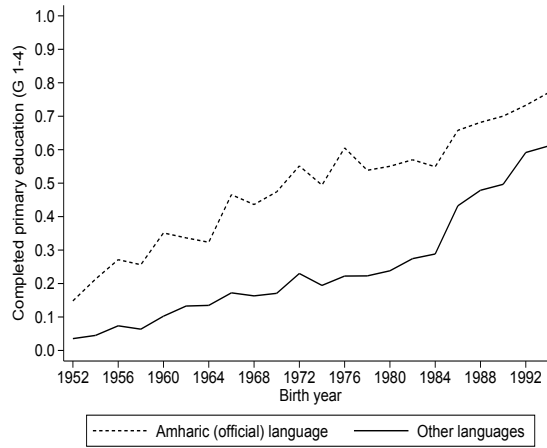
⁶ Amharic mother tongue users make up about 31% of the population. Afan Oromo is the largest non-Amharic language spoken in Ethiopia with a share of 33% whereas Tigrinya and Somali language users make up 6% and 5% of the population respectively.

Figure 3: Trend in educational outcomes by birth cohorts and languages.



(a) Is literate

(b) Ever enrolled in school



(c) Completed primary education (Grade 4)

Source: Author’s illustration based on data from the Ethiopian Demographic and Health Surveys of 2000, 2005 and 2011. The sample consists of men and women aged 15-49.

The figures show that educational outcomes in Ethiopia have improved over birth cohorts. Much of the improvements until the birth cohorts of the early 1970s occurred among individuals who use Amharic as their mother tongue. The pattern has reversed since the birth cohorts of the mid 1980s (i.e., eight years old or younger at the time of the reform) in favor of individuals who use languages other than Amharic as their mother tongue. How much the 1994 language of instruction reform contributed to the improvement in educational outcomes is the main empirical question addressed in the next sections.

3 Empirical strategy

This paper uses the 1994 language reform in Ethiopia as a “natural experiment” in order to examine the effects of language of instruction on learning and labour market outcomes. The quasi-exogenous variation in exposure to the language policy change comes from differences among individuals in their year of birth and mother tongue. The first factor that determines individuals’ exposure to the policy change is their year of birth. Individuals who are of primary or pre-primary school age in 1994 are potentially affected by the reform. Individuals who are above primary school age are not affected by the reform since they are, very likely, outside primary education at the time of the reform. The school entry age in Ethiopia is seven and the primary school leaving age is fourteen. Following this official school age classification, we define the treated birth cohort as those aged 0 to 14 in 1994 whereas those aged 15 to 25 in 1994 form the control birth cohort.

Late school enrollment and grade repetition rates are high in Ethiopia, as in most other Sub-Saharan African countries. For instance, the average age at enrollment ranges between seven and eleven (Nega, 2012). This makes it difficult to precisely determine the treatment status of individuals in the absence of data on age at school entry and grade repetition. Those aged 8-14 might have attended some or all grades of primary education in their mother tongue depending on their age at school entry and grade progression. In the same way, individuals aged 15-19 at the time of the reform could have partial or no exposure to the reform. In a further specification, we use a more disaggregated age group in order to check the sensitivity of the results to the potential bias that may occur due to late school enrollment and grade repetition.

The second factor that determines individuals’ exposure to the policy change is their mother tongue. Individuals whose mother-tongue is a language other than Amharic gained access to primary education in their mother tongue only after 1994. Individuals whose mother-tongue is Amharic, however, could access primary education in Amharic even before 1994. Therefore, the effects of the language change on reading skills and labour market outcomes are obtained by comparing the outcomes over birth cohorts and among individuals whose mother-tongue is Amharic and a language different from Amharic.⁷

Formally, the difference-in-differences estimate can be obtained from the following equation:

$$Y_{ilkr} = \beta_0 + \beta_1 TL_{lr} + \beta_2 TC_k + \beta_3 TL_{lr} * TC_k + \alpha_j + \delta_r + \gamma X_i + \epsilon_{ilkr} \quad (1)$$

where Y_{ilkr} is a measure of reading skills and labour market outcomes of individual i with mother

⁷ Even though more than 80 languages are spoken in Ethiopia, the languages that are considered in this study, other than Amharic, are Afan Oromo and Tigrinya. This is because, as discussed in Section 2, the language policy change was implemented throughout primary education for these languages. In addition, the language of respondents in the Ethiopian Demographic and Health Survey can only be identified for these languages. This point is discussed in detail when describing the data in Section 4

tongue l born in year k and living in region r . TL_{lr} is a binary variable that takes the value one if the individual's mother-tongue is a language other than Amharic and is introduced as medium of instruction in primary education in 1994 in his/her region, and zero if the individual's mother-tongue is Amharic and is one of the medium of instruction in primary education in the region. TC_j is a binary variable that takes one if the individual belongs to the treated birth cohort (i.e., aged 0-14 in 1994) and zero if the individual belongs to the control birth cohort (i.e., aged 15-25 in 1994). α_k and δ_r control for cohort and region specific educational and economic developments. X_i is a vector of individual covariates including gender, an indicator for residing in a rural area as opposed to an urban area, an indicator for being a non-Christian where non-Christian religion includes Islam and traditional religions. Standard errors are clustered at the region-birth year level.

β_3 is the coefficient of interest. It is the difference-in-differences estimate which gives the effects of mother tongue instruction on reading skills and labour market outcomes. Individuals' actual exposure to the policy change, i.e, whether or not they received primary education in mother tongue, is not directly observed in the data used for the empirical analysis. Hence, the estimate from the difference-in-differences approach gives the intent to treat (ITT) effect of the reform. The empirical analysis focuses on comparing the reading skills and labour market outcomes of individuals whose mother tongue is Amharic, Afan Oromo or Tigrinya. Since the language policy reform was implemented throughout primary education for these languages, β_3 represents the effects of accessing mother tongue education for eight years in primary schools. When estimating equation 1, the estimation sample is restricted to individuals who attended formal education for atleast one year.

4 Data

The empirical analysis relies on two data sources. The first data source is the Ethiopian Demographic and Health Survey (EDHS) which is a national representative repeated cross sectional survey of around 20,000 households and their members.⁸ Among others, it provides data on readings skills, employment, health, fertility and various socio-economic characteristics of men and women aged 15-49. The second data source is the 2010 Early Grade Reading Assessment (EGRA), which is a regionally representative survey conducted to assess the reading ability of pupils in primary education. It contains a wealth of information on pupils' reading achievement in grade two and three and various measures of school and family background characteristics including the language used in school and at home.⁹ The effects of language of instruction on reading skills and labour market outcomes are estimated using the EDHS undertaken in 2011. The EGRA, on the other hand, is used to analyze the mechanisms linking mother tongue-based education and reading skills.

⁸ The data can be accessed at <http://dhsprogram.com/>.

⁹ For detail information on EGRA, see Piper (2010).

The main advantage of the EDHS over other data sources, such as the Population and Housing Census and Labour Force Surveys, is that it provides an objective assessment of reading skills. As to the author's knowledge, EDHS is the only data source which provides an objective assessment of the reading skills of adults in Ethiopia. EDHS respondents, whose highest educational attainment is primary education, are asked to read simple sentences written on a card in one of the five major languages used in Ethiopia. These languages are Amharic, Afan Oromo, Tigrinya, Afar and Somali. The available information does not allow us to precisely determine whether reading skills are assessed in Amharic or mother tongue for individuals whose mother tongue is different from Amharic. Those who went to primary schools before 1994 are likely to read the cards in Amharic irrespective of their mother tongue since the language of instruction during primary education was Amharic. On the other hand, individuals who attended primary school after the reform are likely to read the cards in their mother tongue. The implication is that the difference-in-differences estimates from equation 1 are interpreted as the influence of instruction in mother tongue on general reading skills. The reading assessment results are available in three categories indicating whether the individual can read the whole sentence written on the card or he/she can read part of the sentence or he/she cannot read at all. For ease of interpreting the estimation results, the reading skill outcome is binary coded taking the value one if the individual is able to read the whole sentence and zero if the individual can read part of the sentence or none at all.

Early labour market outcomes are measured using information on employment status, occupation and earnings type. An individual is considered employed if he/she has worked during the last seven days preceding the interview. Individuals who have a job but were absent from work for temporary reasons such as illness, maternity leave, etc. are also considered employed. The second variable categorizes the occupation of the respondents based on the occupation's presumed skill content. The variable takes the value (1) if respondents hold unskilled jobs (e.g. laborers in mining and manufacturing, subsistence agriculture workers and sales and service workers in elementary occupations), (2) if respondents hold skilled agriculture/manual jobs (e.g. handicraft, market-oriented skilled agricultural jobs), (3) if respondents hold skilled sales jobs (e.g. models sales and demonstrators) and (4) if respondents hold professional jobs (e.g. professional, managerial, technical and clerical jobs).¹⁰ Finally, we use the information on the type of earning an individual receives for his/her work as an indicator for employment in the formal (non-traditional) sector. The variable takes one if an individual receives cash payments and zero if the individual is paid in cash and in kind, in kind only or not paid at all.

Mother tongue is one of the vital information required to identify individuals' exposure to the language policy change. Respondents' mother tongue is inferred from the language used during the

¹⁰DHS also provides a similar classification of occupations.

interview process. Respondents were asked their language at the beginning of the interview so that the interviewer can decide which questionnaire to use and whether or not a translator is required for the interview. Since the EDHS questionnaires were available in three languages, namely Amharic, Afan Oromo and Tigrinya, the language of the respondents is available for only these three languages. The rest of the respondents are put in the category "Other languages". Descriptive analysis from the 2007 Census show that about 70% of the Ethiopian population uses one of these three languages as mother tongue. Individuals whose mother tongue is neither Amharic, Afan Oromo nor Tigrinya are dropped from the analysis.

Information on region of residence during primary education is required in order to precisely determine whether individuals can access primary education in their mother tongue. For instance, a Tigrinya language speaker has access to primary education in his/her mother tongue only in Tigray region. As Figure 2 shows, most of regions use Amharic and one or more local languages for medium of instruction in primary education. The 2011 EDHS provides information on the current region of residence and not on the region of residence at the time of primary education. The 2007 Census shows that only 17% of the population lives in a region different from the region of birth. Given the low regional mobility in Ethiopia, using the current region of residence to determine treatment status could be feasible. Nevertheless, we use the information on the duration in the current place of residence available in the 2005 wave of EDHS to check the sensitivity of the results.

In addition to estimating the effects of language of instruction on reading skills and labour market outcomes, the empirical analysis aims to identify some of the channels at work. The first potential channel linking mother tongue-based education and an improvement in outcomes is an increase in school enrollment. Providing education in mother tongue could make school more accessible, for instance, by increasing the willingness of parents to send their children to schools. To check whether school enrollment has increased among birth cohorts who gained access to mother tongue education after 1994, we define a binary outcome variable that takes one if an individual has spent at least a year in school and zero if the individual never went to school.

An increase in parental educational investment at home is the second potential channel that links mother tongue-based education and improvement in reading skills. When the language used at home and in school is the same and textbooks are provided in languages that the parents could also understand better, they could be more involved in their child's education. In the 2010 EGRA, pupils in grade two and three are asked whether or not and from whom they receive help with homework. Based on this information, we measure parental educational investment from a time investment perspective (whether or not the parents help with homework) and a financial perspective (whether or not a tutor is hired to help with homework). Descriptive statistics are shown on Appendix Table B.1.

5 Results

5.1 Mother tongue-based education and reading skills

Table 1 shows estimation results for the effects of mother tongue-based education on reading skills. Simple correlations are shown in column (1) whereas basic background controls and fixed effects for region of residence and year of birth are included in column (2). Separate estimates by gender are shown in column (3) and (4).

Table 1: Effects of mother tongue-based primary education on literacy skills

			Female	Male
	(1)	(2)	(3)	(4)
1 if Treated language	-0.333*** (0.031)	-0.215*** (0.026)	-0.300*** (0.036)	-0.166*** (0.032)
1 if Aged 0-14 in 1994	-0.009 (0.020)	0.055 (0.041)	0.268*** (0.083)	-0.070** (0.034)
Difference-in-Differences	0.131*** (0.036)	0.112*** (0.024)	0.103*** (0.031)	0.155*** (0.030)
1 if Female		-0.124*** (0.011)		
1 if Rural residence		-0.225*** (0.012)	-0.255*** (0.018)	-0.210*** (0.016)
1 if Not a Christian		-0.067*** (0.011)	-0.106*** (0.018)	-0.040*** (0.013)
Constant	0.856*** (0.017)	1.049*** (0.041)	0.875*** (0.085)	1.029*** (0.038)
Region fixed effects		✓	✓	✓
Birth cohort fixed effects		✓	✓	✓
R-squared	0.075	0.162	0.202	0.147
Sample	9,028	9,028	4,449	4,579

Source: Author's calculation based on EDHS 2011. Estimation: OLS. Dependent variable: A binary indicator for the ability to read. The treated languages are Afan Oromo and Tigrinya and control language is Amharic. The interaction between "Treated Language" and "Aged 0-14 in 1994" gives the difference-in-difference estimate. Standard errors, clustered at the region-birth year level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels.

Individual whose mother tongue is different from Amharic have lower reading skills compared to Amharic mother tongue users. The gap is twice as large among females than males. The difference-in-differences estimate that gives the effect of the reform on reading skills is shown by the interaction term between being aged 0-14 in 1994 and having a mother tongue other than Amharic. Accessing education in mother tongue for about eight years increases the probability of being able to read by 11 percentage points.^{11 12} As the result of the reform, the literacy gap between Amharic speakers

¹¹Logistic regression gives similar results which are shown on Appendix Table B.2.

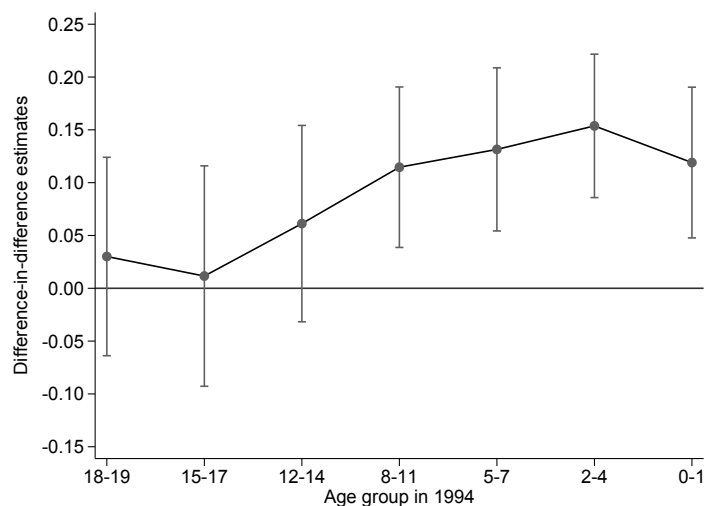
¹²Including the interaction between birth year and region in the regression equation to control for differential cohort-specific trends in educational expansion across regions gives a DID estimate of 0.144 (standard error: 0.035). The household level clustered standard errors lowers to 0.022.

and individuals whose mother tongue is different from Amharic halved from 22 to 11 percentage points. This implies that the language of learning and teaching in Ethiopia’s primary schools is one of the key determinants of reading ability and providing primary education in mother tongue reduces reading skills gap across language groups.¹³

Providing education in pupils’ mother tongue is hypothesized to improve the learning outcomes of girls more than boys. Girls in most developing countries are involved in housework compared to boys who spend more time outside the home environment. This lowers girls exposure to the dominant language spoken in the country. The results on Column (3) and (4) of Table 1 show that the penalty on reading skills of having a mother tongue other than Amharic is 13 percentage points higher for females than males. Due to the huge push made to reduce gender inequality in educational outcomes, the reading skills of females in general has improved over birth cohorts more than males. However, females have not benefited from the language reform more than males in terms gains in reading skills. The DID estimates seem larger for males than females but the difference across gender is not statistically significant. When comparing the reading skills gap among language groups between males and females, the estimates show that the reform almost eliminated the reading skills gap between Amharic and non-Amharic speaking males from 16.6 percentage points to 1.1 (= -0.166 + 0.155) percentage points. The reading skills gap between Amharic and non-Amharic speaking females reduced only by one third from 30 to 20 percentage points as a result of the reform.

Figure 4 shows estimation results by disaggregated age groups. For the sake of clarity, only the difference-in-differences estimates are reported.

Figure 4: Effect of mother tongue instruction on reading literacy across disaggregated age groups.



Source: Author’s illustration based on EDHS 2011

¹³The standard error of the DID estimate increases from 0.024 to 0.030 when clustering both at region and birth year level to account for within-region and within-year serial correlation (Bertrand et al., 2004; Cameron and Miller, 2015).

As expected, the difference-in-differences estimates increase when individuals' age at the time of the reform declines. This implies that the effect of the reform on reading skills is larger among individuals who potentially have full exposure to mother tongue-based primary education.

5.2 Robustness

Table 2 show results for various robustness checks. The first robustness check deals with similarity across languages. 65% of individuals in the treated language group are Afan Oromo mother tongue speakers. The Afan Oromo language differs substantially from Amharic. Afan Oromo language belongs to the Cushitic language family and uses the latin script. Amharic, on the other hand, belongs to the Semitic language family and uses an ancient writing system called Ge'ez (Ethiopic). The rest of the individuals in the treated language group use the Tigrinya language, a language that belongs to the same family and uses the same script as Amharic. In order to check whether or not Afan Oromo speakers benefited more than Tigrinya speakers, the treated language is restricted to Afan Oromo speakers in Column (1) and Tigrinya speakers in column (2) of Table 2. As expected, the substantial share of improvement in reading skills occurred among Afan Oromo speakers.¹⁴

Table 2: Robustness check using various specifications

	Background characteristics					
	Afan Oromo	Tigrinya	Literacy Program	Ethnicity	Household size and wealth	Household Fixed effects
1 if Treated Language	-0.241*** (0.027)	0.085* (0.043)	-0.212*** (0.026)	-0.219*** (0.027)	-0.211*** (0.026)	-0.238*** (0.051)
1 if Aged 0-14 in 1994	0.036 (0.044)	0.029 (0.094)	0.057 (0.041)	0.054 (0.041)	0.056 (0.042)	-0.083 (0.087)
Difference-in-Differences	0.131*** (0.027)	0.064* (0.036)	0.110*** (0.024)	0.113*** (0.024)	0.116*** (0.025)	0.159*** (0.040)
1 if Female	-0.130*** (0.012)	-0.076*** (0.011)	-0.124*** (0.011)	-0.113*** (0.024)	-0.126*** (0.012)	-0.137*** (0.016)
1 if Rural residence	-0.218*** (0.014)	-0.192*** (0.015)	-0.222*** (0.013)	-0.224*** (0.012)	-0.070*** (0.017)	-0.220*** (0.032)
1 if Not a Christian	-0.070*** (0.011)	-0.013 (0.012)	-0.062*** (0.011)	-0.070*** (0.011)	-0.071*** (0.010)	-0.101*** (0.028)
R-squared	0.181	0.089	0.163	0.162	0.182	0.145
Sample	7,732	6,552	9,021	9,028	9,028	4,579

Source: Author's calculation based on EDHS 2011. Estimation: OLS. Dependent variable: A binary indicator for the ability to read. The interaction between "Treated Language" and "Aged 0-14 in 1994" gives the difference-in-differences estimate. All regressions include controls for region of residence and birth year fixed effects. Additional control variables included are an indicator for attending literacy program outside formal education in Column (3), ethnicity in Column (4), household wealth and size in Column (5) and household fixed effects in Column (6). Standard errors, clustered at the region-birth year level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels.

¹⁴The differences across the two language groups are statistically different from each other at 13 significance level with an F statistic of 2.31.

The second robustness check deals with educational programs provided outside formal education that may confound the difference-in-differences estimates. The state and non-governmental organizations including churches or mosques provide basic literacy programs outside the formal education in order to improve literacy skills in Ethiopia. About 17% of individuals in the sample have attended literacy program outside of the formal primary education. Any similar change of the language used for instruction in such literacy programs could confound the difference-in-differences estimates. To account for this, in column (3), we included a binary indicator for attending a literacy program outside of formal primary education and the difference-in-differences estimate remain unchanged.¹⁵

Family background characteristics such as parental educational and occupational status could influence both schooling choices as well as educational outcomes. Regression results in column (4)-(6) take into account differences in socio-economic background characteristics using various approaches. In column (4), we control for ethnicity. In column (5), we include controls for household wealth index, which is constructed based on the household's ownership of assets and access to sanitation and other basic facilities, and household size whereas column (6) exploits the within household variation by including a household fixed effect. The end results show that systematic differences in socio-economic background characteristics barely changes the difference-in-differences estimate.

The main identifying assumption required for a difference-in-differences approach to give a consistent estimate is the parallel trend assumption. For the parallel trend assumption to be fulfilled, reading skills across the treated and the control language groups should follow a similar trend across birth cohorts in the absence of the language policy change. The parallel trend assumption cannot be tested directly. One way to check whether or not the parallel trend assumption is fulfilled is to see if there are any systematic differences in reading skills across language groups in the pre-reform period. This can be done by creating a placebo or psuedo treatment. Any systematic reading skills differences across the language groups in the pre-reform period would question the parallel trend assumption.

As a placebo treatment, individuals aged 26-35 in 1994 are assumed to gain access to mother-tongue based primary education. The reading skills of the placebo-treated birth cohort is compared with individuals aged 15-25 in 1994. The difference-in-differences estimation results are shown in Column (1) of Table 3. The estimate on the interaction term indicates that there is no systematic difference in reading skills across language groups in the pre-reform period.

¹⁵Reading skills are negatively correlated with attending literacy programs outside formal education (-0.036 with standard error of 0.014). This is far from being a causal relation because of negative selection bias (i.e., individuals who attended literacy programs likely have lower unobeservable attributes than individuals who never attended literacy programs). Restricting the sample to individuals who never attended literacy program outside of formal education gives a similar result. The estimated effect of the reform is 0.123 with standard error of 0.028.

Table 3: Accounting for possible threats to identification

	Placebo treatment	Schooled for less than seven years	Regional mobility
	(1)	(2)	(3)
1 if Treated language	-0.196*** (0.031)	-0.145*** (0.047)	-0.175*** (0.035)
1 if Treated birth cohort	0.017 (0.059)	0.073 (0.078)	0.015 (0.062)
Difference-in-Differences	0.016 (0.037)	0.085** (0.042)	0.090*** (0.031)
1 if Female	-0.171*** (0.018)	-0.178*** (0.020)	-0.118*** (0.015)
1 if Rural residence	-0.287*** (0.025)	-0.097*** (0.025)	-0.257*** (0.021)
1 if Not a Christian	-0.098*** (0.022)	-0.004 (0.019)	-0.063*** (0.020)
Constant	1.112*** (0.049)	0.809*** (0.077)	1.093*** (0.057)
R-squared	0.263	0.108	0.210
Sample	2,746	3,833	3,454

Source: Author's calculation based on EDHS 2011 in column (1) and (2) and EDHS 2005 in column (3). Estimation sample restricted to individuals who were schooled for maximum of six years in Column (2) and individuals who lived in the same area since birth in Column (3). See note under Table 1.

The 1994 education reform in Ethiopia is a package of reforms as discussed in Section 2. Any other policy change that influences the educational outcomes of individuals in the treated and the control language group differently would confound the difference-in-differences estimates. One such reform is the elimination of the central school exit examination that students were required to pass at the end of grade six. The central examination abolition increases the educational attainment (and possibly reading skills) of everyone irrespective of mother tongue. Since the examination used to be administered in Amharic, its abolition automatically increases the educational attainment of non-Amharic mother tongue users more than their Amharic counterparts. This makes it difficult to disentangle the effects of the two reforms on years of completed education.¹⁶

To identify the sole effect of the language of instruction reform on reading skills, we restrict the estimation sample to individuals whose educational attainment is not affected by the national examination abolition. These are individuals whose maximum years of education is six years and they make up about 55 percent of the total estimation sample. Results are displayed on Column (2) of Table 3. The difference-in-differences estimate reduces in size but does not become insignificant both economically and statistically. The estimate is lower partly because controlling for educational attainment partials out the effect of the language reform on reading skills.

Another factor that could threaten identification is non-random regional mobility in response to

¹⁶This issue not discussed in Ramachandran (2012). In fact, the 12 percent increase in percentage of individuals completing 6 years or more of schooling that the author finds could be partly due to the central examination abolition.

the policy change. Non-random regional mobility could occur if, for instance, parents who value education move to a different region so that their children could access education in mother tongue while at the same time putting extra investment in their children's education. Ideally, one would need data on the region that the individuals undertook primary education. Due to lack of data in the EDHS 2011, the current region of residence is assumed to be the same region that individuals finished primary education. This is not a strong assumption given that about 70% of individuals live in the same area where they were born according to data from the previous wave of the EDHS. We use the regional information available in the EDHS 2005 to check the sensitivity of the results. Column (3) of Table 3 show results using EDHS 2005 after restricting the estimation sample to individuals who have been living in the same region since birth. The DID estimate show that the reading skills of those affected by the reform has increased by about 9 percentage points which is very close to the 11 percentage points found in the main specification implying that regional mobility does not significantly alter the main results.

5.3 Channels of influence

Improving the accessibility of schools could be one of the mechanisms through which mother tongue instruction improves reading skills. We estimate equation 1 using school enrollment as the outcome variable to check whether there is a positive relationship between access to mother tongue-based education and school enrollment. School enrollment is a binary variable which is one if individuals ever attended formal education and zero otherwise. Table 4 shows the results.

Table 4: Mother tongue education and school enrollment

	(1)	(2)	Female (3)	Male (4)
1 if Treated language	-0.198*** (0.049)	-0.164*** (0.022)	-0.283*** (0.028)	-0.032 (0.031)
1 if Aged 0-14 in 1994	0.134** (0.057)	0.324*** (0.047)	0.428*** (0.060)	0.208*** (0.060)
Difference-in-Differences	0.100*** (0.061)	0.094*** (0.022)	0.149*** (0.028)	0.052* (0.029)
1 if Female		-0.201*** (0.011)		
1 if Rural residence		-0.312*** (0.012)	-0.326*** (0.015)	-0.293*** (0.016)
1 if Not a Christian		-0.071*** (0.011)	-0.101*** (0.014)	-0.033** (0.014)
Constant	0.599*** (0.049)	0.950*** (0.044)	0.798*** (0.052)	0.870*** (0.059)
Region and birth cohort fixed effects		✓	✓	✓
R-squared	0.050	0.313	0.355	0.223
Sample	14,206	14,206	7,976	6,230

Source: Author's calculation based on EDHS 2011. Dependent variable: A binary indicator for ever been enrolled in school. See note under Table 1.

School enrollment is on average lower among non-Amharic mother tongue users compared to Amharic mother tongue users. The negative correlation between non-Amharic mother tongue users and school enrollment is observed only among females. The enrollment rate of the young birth cohorts (those aged 0-14 in 1994) has improved substantially compare to the old birth cohorts. The improvement in enrollment among females is twice as large as for males. The difference-in-differences estimates show that school enrollment among birth cohorts that gained access to mother tongue-based education after 1994 increased by about 10%. In terms of school enrollment, the language reform was thus of greatest benefit for non-Amharic speaking women.

A further positive side effect of the reform could be that parents enhance their investment at home when the language used at home and in school is the same and textbooks are provided in languages that parents could understand better. The EGRA allows measuring parental educational investment at home with respect to helping with homework from two perspectives: time investment and financial investment. Table 5 shows the results.

Table 5: Mother tongue education and parental educational investment at home

	Who helps with home work?					
	Somebody		Father		Tutor	
	(1)	(2)	(3)	(4)	(5)	(6)
1 if Child is in MT school	0.131*** (0.036)	0.045** (0.022)	0.043*** (0.015)	0.040** (0.017)	0.012** (0.005)	0.015*** (0.004)
Child's age		-0.019*** (0.003)		-0.007*** (0.002)		-0.000 (0.001)
1 if Child is female		-0.016 (0.010)		-0.005 (0.008)		-0.007* (0.004)
1 if Child is in grade 3		0.020* (0.011)		0.025*** (0.008)		-0.005 (0.006)
1 if Child attended KG		0.023* (0.014)		0.017 (0.012)		-0.006 (0.005)
1 if Father is literate		0.076*** (0.015)		0.110*** (0.013)		-0.014** (0.006)
1 if Mother is literate		0.047*** (0.014)		0.007 (0.011)		-0.005 (0.004)
Socio-economic status score		0.067*** (0.008)		0.019** (0.009)		0.010** (0.004)
Constant	0.585*** (0.038)	0.739*** (0.048)	0.096*** (0.014)	0.043 (0.030)	0.006** (0.003)	0.031 (0.020)
School fixed effects		✓		✓		✓
Mean [sd] of dependent variable	0.700 [0.458]		0.134 [0.341]		0.016 [0.127]	
R-squared	0.009	0.037	0.002	0.031	0.001	0.007
Sample	7,915	7,913	7,915	7,913	7,915	7,913

Source: Author's calculation based on Early Grade Reading Assessment (EGRA) 2010. Estimation: OLS. Standard errors, clustered at the school level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels. MT stands for mother tongue.

The dependent variable in columns (1) & (2) is one if the child receives help with homework from somebody in the household and zero if nobody helps the child with homework. The dependent variable in columns (3) & (4) is one if the child's father helps with homework and zero if otherwise. The dependent variable in columns (5) & (6) takes the value one if a tutor is hired to help the child with homework and zero if otherwise. The main explanatory variable of interest is whether a child goes to a school where instruction is provided in his/her mother tongue. Simple correlations are shown in the first column for each outcome variable whereas child level, family background characteristics and school fixed effects are included in the rest of the columns.

The results show that parental educational investment at home is positively associated with the use of mother tongue in primary schools. Parents increase their educational investment at home either directly by providing support to their child with homework or indirectly by hiring a tutor to provide help with homework. The probability that a child receives help with homework increases by about 1.5% to 4.5% if the child uses the same language at home and in school.

5.4 Early labour market outcomes

Human capital is one of the main determinants of labour market outcomes. The improved reading skills that resulted from the introduction of mother tongue-based primary education could ultimately lead to better labour market outcomes. This section examines the labour market returns to mother tongue-based education by estimating the reduced-form effects of the reform on early labour market outcomes.¹⁷ Labour market outcomes are measured using three variables: employment status, occupation and earning type.

Results are shown in Table 6. The outcome measure in column (1)-(2) is whether the respondent is employed or not. Individuals whose mother tongue is different from Amharic have a lower probability to become employed compared to Amharic mother tongue users. The young birth cohorts also have a lower probability to be employed mainly because they have less work experience compared to the older birth cohorts. The interaction term shows that there is a very small positive correlation between the reform and the probability to be employed. The finding that the reform has a negligible influence on the probability of finding a job allows me to look at the quality of job's held by restricting the estimation sample to individuals who are employed, without compromising the sample composition.

¹⁷It is called "early" because the birth cohort that gained access to primary education in mother tongue is between the age of 16 and 30 at the time where labour market outcome measures are collected. The average age of the treated birth cohort is about 22 and the average individual in the control birth cohort is about 36 years old.

Table 6: Labour market outcomes: Employment status, occupation and earnings

	Employed			Skilled worker - Manual/Agriculture		Skilled worker - Sales		Skilled worker - Professional/technical/managerial		Receives earnings in cash	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
1 if Treated language	-0.074*** (0.023)	-0.082*** (0.023)	0.358*** (0.060)	0.369*** (0.063)	0.565*** (0.119)	0.622*** (0.135)	0.499*** (0.111)	0.563** (0.152)	-0.142*** (0.026)	-0.128*** (0.025)	
1 if Aged 0-14 in 1994	-0.303*** (0.056)	-0.304*** (0.056)	0.329*** (0.106)	0.337*** (0.115)	0.315*** (0.082)	0.326*** (0.088)	0.090*** (0.053)	0.252** (0.173)	-0.130*** (0.046)	-0.112*** (0.043)	
Difference-in-Differences	0.034 (0.022)	0.041* (0.022)	1.687*** (0.268)	1.651*** (0.263)	1.732*** (0.334)	1.642** (0.324)	1.418 (0.305)	1.318 (0.327)	0.072*** (0.022)	0.065*** (0.021)	
1 if Female	-0.288*** (0.010)	-0.289*** (0.010)	0.588*** (0.073)	0.616*** (0.075)	3.994*** (0.406)	4.178*** (0.421)	1.619*** (0.156)	2.459*** (0.286)	0.034** (0.014)	0.040*** (0.014)	
1 if Rural residence	0.094*** (0.015)	0.081*** (0.015)	0.208*** (0.023)	0.240*** (0.026)	0.288*** (0.036)	0.328*** (0.044)	0.145*** (0.020)	0.446*** (0.066)	-0.444*** (0.017)	-0.382*** (0.017)	
1 if Not a Christian	-0.044*** (0.012)	-0.048*** (0.012)	1.168 (0.122)	1.246** (0.132)	2.001*** (0.229)	2.121*** (0.247)	0.785** (0.088)	1.317*** (0.198)	-0.019 (0.013)	0.002 (0.014)	
1 if Secondary education	-0.066*** (0.015)	-0.066*** (0.015)	1.480*** (0.138)	1.480*** (0.138)	1.714*** (0.181)	1.714*** (0.181)	9.434*** (1.505)	9.434*** (1.505)	0.095*** (0.017)	0.095*** (0.017)	
1 if Higher education	-0.005*** (0.020)	-0.005*** (0.020)	2.078*** (0.257)	2.078*** (0.257)	1.714*** (0.181)	1.714*** (0.181)	111.515*** (21.423)	111.515*** (21.423)	0.237*** (0.022)	0.237*** (0.022)	
Constant	1.127*** (0.042)	1.148*** (0.045)	1.658*** (0.469)	1.376 (0.421)	0.430*** (0.120)	0.323*** (0.098)	0.403** (0.163)	0.026*** (0.013)	0.699*** (0.046)	0.613*** (0.044)	
Region fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Birth cohort fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Model	OLS	OLS	Multinomial logit				OLS	OLS	OLS	OLS	OLS
Sample	9,028	9,028	6,767				6,767	6,767	6,767	6,767	6,767

Source: Author's calculation based on EDHS 2011. Estimation: OLS in Columns (1-2) and Columns (9-10). Multinomial logit in Columns (3-8). The base categories are "not employed" in Column (1-2), "unskilled manual/agriculture/service worker" in Columns (3-8) and "receiving payment in kind/in cash and in kind/nothing" in Columns (9-10). Relative risk ratios are reported in the multinomial logit regression. The treated languages are Afan Oromo and Tigrinya and control language is Amharic. The interaction between "Treated Language" and "Aged 0-14 in 1994" gives the difference-in-difference estimate. Standard errors, clustered at the region-birth year level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels.

Based on the sample of employed workers, Column (3)-(8) show results from a multinomial regression where occupations are categorized into four groups based on their skill content (unskilled jobs, skilled manual or agricultural jobs, skilled sales jobs and professional jobs). Results show that individuals whose mother tongue is different from Amharic and the youth are less likely to hold skilled jobs in general. However, the difference-in-differences estimate show that the skill content of jobs held by those affected by the reform has improved significantly. In addition, Column (5) show that non-Amharic mother tongue speakers affected by the reform are more likely to receive their earnings in cash as opposed to informal means of payments such as cash and in kind, in kind only or receiving any payments for their work. A robustness check on Appendix Table B.3 shows stronger effects on the labour market outcomes of individuals whose mother tongue is Afan Oromo. This result complements the finding on Table 2 that the reform improved the reading skills of Afan Oromo speakers substantially.

The main arguments put against mother tongue-based education is that it could limit employment and other economic opportunities in the labour market. It does so by reducing proficiency skill in the language that dominates the labour market. The findings of this paper are against this criticism. The use of mother tongues as medium of instruction in Ethiopia’s primary schools has led to improved labour market outcomes in terms of the skill contents of jobs held and the type of payment an individual receives for his/her work. The positive returns on the labour market occurred because the improved reading skills provided better employment opportunities in the formal labour market or it led to better educational attainments and general human capital development which are in turn positively rewarded in the labour market.

6 Conclusions

The change in the language of instruction in Ethiopia’s primary schools provides a “natural experiment” to examine the relationship between language of instruction, literacy skill and labour market outcomes. The difference-in-differences estimates show that birth cohorts that gained access to mother tongue-based primary education after 1994 have significantly better reading skills as adults. The reform was thus effective in improving long-term literacy skills. The results are found to be robust to various sensitivity checks such as controlling for family background characteristics and regional mobility among others, and a placebo-treatment test.

Heterogeneous analysis reveals that the reform has not improved the reading skills of females more than males. This is in contrast to the belief that mother tongue education benefits girls more than boys since girls are involved in housework and hence have lower exposure to the dominant language spoken in the country. A substantial increase in school enrollment, especially among females, and in

parental educational investment outside schools are identified as some of the channels of influence. Moreover, the improved human capital as a result of being taught in mother tongue do translate into gains in the labour market. Non-Amharic mother tongue speakers affected by the reform are more likely to work as skilled workers and to receive their earnings in cash as opposed to informal means of payments.

The results have important implication for the status of educational and economic inequality across groups in Ethiopia as well as for the potential role that mother-tongue education policy plays in reducing inequality across groups in other countries. The findings show that changing the language of learning and teaching from Amharic to mother tongue-based has reduced inequality across ethno-linguistic groups in Ethiopia. Furthermore, parents are engaged more in their child's education outside school when education is provided in mother tongue thereby potentially improving inter-generational mobility. Mother tongue-based education policy, therefore, could play a key role in reducing inequality across groups divided based on language in other countries. Language related inequality could exist as a result of colonization in African countries and migration in Western countries.

Further research is required in the following area. The increased enrollment rate among non-Amharic speaking females has not translated into an improvement in their reading skills compared to their Amharic speaking as well as their male counterparts. Further investigation is required to identify the reasons why the gap in reading skills remain high between Amharic speaking and non-Amharic speaking females. Furthermore, the consequence of providing formal education in mother tongue on regional mobility and the efficient allocation of skill in labour markets across regions is open for further research.

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B Appendix

Table B.1: Summary statistics

	Overall	Amharic language		Non-Amharic language	
		Pre-1994	Post-1994	Pre-1994	Post-1994
	(1)	(2)	(3)	(4)	(5)
1 if able to read	0.733 (0.443)	0.856 (0.351)	0.847 (0.360)	0.523 (0.500)	0.645 (0.479)
1 if employed	0.736 (0.441)	0.849 (0.359)	0.696 (0.460)	0.909 (0.288)	0.739 (0.440)
Occupation					
1 if unskilled worker	0.565 (0.496)	0.345 (0.476)	0.485 (0.500)	0.675 (0.469)	0.691 (0.462)
1 if skilled manual/agricultural worker	0.159 (0.366)	0.244 (0.429)	0.175 (0.380)	0.120 (0.325)	0.111 (0.314)
1 if skilled sales worker	0.131 (0.337)	0.166 (0.372)	0.123 (0.329)	0.119 (0.325)	0.122 (0.328)
1 if professional worker	0.145 (0.352)	0.246 (0.431)	0.218 (0.413)	0.087 (0.281)	0.076 (0.265)
1 if receives earnings in cash only	0.506 (0.500)	0.764 (0.425)	0.638 (0.481)	0.332 (0.471)	0.312 (0.464)
Background Characteristics					
1 if female	0.492 (0.470)	0.481 (0.500)	0.545 (0.498)	0.316 (0.465)	0.474 (0.499)
1 if rural resident	0.470 (0.499)	0.206 (0.404)	0.303 (0.459)	0.727 (0.446)	0.738 (0.440)
1 if not a Christian	0.301 (0.459)	0.184 (0.387)	0.210 (0.407)	0.457 (0.499)	0.432 (0.495)
Household Wealth Index					
1 if poorest quantile	0.072 (0.259)	0.033 (0.179)	0.050 (0.218)	0.109 (0.311)	0.109 (0.312)
1 if poorer quantile	0.097 (0.103)	0.044 (0.205)	0.064 (0.245)	0.136 (0.343)	0.154 (0.361)
1 if middle quantile	0.103 (0.304)	0.036 (0.187)	0.071 (0.258)	0.155 (0.362)	0.158 (0.365)
1 if richer quantile	0.151 (0.359)	0.066 (0.249)	0.089 (0.284)	0.255 (0.436)	0.244 (0.430)
1 if richest quantile	0.576 (0.494)	0.820 (0.384)	0.726 (0.446)	0.345 (0.476)	0.335 (0.472)
Household size	4.887 (2.150)	4.430 (2.019)	4.631 (2.169)	5.645 (1.853)	5.220 (2.150)
Observations	9,028	1,236	4,020	792	2,980
Employed sample	6,767	1,049	2,797	720	2,221

Source: Author's calculation based on EDHS 2011. Standard deviation are in parentheses.

Table B.2: Results from a logistic regression

			Female	Male
	(1)	(2)	(3)	(4)
1 if Treated language	-0.291*** (0.028)	-0.166*** (0.023)	-0.223*** (0.030)	-0.127*** (0.031)
1 if Aged 0-14 in 1994	-0.012 (0.027)	0.056 (0.040)	0.248*** (0.064)	-0.076* (0.040)
Difference-in-Differences	0.099*** (0.034)	0.082*** (0.023)	0.069** (0.029)	0.119*** (0.031)
1 if Female		-0.126*** (0.012)		
1 if Rural residence		-0.204*** (0.012)	-0.220*** (0.016)	-0.208*** (0.018)
1 if Not a Christian		-0.062*** (0.009)	-0.093*** (0.014)	-0.039*** (0.012)
Constant	1.782*** (0.141)	2.931*** (0.260)	1.720*** (0.436)	3.062*** (0.288)
Region fixed effects		√	√	√
Birth cohort fixed effects		√	√	√
Pseudo R-squared	0.065	0.151	0.174	0.152
Sample	9,028	9,028	4,449	4,579

Source: Author's calculation based on EDHS 2011. Estimation: Logit model. Marginal effects are reported. Dependent variable: A binary indicator for the ability to read. The treated languages are Afan Oromo and Tigrinya and control language is Amharic. The interaction between "Treated Language" and "Aged 0-14 in 1994" gives the difference-in-difference estimate. Standard errors, clustered at the region-birth year level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels.

Table B.3: Labour market outcomes: Afan Oromo as the treated language

	Employed			Skilled worker - Manual/Agriculture		Skilled worker - Sales		Skilled worker - Professional/technical/managerial		Receives earnings in cash	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
1 if Treated language	-0.075*** (0.027)	-0.082*** (0.028)	0.307*** (0.059)	0.308*** (0.060)	0.593*** (0.149)	0.634* (0.167)	0.540** (0.152)	0.574 (0.207)	-0.111*** (0.030)	-0.104*** (0.025)	
1 if Aged 0-14 in 1994	-0.285*** (0.068)	-0.287*** (0.069)	0.182*** (0.062)	0.177*** (0.061)	0.332*** (0.125)	0.331*** (0.127)	0.066*** (0.052)	0.167** (0.150)	-0.104** (0.049)	-0.095* (0.049)	
Difference-in-Differences	0.027 (0.029)	0.031 (0.029)	1.915*** (0.387)	1.952*** (0.389)	1.881** (0.500)	1.853** (0.499)	1.449 (0.427)	1.465 (0.543)	0.059** (0.026)	0.065** (0.025)	
1 if Female	-0.319*** (0.013)	-0.322*** (0.014)	0.791 (0.129)	0.795 (0.129)	5.600*** (0.703)	5.663*** (0.712)	1.855*** (0.266)	2.910*** (0.473)	0.097** (0.017)	0.102*** (0.016)	
1 if Rural residence	0.059*** (0.019)	0.039 (0.019)	0.231*** (0.033)	0.249*** (0.037)	0.322*** (0.058)	0.340*** (0.065)	0.123*** (0.019)	0.432*** (0.083)	-0.479*** (0.022)	-0.422*** (0.022)	
1 if Not a Christian	-0.026* (0.015)	-0.033*** (0.015)	1.273** (0.154)	1.327** (0.162)	1.774*** (0.252)	1.830*** (0.269)	0.764* (0.108)	1.244 (0.252)	-0.010 (0.016)	0.006 (0.016)	
1 if Secondary education	-0.069*** (0.021)	-0.069*** (0.021)	-0.069*** (0.021)	1.249* (0.169)	1.402** (0.220)	1.402** (0.220)	1.402** (0.220)	11.347*** (2.908)	0.061*** (0.023)	0.061*** (0.023)	
1 if Higher education	-0.047 (0.030)	-0.047 (0.030)	-0.047 (0.030)	1.647*** (0.303)	1.357 (0.313)	1.357 (0.313)	1.357 (0.313)	156.545*** (42.050)	0.242*** (0.028)	0.242*** (0.028)	
Constant	1.050*** (0.046)	1.078*** (0.045)	1.013 (0.247)	0.949 (0.243)	0.258*** (0.095)	0.238*** (0.092)	0.519** (0.137)	0.029*** (0.010)	0.675*** (0.046)	0.605*** (0.046)	
Region fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Birth cohort fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Model	OLS	OLS	Multinomial logit	Multinomial logit	Multinomial logit	Multinomial logit	Multinomial logit	Multinomial logit	OLS	OLS	
Sample	5,043	5,043	3,712	3,712	3,712	3,712	3,712	3,712	3,712	3,712	

Source: Author's calculation based on EDHS 2011. Estimation: OLS in Columns (1-2) and Columns (9-10). Multinomial logit in Columns (3-8). The base categories are "not employed" in Column (1-2), "unskilled manual/agriculture/service worker" in Columns (3-8) and "receiving payment in kind/in cash and in kind/nothing" in Columns (9-10). Relative risk ratios are reported in the multinomial logit regression. The treated language is Afan Oromo and control language is Amharic. The interaction between "Treated Language" and "Aged 0-14 in 1994" gives the difference-in-difference estimate. Standard errors, clustered at the region-birth year level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels.