Regional inequality of economic outcomes and opportunities in Ethiopia

A tale of two periods

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Abstract: This paper provides an informative picture of the extent of regional inequality of economic outcomes and opportunities in the pre-and post-reform Ethiopia. We start by presenting evidence that regional inequality in educational attainment, formal employment, and access to safe water and sanitation facilities declined substantially between the mid-1990s and late 2000s. When we measure regional inequality of opportunities using the intergenerational persistence of educational attainment, we find a moderate increase in intergenerational mobility at the national level and a declining gap across regions. Given the regional concentration of ethnic and language groups in Ethiopia, further reducing the unequal distribution of economic outcomes and opportunities across regions have important implications for the political stability and economic development of the country.

Tables and figures: all author's own.

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1 Introduction

A substantial focus has been given to identifying the causes and consequences of rising income inequality in most developed and developing countries (Acemoglu and Autor, 2011; Dabla-Norris et al., 2015; Alvaredo and Gasparini, 2015). A relatively smaller, but growing part of the literature addresses different dimensions of inequality including horizontal inequality (e.g. Stewart et al., 2005) and intergenerational mobility (see Solon, 1999; Black and Devereux, 2011, for review). Inequality across culturally defined groups in a society, i.e. horizontal inequality, triggers civil conflict (Østby, 2008; Østby et al., 2009; Cederman et al., 2011) and is related to under-development (Alesina et al., 2016). Similarly, strong intergenerational linkage, i.e. low intergenerational mobility, implies an uneven distribution of opportunities and has consequences on the persistence of inequality (Corak, 2013; Lambert et al., 2014).

This paper examines regional inequality in economic outcomes and opportunities in the context of a developing country, Ethiopia. Ethiopia is an interesting case to study because with GDP (Gross Domestic Product) growing at 10.5 per cent per year since 2005, the country is one of the fastest growing economies in the world (Seid et al., 2015) and targets to become a low middle-income country by 2025 (MoFED, 2015). Ethiopia has also managed to keep income inequality at a relatively lower level since the early 1990s. With a Gini coefficient of 0.30 in 2011, it is one the least unequal nations in the world (MoFED, 2013; World Bank Group, 2015). Despite the remarkable economic growth and the stability of income inequality, the country is one of the poorest nations in the world. Around 31 per cent of the population lives below the international poverty line of 1.25 PPP a day (World Bank Group, 2015). Since the early 1990s, the country has undergone through various policy reforms which aimed, among other goals, to reduce inequality across regions bordered along ethno-linguistic lines (MoE, 1994; MoH, 1998; MoFED, 2002). However, despite efforts, substantial inequality across regions and ethno-linguistic groups remains (Kedir, 2014; Tesfay and Malmberg, 2014; fhi360 EPDC, 2015). The main goal of this paper is, therefore, to examine the distribution of economic outcomes and opportunities across regions in the pre- and post-reform periods.

How regional difference in economic outcomes and opportunities has evolved since the mid 1990s? Do regions with low economic outcomes also have low intergenerational mobility? These are some of the questions we address in this paper. As to the author's knowledge, this is the first paper to study regional inequality of opportunities in Ethiopia and is among the scarce evidence on regional inequality of economic outcomes available for the country. The only study known to the author on intergenerational mobility in Ethiopia is Hertz et al. (2007)[1]. Hertz et al. (2007) measure and compare intergenerational mobility in educational attainment for a sample of 42 countries. The

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[1] The available evidence focuses on identifying the structural parameters in children's human capital equation (e.g. Kebede, 2005; Argaw, 2010).

authors use the Ethiopian Rural Household Survey from 1994 and rely on different age cohorts to examine the trend in intergenerational educational mobility. Our study, on the other hand, analyses the trend in intergenerational mobility in educational attainment by comparing similar age cohorts in 1994 and 2007 for the country as a whole and disaggregated by regional states.

We start by providing evidence on the ethno-linguistic diversity of the regions in Ethiopia based on data from the 1994 and 2007 censuses. We show that regional boundaries in Ethiopia represent more than just geographical demarcation. Instead, regional states are proxies for ethno-linguistic identity. Using various measures of ethnic diversity, such as polarization and cross-cuttingness, we find a clear regional concentration of ethnic and language groups with negligible change between 1994 and 2007. In line with the previous evidence, we do find a decline in economic inequality across regional states. The Gini-coefficient declined between 19 to 56 percentage points between 1994 and 2007 for educational attainment, household asset and access to safe drinking water and sanitation facilities. However, there still exists a substantial gap in economic outcomes between the regional states. The dominantly pastoral regions of the country (Affar and Somali) have the lowest economic outcomes and experienced the least change between 1994 and 2007, especially in educational attainment. We also find that regional inequality is higher among rural residents compared to their urban counterparts and among females compared to males. On the positive side, the largest decline in regional economic inequality is observed in rural areas and among females.

When individuals' economic outcomes are strongly related to those of their parents, it implies an unequal distribution of opportunities and with consequences on the persistence of inequality. When we examine the trend in intergenerational educational mobility at the national level and the differences across regions, our results show a modest increase in intergenerational educational mobility in the post-reform period. The intergenerational correlation in education declined from 0.46 in 1994 to 0.42 in 2007. Furthermore, when we take into account region of residence in the regression, the intergenerational correlation reduces by 35 per cent in 1994 and by 30 per cent in 2007. This implies that region of residence has a relatively larger influence on intergenerational persistence in the pre-reform period than in the post-reform period. The capital city, Addis Ababa, has the highest educational mobility with no significant change over the years. Similar to our results on regional inequality in economic outcomes, the predominantly pastoral regions of the country not only have the lowest intergenerational educational mobility but also show a declining trend in the post-reform period.

The rest of the paper is structured as follows. Section 2 provides background information about Ethiopia and its ethnic diversity. In Section 3, we describe the data and the methods we use to measure regional inequality of economic outcomes and opportunities. Results are presented and discussed in Section 4 whereas we provide concluding remarks in Section 5.

2 Background

Ethiopia is the second most populous nation in Africa and home to more than 80 ethnic groups. For most of Ethiopian history, the Amhara ethnic group, and hence the Amharic language, and the Ethiopian Orthodox church have dominated and defined the political, social and cultural affairs of the country (Gudina, 2007). Until the downfall of the Marxist Derge regime (1974-1991) in the early 1990s, ethnic groups other than Amharas and Tigrayans were not given recognition and hence socio-economic inequality along ethno-linguistic lines were prevalent (Menigisteab, 1997; Aalen, 2002). The topic of ethnicity, and hence the language and identity of other ethnic groups, was very much suppressed in the political and social discourses during the Monarch system (until 1974) and the Derge regime (Menigisteab, 1997). This was completely changed in 1991 after the Derge regime was overthrown by the guerrilla movement composed of multi-ethnic political groups[2]. The Transitional Government of Ethiopia (TGE) and later the current ruling party, the Ethiopian People's Revolutionary Democratic Front (EPRDF), made ethnicity the ideological basis of its political organization through ethnic-based federalism.

The organization of major administrative units have changed under the different political systems. Prior to 1994, the country was divided into 13 provinces which were further subdivided into districts (*awrajjas*). During the constitutional assembly in 1994, regional borders were reorganized along ethno-linguistic lines. Currently, there are nine ethnic-based regional states (*kililoch*), which are subdivided into zones, and two chartered cities. Prior to 1994, most political, administrative and economic decisions were centralized. Under the New Constitution of the country, which was ratified in 1994 and adopted in 1995, each nation and nationality was given the right to self-determination and political, administrative and economic powers were dissolved to regional states.

Various studies address the challenges of ethnic-federalism and question the autonomy of regional states within the dominant party system that exists in Ethiopia (e.g. Menigisteab, 1997; Aalen, 2002; Samatar, 2004; Gudina, 2007; Aalen, 2011; Kefale, 2013). The large scale conflicts between the central government and etic based liberation fronts that were prevalent in the previous periods is now replaced with conflicts at the local level (Aalen, 2011). A growing number of ethnic groups within regions are demanding to have their own administration units and/or to have more regional power. For instance, the Silte ethnic group was separated from the rest of the Gurage ethnic group in 2001 (Smith, 2007) whereas the Sidama and Wolayta ethnic groups compete for power in the multi-ethnic region of the Southern Nations, Nationalities, and Peoples' Region (SNNPR) (Aalen, 2011).

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[2] The Tigrayans, Eritreans and Oromos were respectively represented by the Tigrayan People Liberation Front (TPLF), the Eritrean People Liberation Front (EPLF) and the Oromo Liberation Front (OLF).

The current regions of Ethiopia are depicted on Figure 1.
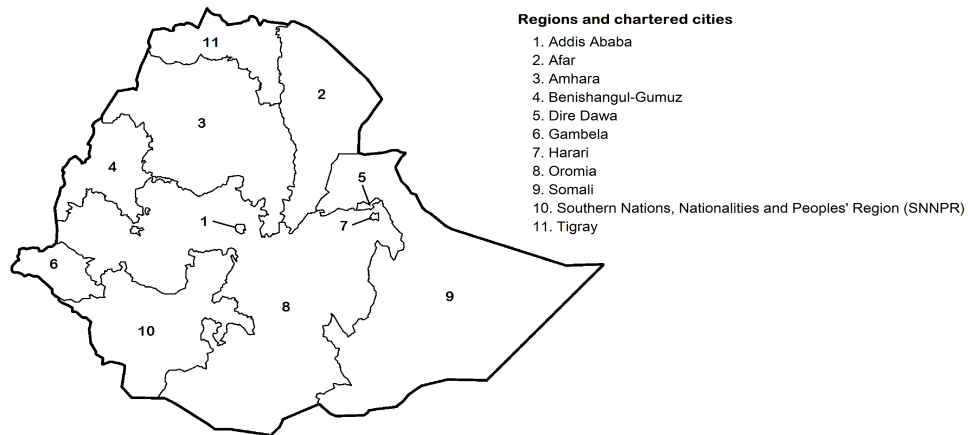
Figure 1: Administrative Map of Ethiopia

Source: Map of Ethiopia from commons.wikimedia.org "Ethiopia regions blank.png" accessed on 10/06/2015.

Table 1: Distribution of ethnic groups across regions

	Country	Ethnic groups						
		Oromo	Amhara	Somali	Tigre	Sidama	Welaita	Others
1994								
Addis Ababa	3.85	19.60	48.65	0.14	7.70	0.06	0.49	23.36
Afar	2.19	0.95	4.55	0.08	0.89	-	0.38	93.15
Amhara	25.94	2.92	91.24	-	0.32	-	-	5.51
Ben-Gumuz[1]	0.86	12.97	21.96	-	0.97	0.01	0.08	64.01
Dire Dawa	0.46	48.66	27.55	14.09	1.51	0.01	0.12	8.06
Gambela	0.30	6.53	7.26	0.01	1.57	0.04	0.17	84.43
Harari	0.25	52.16	33.08	1.56	1.64	0.05	0.01	11.50
Oromia	34.57	85.14	9.13	0.52	0.35	0.10	0.23	4.52
Somali	6.33	2.67	0.76	94.60	0.03	0.04	0.01	1.90
SNNPR[2]	19.51	1.94	3.03	-	0.15	17.51	11.66	65.70
Tigray	5.75	0.14	2.59	-	94.78	-	-	2.49
Country		32.01	30.00	6.25	6.03	3.46	2.38	19.87
2007								
Addis Ababa	3.77	20.09	48.11	0.13	6.34	0.11	0.67	24.56
Afar	1.88	0.68	5.71	0.04	0.98	0.01	0.60	91.99
Amhara	23.53	2.68	91.24	0.03	0.22	-	-	5.83
Ben-Gum[1]	1.08	12.45	23.02	0.01	0.90	0.04	0.04	63.55
Dire Dawa	0.47	47.12	23.31	19.03	1.43	-	0.16	8.96
Gambela	0.44	5.53	8.95	0.02	1.61	0.62	0.70	82.57
Harari	0.25	56.58	23.21	3.73	2.38	-	0.15	13.94
Oromia	36.47	87.27	7.57	0.32	0.23	0.18	0.25	4.17
Somali	6.05	0.46	0.80	96.98	0.03	-	0.01	1.72
SNNPR[2]	20.21	1.53	2.76	0.01	0.12	19.28	10.61	65.69
Tigray	5.85	0.16	1.56	0.03	96.80	-	-	1.45
Country		34.10	27.30	6.10	6.11	3.97	2.28	20.14

Note: Own calculation based on census 1994 and 2007.
[1] stands for Benishangul-Gumuz region
[2] stands for Southern Nations, Nationalities, and Peoples' Region.

Table 1 shows regional population share and the distribution of ethnic groups across regions. About 60 per cent of the Ethiopian population lives in Oromia and Amhara regions. More than 85 per cent of the population living in these two regions belong to the Oromo and Amhara ethnic groups respectively. The other regions that are ethnically homogeneous are Tigray, Somali and Afar which together make up 14 per cent of the population. The third largest and the most diverse region is SNNPR. It is home to 20 per cent of the population and to more than 45 ethnic groups. Harari and Benshangul Gumuz regions and the two chartered cities (Dire Dawa and Addis Ababa) have a relatively diverse ethnic composition and together make up only 6 per cent of the population[3].

As a further evidence for the proximity between region, ethnicity and language groups in Ethiopia, we measure the ethnic diversity of the Ethiopian population using statistical-based approaches. We start with the most commonly used measures of diversity: Fractionalization (Taylor and Hudson, 1972) and Polarization (Montalvo and Reynal-Querol, 2005). Fractionalization is 'the probability that two randomly selected individuals do not belong to the same group' whereas polarization measures 'the degree that a country is divided into two equally-sized sub-groups' (Selway, 2011). In order to improve upon the unidimensionality of the two measures of diversity, we use Selway (2011)'s *Crosscuttingnees (CC)* and *Cross-Fractionalization (CF)*. CC measures 'the degree groups on a first cleavage are identically distributed among groups on a second cleavage' (Selway, 2011). CF, on the other hand, measures 'the degree that members of a group on one cleavage are divided into groups on a second cleavage and share membership on the second cleavage with members of other groups on the first cleavage' (Selway, 2011). Studies show a positive association between economic growth and CF and CC but a negative association with fractionalization and polarization (Easterly and Levine, 1997; Montalvo and Reynal-Querol, 2005; Selway, 2011). The formulas are given in the Appendix and the results are shown on Table 2.

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[3] Table A.1 and Table A.2 in the Appendix show the diversity of regions in terms of language and religion. The distribution of languages across regions is very similar to ethnicity. Unlike ethnicity and language, regions in Ethiopia are relatively diverse when it comes to religion. Orthodox Christianity is the dominant religion (i.e. have more than 50 per cent of followers) in the capital city, Addis Ababa, and in Tigray and Amhara regions. Islam is the dominant religion in Afar, Dire Dawa, Harari and Somali regions. Protestantism has become the dominant religion in Gambela and SNNPR. The most religiously diverse regions are Oromia and Benishangul-Gumuz.

Table 2: Uni and multidimensional measures of ethnic diversity

| | Fractionaliz. & Polarization | | | CC and CF | | |
Year	Region	Ethnicity	Language	Region/ Ethnicity	Region/ Language	Ethnicity/ Language
	Fractionalization			Crosscuttingnees (CC)		
2007	0.76	0.80	0.79	0.26	0.27	0.19
1994	0.77	0.80	0.79	0.28	0.28	0.14
	Polarization			Cross-Fractionalization (CF)		
2007	0.67	0.57	0.59	0.12	0.13	0.03
1994	0.67	0.57	0.60	0.15	0.16	0.04

Source: Own calculation based on census 1994 and 2007.

The main message of Table 2 is that the Ethiopian population is highly polarized and fractionalized along regions and ethno-linguistic lines. For instance, there is an 80 per cent chance that two randomly selected individuals do not belong to the same ethnic or language groups and a 76 per cent chance that they do not live in the same region. Furthermore, region-ethnicity and region-language CC and CF are low and declining. There is a 26 per cent probability that two individuals belonging to the same ethnic group or having the same mother tongue live in different regions[4]. When we compare the above results with the diversity of the Ethiopian population along religious-lines, we find that even though the country is religiously very polarized (85 per cent), there is a relatively high cross-cuttingness and cross-fractionalization between religious affiliation, ethnicity and region of residence (not shown on Table 2). Specifically, there is a 64 per cent chance that two individuals having the same religion live in different regional states and a 54 per cent chance that they belong to different ethnic groups. Since there is a relatively even distribution of religion across ethno-linguistic groups and regional states, religious affiliation - compared to geographical location and ethno-linguistic identity - does not seem to be the relevant cleavage to study horizontal inequality and its consequences on the political instability and economic development of Ethiopia.

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[4] Our estimates are slightly different to that of Selway (2011). This is mainly due to differences in the classification of ethnicity and language groups. While Selway uses a more aggregated group classification, we classify groups as detailed as possible.

3 Data and method

3.1 Data and variables

Data poses major challenges for the analysis of horizontal inequality. In Ethiopia, the population and housing census is one useful source because it includes data on ethnicity, mother tongue and economic status. Another possible source include the Ethiopian Demographic and Health Surveys (EDHS). The main empirical analysis relies on data from the censuses undertaken by the Ethiopian Central Statistics Agency (CSA) in 1994 and 2007[5]. We complement the analysis with data from the EDHS. In addition to its large sample size, the timing of the 1994 census coincide with the beginning of the reforms of the early 1990s. Hence, we use it as a benchmark to examine the pattern of regional inequality and intergenerational mobility in the pre- and post-reform periods. The censuses are accessed through the IPUMS International (Integrated Public Use Microdata Series) project[6]. Other than its main objective of counting the population size, CSA collects data on demographic and socio-economic characteristics at the individual and household level during the census. Individual level outcomes include age, gender, marital status, literacy skills, educational attainment, fertility, employment and health outcomes. Household-level variables include housing amenities, access to safe drinking water and sanitation facilities. We restrict the sample to individuals aged 15 and above at the time of the survey. For the analysis of regional gap in intergenerational mobility, the sample is restricted to individuals for whom at least one parent can be identified in the censuses. We restrict the sample to individuals between the age of 15 and 45 in order to exclude children who are still in school and those who are too old to live with their parents. Appendix Table A.3 shows the step-by-step sample selection procedure and the sample size available for the intergenerational mobility analysis.

Two types of questionnaires were administered during the censuses. A short-form questionnaire was used to collect information on basic demographic characteristics such as age, gender, religion, language and ethnicity. A long questionnaire gathered data on educational attainment, employment, health status, fertility and household level information such as housing amenities and access to basic facilities. The long-form questionnaire was administered to 1-in-5 households randomly selected in each enumeration areas in all regions except Afar and Somali regions, where 1-in-20 households were selected for the long questionnaires. The short questionnaire was administered to the remaining households. Only 10 per cent of the data is available as public use file. The 10 per cent sample is

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[5] The first census took place in 1984. We do not use these data because the sampling weight does not account for the fact that some areas in Tigray and Wollo regions were not covered by the census since these areas were very prone to war and famine at the time of survey. In addition, direct interview with the responsible person at the CSA revealed that certain portion of the 1984 census data was lost when transferring the data from its older original format to the format that the Agency currently uses.

[6] The IPUMS project is a collaboration of the Minnesota Population Center (MPC), National Statistical Offices, and international data archives.

selected based on the systematic sampling of 1-in-2 household from the original 20 per cent of the long-form questionnaire respondents in the 1994 census and 1-in-10 households from all respondents in 2007[7]. Sample weights, computed by the Minnesota Population Center (MPC) in 1994 and the CSA in 2007, are used to arrive at regionally and nationally representative results.

Our first economic outcome of interest is educational attainment. Individuals who are attending school or who attended school in the past are asked to provide the highest grade they completed. When measuring educational attainment, it is important to take into account the major educational reform that the government undertook in 1994 which changed the structure of the education system, among other things. Figure 2 shows the Ethiopian education system before and after 1994.

Figure 2: Ethiopian education system before and after 1994.
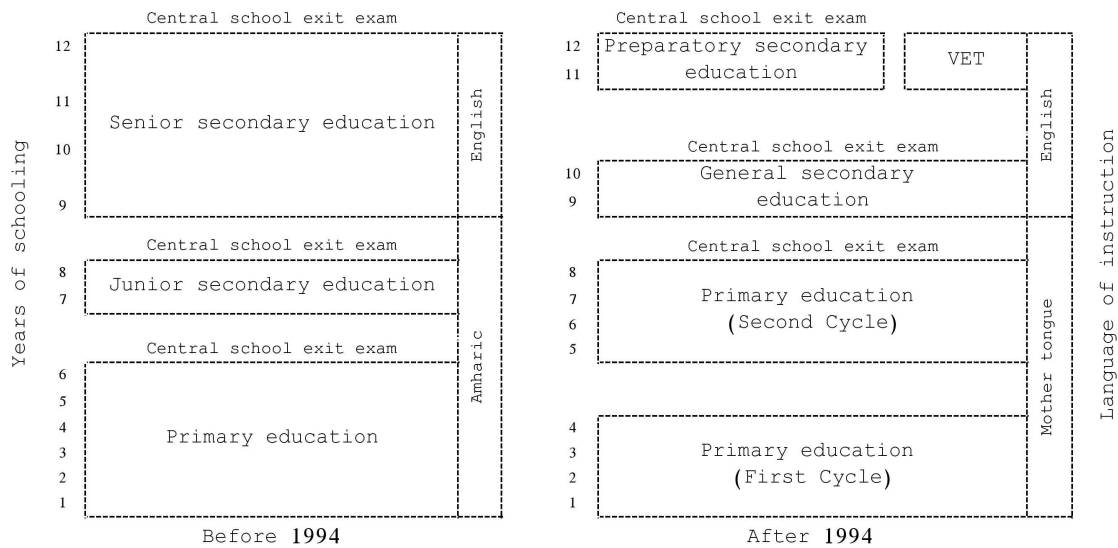
Source: Argaw (2016)
Note: VET stands for Vocational Education and Training

Before 1994, the education system consisted of primary education (grades 1-6), junior secondary education (grades 7-8) and senior secondary education (grades 9-12). After 1994, primary education lasts from grades one to eight and is divided into a first cycle (grades 1-4) and a second cycle (grades 5-8). General secondary education lasts only until grade 10. Under the new system, students who completed general secondary education sit for a national examination whose result determines entry into preparatory secondary education (grades 11-12 leading to university) or to vocational training (certificate or diploma at level 1-3). In the old system, students sit for 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.

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[7] Since only 20 per cent of household received the long questionnaire, only 20 per cent of individuals in the public use file of the 2007 census have detailed information for most socio-economic outcomes.

Based on the information available on the censuses, two measures of educational attainment are generated. The first one is years of education. Individuals whose highest educational attainment is above secondary education are assigned 13 years of education by the census group. However, this does not differentiate the years required to obtain different levels of post-secondary education. Hence, instead of assigning 13 years for all types of post-secondary education, we assign 13 years for post-secondary non-tertiary education, 14 years for diploma completed or bachelor incomplete, 15 years for bachelor completed or graduate incomplete, 16 years for master's degree, and 17 years for doctorate degree. We also use a categorical measure of educational attainment. The variable takes the value 0=no formal education, 1=some primary education (i.e. completed grades 1 to 5), 2= completed primary education and some secondary education (i.e. completed grades 6 to 9), 3=completed secondary education (i.e. grades 10 to 12), 4= some post-secondary education (i.e. vocational certificate and diploma, completed diploma or incomplete bachelor's degree) and 5= university degree or above (i.e. completed bachelor's degree, incomplete graduate and above).

Labour market outcomes are measured using two variables which depicts the *quantity* and *quality* of employment. The first variable is an indicator for being employed. Individuals are considered employed if they have worked during the last seven days preceding the interview. Individuals who have jobs but were absent from work for temporary reasons such as illness, maternity leave, etc. are also considered employed. The second variable is an indicator for being a paid worker. The variable takes one if an individual is self-employed or wage/salary worker and zero if an individual works as an unpaid family worker[8]. We measure literacy skills based on a subjective assessment of the respondents' ability to read and write. The variable takes one if an individual is able to read and write in any language and zero otherwise. The variable is only available for individuals who never attended formal education. The wealth status of households is measured using household asset (radio and number of rooms) and access to basic services (safe drinking water and toilet). Finally, we use disability status of survey respondents, child death and fertility at the household level as measures of health and fertility outcomes.

Table 3 shows descriptive statistics.

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[8] We can not measure employment quality based on occupation type since the data is only available in 1994.

Table 3: Summary statistics

	2007	1994	△
Educational outcomes			
Years of education	2.18	1.26	0.92
1 if some primary education	0.16	0.09	0.07
1 if completed primary education and some secondary education	0.12	0.07	0.05
1 if completed secondary education	0.04	0.04	0.00
1 if some post-secondary education	0.02	0.01	0.01
1 if university degree or above	0.004	0.001	0.003
Literacy and labour market outcomes			
1 if literate	0.40	0.24	0.16
1 if employed	0.74	0.75	0.01
1 if paid worker	0.79	0.56	0.24
Household asset and access to basic services			
1 if has a radio	0.40	0.18	0.22
1 if has more than two rooms	0.21	0.13	0.08
1 if safe water	0.29	0.15	0.14
1 if has toilet	0.35	0.15	0.20
Health and fertility outcomes			
1 if disabled	0.02	0.03	-0.01
1 if atleast one child death in the household	0.77	0.81	-0.05
1 if more than two children live in the household	0.74	0.76	-0.02

Source: Own calculation based on census 1994 and 2007.
Note: Sample is restricted to individuals aged 15 and above.

Ethiopia has made a substantial progress in the educational attainment of its population. The average years of education increased almost by one year between 1994 and 2007. Much of the improvement is observed in primary education. Furthermore, the reading and writing skills of the population have improved by 15 percentage points from 24 per cent in 1994 to 39 per cent in 2007. Table 3 also shows that while employment rate remains at 75 per cent over the years, the share of the employed population getting payment for their work has increased from 56 per cent in 1994 to 79 per cent in 2007. Significant progresses have also been made in household asset holding and access to basic sanitation facilities. However, the share of households who have access to safe drinking water and to toilet facilities remain very low at 35 per cent and 29 per cent respectively.

The health and fertility measures in the census show little progress between 1994 and 2007. Since the EDHS provides better data on health and fertility outcomes, we supplement our analysis on regional inequality in health and fertility outcomes using the 2000 and 2011 EDHS[9]. Appendix Table A.5 shows that women's use of antenatal care services and modern contraception have increased by 8 and 12 percentage points respectively between 2000 and 2011. While we do not see a significant

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[9] EDHS is a nationally representative survey of women aged 15-49 and men aged 15-59. It gathers information on demographic and various measures of socio-economic outcomes especially on health and fertility measures. EDHS samples were selected following a stratified, two-stage cluster design and the 1994 and 2007 censuses provided the sampling framework. Samples were allocated non-proportionally across regions and in urban and rural areas. Hence, sampling weights are used to arrive at results that are representative at the national and regional level.

improvement in low birth weight, we find a 6 percentage points decline in child stunting and underweight. Finally, there is a moderate increase in women's age at first marriage and a decline in their desired number of children.

3.2 Empirical approach

(a) Regional inequality

Following Stewart et al. (2010), we use the group-weighted Gini coefficient (GGini), coefficient of variation (GCVO) and Theil indexes (GTheil) to measure regional inequality in economic outcomes. The group inequality measures calculate the concentration of the stock of economic outcomes in any region. A value of zero imply an equal distribution of economic outcomes across regions, whereas a value of one corresponds to a situation where all economic outcomes are concentrated in one region. Since the GGini is the widely used measurement of inequality, we base our main analysis on the GGini. We check the sensitivity of the results to the type of inequality measurements by using the GCOV and GTheil. The respective formulas are:

$$GGini = \frac{1}{2\bar{y}} \sum_r^R \sum_s^S P_r P_s |\bar{y}_r - \bar{y}_s| \tag{1}$$

where $\bar{y}_r = \frac{1}{\bar{n}_r} (\sum_i^{nr} y_{ir}$ is region $r's$ mean value; R is region $r's$ population size; P_r is region $r's$ population share; y_{ir} is the quantity of the variable of interest of the ith member of region r. $Ggini$ compares every group with every other group.

$$GCOV = \frac{1}{\bar{y}} \left(\sum_r^R P_r((\bar{y}_r - \bar{y})^2) \right)^{\frac{1}{2}} \tag{2}$$

where $\bar{y}_r = \frac{1}{\bar{n}_r} (\sum_i^{nr} y_{ir}$ is region $r's$ mean value; R is region $r's$ population size; P_r is region $r's$ population share; y_{ir} is the quantity of the variable of interest of the ith member of region r.

$$GTheil = \sum_r^R P_r \frac{\bar{y}_r}{\bar{y}} log \frac{\bar{y}_r}{\bar{y}} \tag{3}$$

where $\bar{y}_r = \frac{1}{\bar{n}_r} (\sum_i^{nr} y_{ir}$ is region $r's$ mean value; R is region $r's$ population size; P_r is region $r's$ population share; y_{ir} is the quantity of the variable of interest of the ith member of region r. $GTheil$ compares each group with the mean.

(b) Intergenerational mobility

Intergenerational mobility is measured by the correlation between parental and children's economic outcomes. We focus on intergenerational mobility in educational attainment since education

is a good indicator of economic status in the absence of data on permanent income or occupational status. We estimate the correlation between parental and children educational attainment using equation (4). To examine regional differences in the intergenerational persistence of educational attainment, we estimate the equation for each region.

$$Y_{ij} = \alpha + \beta P_j + \gamma X_{ij} + \epsilon_{ij} \tag{4}$$

where Y_{ij} is the educational attainment of child i in household j, P_j is parental education attainment in household j, and β is the intergenerational regression coefficient. X_{ij} is a vector of predetermined variables including children's age dummies, gender and religion. We use ordinary least squares to estimate the intergenerational regression coefficient (β).

The estimated intergenerational regression coefficient ($\hat{\beta}$) is the most widely used measure of intergenerational mobility (Solon, 1999; Black and Devereux, 2011). However, when the sample used to measure intergenerational mobility is based on children living with their parents (i.e. coresident sample), recent studies show that $\hat{\beta}$ is severely biased as a result of truncation (Emran and Shilpi, 2015; Emran et al., 2016). Specifically, Emran et al. (2016) show that an ordinary least squares estimates of intergenerational persistence is downward biased due to coresidence sample selection. However, the authors show that the downward bias in the estimated intergenerational correlation ($\hat{\rho}$) is much smaller than the bias in the regression coefficient ($\hat{\beta}$). The authors use data from India and Bangladesh and find that the bias in $\hat{\rho}$ is less than one-third of the bias in $\hat{\beta}$.

The intergenerational correlation, $\hat{\rho}$, is calculated by multiplying the intergenerational regression coefficient by the ratio of the variances of parental and children educational attainment (σ_p and σ_c respectively). i.e. $\hat{\rho} = \hat{\beta}(\hat{\sigma}_p/\hat{\sigma}_c)$. Since our empirical analysis is based on a coresident sample, our preferred measure of educational mobility is based on $\hat{\rho}$. We also provide estimates for the intergenerational regression coefficient ($\hat{\beta}$) for comparison purpose.

4 Results

4.1 Pattern of regional inequality

Table 4 shows the level and pattern of regional inequality and vertical inequality in Ethiopia. Regional inequality is measured using the group-weighted Gini coefficient based on equation (1) and results are reported on columns (1)-(3). Similarly, vertical inequality, measured using the Gini coefficient at the individual and household levels, are reported on columns (4)-(6).

Table 4: Trend in regional inequality and vertical inequality using gini coefficient

	Regional inequality			Vertical inequality		
	2007	1994	△	2007	1994	△
	(1)	(2)	(3)	(4)	(5)	(6)
Educational outcomes						
Years of education	0.231	0.424	-0.193	0.761	0.865	-0.104
1 if completed primary education	0.258	0.466	-0.208	0.814	0.893	-0.079
1 if completed secondary education	0.476	0.701	-0.225	0.935	0.957	-0.022
Literacy and labour market outcomes						
1 if literate	0.104	0.225	-0.121	0.605	0.761	-0.156
1 if employed	0.038	0.052	-0.014	0.257	0.247	0.010
1 if paid worker	0.031	0.081	-0.050	0.208	0.445	-0.237
Household asset and access to basic service						
1 if has a radio	0.118	0.450	-0.332	0.599	0.818	-0.219
1 if has more than two rooms	0.063	0.268	-0.205	0.791	0.872	-0.081
1 if safe drinking water	0.315	0.879	-0.564	0.711	0.851	-0.140
1 if has toilet	0.203	0.611	-0.408	0.654	0.852	-0.198
Health and fertility outcomes						
1 if disabled	0.074	0.082	-0.008	0.981	0.972	0.009
1 if atleast one child death in the household	0.006	0.010	-0.004	0.232	0.187	0.045
1 if more than two children live in the household	0.016	0.010	+0.006	0.257	0.238	0.019

Source: Own calculation based on census 1994 and 2007.
Note: Sample is restricted to individuals aged 15 and above.

Differences in economic outcomes across regions have declined substantially between 1994 and 2007. The Gini coefficient in educational attainment declined between 19 and 23 percentage points. The Gini coefficient for literacy skills also declined from 0.23 in 1994 to 0.14 in 2007. The decline in regional educational gap during the post-reform period has also been documented by other studies (Woldehanna and Jones, 2006; Kedir, 2014). For instance, Woldehanna and Jones (2006) finds that public expenditure on education has been pro-rural and favoured disadvantaged regions. The highest regional inequality is observed in secondary education completion and above. Woldehanna and Jones (2006) also finds that the country's Education Strategy Development Programme (ESDP) has been less successful at improving educational equity at secondary level.

Regional inequality in household asset and access to sanitation services has also declined in the post-reform period. The regional gap in access to safe drinking water and toilet facility decline by more than 40 percentage points between 1994 and 2007. Despite the improvement, there remains a substantial gap in economic outcomes across regions. Appendix Table A.4 shows the average economic outcomes differentiated by region. Economic outcomes are higher in the capital city, Addis Ababa, followed by the other chartered city of Dire Dawa and Harari region. For instance, about 43 to 64 per cent of the population in Addis Ababa, Dire Dawa and Harari completed secondary education in 2007 as compared with only 2 to 24 per cent elsewhere. Access to safe drinking water is above 60 per cent in Addis Ababa, Dire Dawa and Harari regions whereas the figure is less than

20 per cent in Benishangul-Gumuz, Afar and Somali regions. In general, the predominantly pastoral regions (Afar and Somali) have low access to education and basic sanitation facilities and experienced the least change between 1994 and 2007.

Regional inequalities in labour market, health and fertility outcomes are very low and do not show a significant change between 1994 and 2007. However, this result is not conclusive since the information available in the census on labour market, health and fertility outcomes and the period under consideration in this paper may not capture the effects of major programmes that the government undertook to improve these outcomes. For instance, the government undertook a major pro-poor health reform in 2003, namely the Ethiopian Health Services Extension Programme, which has significantly reduced maternal and child mortality and improved access to health care services (Admassie et al., 2009; Workie and Ramana, 2013). In addition, Khan et al. (2015) find a declining inequality in access to health care and family planning services across districts in Ethiopia as a result of the donor-financed block grant called the Promotion of Basic Services (PBS). When we complement the analysis using data from the 2000 and 2011 EDHS, we do find evidence for a declining regional gap in delivery by birth attendant and the use of modern contraception (See Appendix Table A.5).

Similar to horizontal inequality, columns (3)-(4) show that vertical inequalities in educational attainment, household asset and access to sanitation services declined between 1994 and 2007 implying that the distribution of access to these services in the population has become more equal post-1994. However, unlike the substantial reduction in horizontal inequality observed in the post-reform period, we find a modest reduction in vertical inequality. The only exception where reduction in vertical inequality is larger than the reduction in horizontal inequality is the probability of being a paid worker. The results for vertical inequality in health and fertility outcomes is rather mixed. Appendix Table A.5 shows that while vertical inequality in the use of modern contraception, antenatal care and delivery at health care facilities declined, inequality in child mortality and nutritional status has increased in the post-reform period.

The available evidence on income inequality in Ethiopia shows a rather mixed picture. The figure from the country's Ministry of Finance and Economic Development based on Household Income and Consumption Expenditure Surveys and the Welfare Monitoring Surveys show that the Gini coefficient has remained stable at around 0.30 since 1995/96 (MoFED, 2013). As a result, Ethiopia is labeled as one of the most equal nations compared to other African countries (World Bank Group, 2015). On the other hand, Bigsten and Shimeles (2007) use household panel data and find a higher income inequality in the country. The Gini coefficient declined from 0.48 in 1995 to 0.45 in 2004.

Table 5 compares regional inequality with other dimensions of horizontal inequality. The table also report estimates for the GCOV and GTheil given by equation (2) and (3), respectively, based on data on individuals aged 15+ and 25+ as robustness checks. For the sake of brevity, the table only shows regional inequality in years of education.

Table 5: Educational inequality using different inequality measurments and dimensions

	Year	Region	Urban/ Rural	Capital/ Others	Gender	Ethnicity	Language	Religion
Individuals aged 15 and above								
	2007	0.231	0.337	0.121	0.131	0.091	0.110	0.134
GGini	1994	0.424	0.452	0.206	0.153	0.110	0.136	0.164
	△	**-0.193**	**-0.115**	**-0.085**	**-0.022**	**-0.019**	**-0.026**	**-0.030**
	2007	0.591	0.846	0.543	0.262	0.291	0.319	0.294
GCOV	1994	1.011	1.254	0.959	0.306	0.335	0.392	0.387
	△	**-0.420**	**-0.408**	**-0.416**	**-0.044**	**-0.044**	**-0.073**	**-0.093**
	2007	0.130	0.278	0.095	0.034	0.053	0.062	0.047
GTheil	1994	0.298	0.533	0.243	0.048	0.063	0.085	0.082
	△	**-0.168**	**-0.255**	**-0.148**	**-0.014**	**-0.010**	**-0.023**	**-0.035**
Individuals aged 25 and above								
	2007	0.340	0.410	0.178	0.192	0.099	0.122	0.150
GGini	1994	0.498	0.470	0.223	0.248	0.101	0.122	0.168
	△	**-0.158**	**-0.060**	**-0.045**	**-0.056**	**-0.002**	**0.000**	**-0.018**
	2007	0.846	1.067	0.805	0.384	0.305	0.341	0.335
GCOV	1994	1.145	1.343	1.093	0.497	0.306	0.341	0.404
	△	**-0.299**	**-0.276**	**-0.288**	**-0.113**	**-0.001**	**0.000**	**-0.069**
	2007	0.224	0.416	0.183	0.075	0.054	0.067	0.061
GTheil	1994	0.351	0.588	0.291	0.130	0.052	0.064	0.088
	△	**-0.127**	**-0.172**	**-0.108**	**-0.055**	**+0.002**	**+0.003**	**-0.027**

Source: Own calculation based on census 1994 and 2007.
Note: Sample is restricted to individuals aged 15 and above.

We find that inequality in years of education is much stronger along the spatial dimension. The highest educational inequality is observed between urban and rural residents followed by regional and gender inequality. The largest decline in educational inequality between 1994 and 2007 is also observed along the spatial dimension. Though the country started out with a similar level of rural-urban and regional inequality in educational attainment in 1994, it now has higher educational inequality across the rural-urban dimension due to a higher decline in regional inequality between 1994 and 2007. These results are for the most part independent of the method we use to measure horizontal inequality implying a high correlation across the three measures. When comparing the two age groups, we find that the decline in horizontal educational inequality between 1994 and 2007 is higher in the 15+ age group than the 25+ age group. This indicates that educational inequality is lower among the youth of 2007 than the youth of 1994.

To further explore the spatial and gender dimension of regional inequality, we divide the data into sub-groups and compare regional inequality in economic outcomes between men and women and between urban and rural areas. Results are shown on Table 6.

Table 6: Regional inequality differences across gender and urban-rural residences

| | A. Female | | | B. Male | | |
	2007	1994	△	2007	1994	△
Years of education	0.28	0.54	-0.26	0.20	0.36	-0.16
1 if completed primary education	0.31	0.58	-0.27	0.23	0.40	-0.17
1 if completed secondary education	0.53	0.81	-0.28	0.45	0.65	-0.20
1 if literate	0.16	0.35	-0.19	0.08	0.16	-0.08
1 if employed	0.05	0.08	-0.03	0.03	0.04	-0.01
1 if paid worker	0.06	0.21	-0.15	0.02	0.04	-0.02
	C. Rural			D. Urban		
	2007	1994	△	2007	1994	△
Years of education	0.10	0.19	-0.09	0.07	0.10	-0.03
1 if completed primary education	0.10	0.21	-0.11	0.07	0.10	-0.03
1 if completed secondary education	0.25	0.17	0.08	0.10	0.12	-0.02
1 if literate	0.07	0.10	-0.03	0.05	0.07	-0.02
1 if employed	0.02	0.03	-0.01	0.04	0.04	0.00
1 if paid worker	0.02	0.05	-0.02	0.02	0.03	-0.02
1 if has a radio	0.05	0.22	-0.17	0.06	0.10	-0.04
1 if has more than two rooms	0.16	0.12	0.04	0.12	0.17	-0.05
1 if safe water	0.14	0.29	-0.15	0.06	0.09	-0.03
1 if has toilet	0.17	0.20	-0.03	0.08	0.10	-0.02

Source: Own calculation based on census 1994 and 2007.
Note: Sample is restricted to individuals aged 15 and above.

We find higher regional inequality among females than males and in rural areas than in urban areas both in 1994 and 2007. On the positive side, the largest decline in regional inequality between 1994 and 2007 is observed among females and rural residents. The only exception where we see an increase in regional inequality in rural areas is educational attainment at the secondary level and number of rooms in the households. Kedir (2014) also finds improvements in economic outcomes particular in primary school enrollment and access to water and sanitation services in the rural areas of most regional states. The higher horizontal inequality we find in rural areas is in contrast to the available evidence on the rural-urban difference in vertical inequality. The figure from the country's Ministry of Finance and Economic Development show that income inequality has been higher in urban areas (0.37) than in rural areas (0.27) since 1994 (MoFED, 2013)[10]. MoFED (2013) also reports that the reduction in income inequality since 2004 has been larger in urban areas compared to rural areas and this resulted in a reduced income inequality between urban and rural areas[11].

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[10] Kedir (2014) finds higher inequality in rural areas compared to urban areas in land ownership and total household consumption expenditure between 1994 and 2004.

[11] In contrast, Geda et al. (2008) show that income inequality has been rising in urban areas.

While our results also show that the rural-urban gap in horizontal inequality has declined post-1994, the reduction mainly came from a decline in horizontal inequality in rural areas.

4.2 Intergenerational mobility in educational attainment

The analysis so far reveal that regional inequality declined post-1994 but it remains a crucial challenge. Regional inequality in economic outcomes could have consequences on political stability and economic development especially if it is persistent. In additional to looking at the trend in regional inequality, the persistence of regional inequality can be measured using the trend in intergenertional mobility. If individuals living in economically disadvantaged regions also experience low economic mobility across generations, they could be trapped in low economic outcome state from generation after generation. In this section, we examine the trend in intergenerational mobility and the differences across regions in the pre- and post-reform period.

Table 7 reports estimates for the intergenerational persistence of educational attainment based the methods discussed in Section 3. Results are presented with respect to parental education in panel A, where parental education is defined as the the maximum of father's and mother's years of schooling, and separately for father's education in panel B and for mother's education in panel C. Results are shown for all children in columns (1)-(2) and separately for boys in columns (3)-(4) and girls in columns (5)-(6).

Table 7: Intergenerational educational mobility at the national level

	All Children		Boys		Girls	
	1994	2007	1994	2007	1994	2007
	(1)	(2)	(3)	(4)	(5)	(6)
Parental years of education ($\hat{\beta}$)	0.731***	0.536***	0.736***	0.544***	0.723***	0.524***
	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.005)
Correlation ($\hat{\rho}$)	0.464	0.423	0.438	0.409	0.497	0.442
Observations	620,850	161,880	372,948	97,150	247,902	64,730
Father's years of education ($\hat{\beta}$)	0.725***	0.546***	0.731***	0.561***	0.717***	0.526***
	(0.005)	(0.004)	(0.006)	(0.005)	(0.005)	(0.006)
Correlation ($\hat{\rho}$)	0.481	0.442	0.453	0.432	0.521	0.457
Observations	467,954	118,475	286,222	72,193	181,732	46,282
Mother's years of education ($\hat{\beta}$)	0.927***	0.632***	0.930***	0.633***	0.919***	0.630***
	(0.005)	(0.005)	(0.007)	(0.007)	(0.006)	(0.007)
Correlation ($\hat{\rho}$)	0.386	0.364	0.355	0.341	0.425	0.395
Observations	597,951	156,146	360,968	94,116	236,983	62,030

Source: Own calculation based on census 1994 and 2007.
Note: Sample is restricted to children aged between 15 and 45 with non-missing data on parental educational attainment. All regressions include control for children's age dummies and gender. Standard errors, clustered at the household level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels.

The persistence of educational attainment across generations has declined between 1994 and 2007. The decline is much larger when we measure intergenerational persistence based on the intergenerational regression coefficient ($\hat{\beta}$) compared to the intergenerational correlation ($\hat{\rho}$). The estimated regression coefficient for all children declined from 0.694 in 1994 to 0.496 in 2007 whereas the intergenerational correlation declined slightly from 0.440 to 0.392. The persistence of educational attainment with respect to mother's education is very sensitive to the how it is measured compared to father's education. The regression coefficient estimates indicate that the persistence of educational attainment is much higher with respect to the mother's education compared to the father's education. However, since there is small variation in maternal educational attainment in the data, the intergenerational correlation with respect to the mother's education becomes smaller than the father's education.

Our estimate of the regression coefficient is similar to Hertz et al. (2007) but they find a much lower intergenerational correlation (0.10). This is mainly because of differences in sample selection and how we measure paternal education. Hertz et al. (2007) use the 1994 Ethiopian rural household survey and hence their results are only representative of individuals residing in rural areas. When we restrict the estimation sample to rural areas and measure paternal education as the average of father's and mother's education, we find a intergenerational correlation of 0.19. Comparing Ethiopia's average intergenerational educational correlation (0.42) with that of the three African countries (Ghana, South Africa and Egypt) covered in Hertz et al. (2007), we find that the country's intergenerational educational correlation is very close to that of Ghana's (0.39) and South Africa's (0.44) whereas Egypt has the highest intergenerational correlation in education (0.50).

In a setting where years of education is quite low, the transition matrix based on a categorical measure of educational attainment gives a better picture of the intergenerational mobility of education. We use four education categories: 1 if no education, 2 if some primary education, 3 if completed primary education and some secondary education, 4 if completed secondary education and post secondary education. The off diagonal items (p_{ij}) of the transition matrix gives the probability of a parent with education category i having a child with education category j. The diagonal items p_{ii} gives the probability of a parent with education i having a child with the same level of education. Smaller values for the diagonal items and larger values for the off-diagonal items imply higher intergenerational educational mobility. Table 8 reports the results.

Table 8: Intergenerational transitional probabilities

	1994				2007			
	Children's education							
Parental education	1	2	3	4	1	2	3	4
1	0.752	0.126	0.084	0.039	0.533	0.251	0.174	0.041
2	0.279	0.231	0.290	0.200	0.190	0.377	0.318	0.115
3	0.145	0.165	0.366	0.324	0.125	0.263	0.413	0.200
4	0.052	0.132	0.356	0.523	0.043	0.088	0.404	0.464

Source: Own calculation based on census 1994 and 2007.
Note: Sample is restricted to children aged between 15 and 45 with non-missing data on parental educational attainment.

The diagonal items show that the intergenerational persistence of educational attainment has declined in the post-reform period. The decline in educational persistence is concentrated at the lower and upper distribution of education. For instance, for parents who never attended formal education, the percentage of children who also never attended formal education declined from 75 per cent in 1994 to 53 per cent in 2007. The percentage that acquires some or completed primary education doubled between 1994 and 2007. Even though educational persistence declined at the upper part of the education distribution in post-1994, we find that the observed educational mobility is rather downward. For parents who completed secondary education, the percentage of children who attained the same level of education declined slightly from 52 per cent to 46 per cent.

The diagonal items in the middle of the education distribution show that the share of children who attended the same level of education as their parents increased between 1994 and 2007 implying an increasing intergenerational persistence. The off-diagonal items in the middle of the education distribution show mixed results. For instance, for parents with some primary education, the percentage of children who completed primary education increased from 29 per cent in 1994 to 32 per cent in 2007 implying a slight increased in upward mobility. On the other hand, for parents who completed primary education, we find that the percentage of children who have completed secondary education declined from 32 per cent in 1994 to 20 per cent in 2007 implying a downward mobility. Overall, we can conclude that the average decline in the intergenerational persistence of educational attainment we observe in the post-reform period is largely driven by an increase in educational mobility at the lower end of the education distribution. That is, an increasing number of children from parents who never attended formal education are attending formal education in the post-reform period.

We next examine the role that region of residence plays on the intergenerational mobility of education. Table 9 reports the estimated intergenerational persistence of education after controlling for region and culturally defined groups such as ethnicity, language and religion.

Table 9: Controlling for region and culturally defined groups

	(1)	(2)	(3)	(4)	(5)
1994					
Parental years of education ($\hat{\beta}$)	0.731***	0.694***	0.697***	0.668***	0.474***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Correlation ($\hat{\rho}$)	0.464	0.440	0.442	0.423	0.301
Observations	620,850	620,850	620,850	620,850	620,850
2007					
Parental years of education ($\hat{\beta}$)	0.536***	0.496***	0.489***	0.447***	0.371***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Correlation ($\hat{\rho}$)	0.423	0.392	0.386	0.377	0.293
Observations	161,880	161,880	161,880	161,880	161,880
Age & gender	√	√	√	√	√
Additional controls		Religion	Language	Ethnicity	Region

Source: Own calculation based on census 1994 and 2007.
Note: See note on Table 7.

The estimated intergenerational correlation changes only slightly when we control for religion, ethnicity and language in columns (2)-(4). On the other hand, region of residence plays a significant role in the intergenerational persistence of educational attainment. The intergenerational correlation declines by 35 per cent when taking into account region of residence in 1994 whereas the correlation reduces by 30 per cent in 2007. This implies that region of residence has a relatively larger influence on intergenerational persistence in the pre-reform period than in the post-reform period. To further explore the role of region of residence on the intergenerational correlation of educational attainment, Table 10 reports separate estimates by region.

Table 10: Regional differences in intergenerational educational mobility

	1994			2007			
	$\hat{\beta}$	s.e	$\hat{\rho}$	$\hat{\beta}$	s.e	$\hat{\rho}$	$\triangle\hat{\rho}$
Addis Ababa	0.167***	(0.004)	0.240	0.155***	(0.008)	0.241	0.001
Afar	0.247***	(0.066)	0.154	0.443***	(0.061)	0.293	0.139
Amhara	0.727***	(0.009)	0.362	0.453***	(0.009)	0.309	-0.054
Ben-Gumuz[1]	0.462***	(0.035)	0.300	0.274***	(0.042)	0.201	-0.099
Dire Dawa	0.248***	(0.022)	0.196	0.272***	(0.038)	0.265	0.069
Gambela	0.264***	(0.049)	0.152	0.229***	(0.069)	0.190	0.038
Harari	0.181***	(0.025)	0.173	0.147***	(0.051)	0.160	-0.013
Oromia	0.469***	(0.005)	0.274	0.382***	(0.007)	0.297	0.024
Somali	0.202***	(0.034)	0.170	0.459***	(0.035)	0.386	0.217
SNNPR[2]	0.344***	(0.007)	0.209	0.273***	(0.009)	0.233	0.024
Tigray	0.705***	(0.016)	0.367	0.457***	(0.017)	0.283	-0.084

Note: Own calculation based on census 1994 and 2007. Sample is restricted to children aged between 15 and 45 with non-missing data on parental educational attainment. All regressions include control for children's age dummies, gender, religion, ethnicity and language. Standard errors, clustered at the household level, are reported in parentheses. ***, **, * denote significance at the 0.01, 0.05, and 0.10 levels. [1] stands for Benishangul-Gumuz region; [2] stands for Southern Nations, Nationalities, and Peoples' Region.

Intergenerational persistence in educational attainment was the highest in Amhara, Tigray and Benshangul-Gumuz regions in the pre-reform period. However, these regions also experienced the largest decline in intergenerational correlation between 1994 and 2007. On the other hand, the predominantly pastoral regions had one of the lowest intergenerational correlation in 1994, but they experienced an increasing trend between 1994 and 2007. This implies that the role of parental background on the children's education has become more important in the post-reform period in these regions. These regions are not only the most disadvantaged regions in the country in terms of average economic outcomes but also have the lowest intergenerational mobility.

5   Conclusions

This paper examines regional inequality in economic outcomes and opportunities in the context of a developing country, Ethiopia. This is the first paper to study regional differences in intergenerational mobility in Ethiopia and is among the scarce evidence on regional inequality of economic outcomes available for the country. We measure regional inequality and intergenerational mobility in the pre- and post-reform periods based on data from the 1994 and 2007 national population and housing censuses. Our results show that regional inequality in economic outcomes has declined substantially in the post-reform period. However, there still exists a substantial gap in economic outcomes between the regional states. The dominantly pastoral regions of the country (Afar and Somali) have the lowest economic outcomes and experienced the least change between 1994 and 2007.

Despite the substantial decline in regional inequality of economic outcomes and opportunities in the post-reform period, tacking the remaining gap poses a big challenge. There are different policy prescriptions put forward to manage inequality across groups. Following Stewart et al. (2007), we discuss three distinct approaches within the Ethiopian context namely direct, indirect and integrationist approaches. The direct approach involves targeting specific groups, for instance, by allocating quotas for employment or education or credit. This strategy is seldom recommended or used as it may lead to opposition from other groups. The indirect approach, and the one closely related to the strategies of the Ethiopian government, involves the decentralization of power and development policies to regional states. Stewart et al. (2007) write 'where groups are geographically concentrated, a federal constitution can empower different groups, by allowing them control over many areas of decision-making, the degree of empowerment clearly depending on the allocation of powers'. Even though the country has a decentralized system of governance, various studies question the autonomy of regional states within the country's dominant party system (e.g. Menigisteab, 1997; Aalen, 2002; Samatar, 2004; Gudina, 2007; Aalen, 2011; Kefale, 2013).

There is progress towards addressing horizontal inequality in the country indirectly through re-

gional development policies. For instance, the government gave special attention to providing better access to education in pastoral areas in its third Education Sector Development Plan (MoE, 2005) and developed a Pastoralist Education Strategy in 2008 (MoE, 2008). The strategies include providing alternative basic education, mobile schools and boarding schools among others. Similarly, Pastoralist Health Promotion and Disease Prevention Directorate was established under the Federal Ministry of Health (MoH, 2010) to tackle health inequality. Furthermore, improving the livelihood of pastoral areas is an integral part of the country's second Growth and Transformation Plan (MoFED, 2015). The impacts of these policy reforms on reducing regional inequality of economic outcomes and opportunities remain to be seen.

The integrationist approach to tackling horizontal inequality involves managing inequality by 'working towards greater integration' (Stewart et al., 2007). Some of the policy prescriptions include providing incentives for cross-group economic activities and promoting multicultural school environment. The reforms of the early 1990s made it possible for regional states to choose their official working language as well as the language for medium of instruction in primary schools. The regional concentration of ethno-linguistic groups coupled with the right of regions to choose their official working language may have limited individuals' mobility opportunities across regions (Geda and Degefe, 2005) thereby lowering integration (Wodajo, 2014). Similarly, even though mother-tongue based education reduces educational and labour market inequalities across language groups (Argaw, 2016), it could be an anti-intergrationist policy if it lacks to support multicultural school and work environment.

Further research is required in the following area. Ethiopia's economy has been growing at around 10 per cent since the mid-2000s. Most of the regional development policies targeting disadvantaged regions were also initiated after the mid-2000s. Therefore, it is important to document the consequences of these changes on horizontal inequality and intergenertional mobility once the 2016 census data become available. Furthermore, this paper focuses on horizontal inequality in non-monetary measures of economic outcomes since monetary measures are not available in the censuses. Horizontal inequality and intergenerational mobility in monetary outcomes such as income or earning also have important implications. The currently available surveys that contain information on income (such as the Household Income and Consumption Expenditure Surveys, the Welfare Monitoring Surveys and the Labour Force Surveys) do not collect data on the ethnicity or mother tongue of respondents and some are not even representative at the region level. Tackling these data shortcomings enhances further research on the extent and pattern of horizontal inequality and intergenerational mobility in the country.

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A   Appendix

Table A.1: Distribution of linguistic groups across regions.

	Country	Amharic	Oromiffa	Somaligna	Tigrinya	Sidamigna	Welaitigna	Others
1994								
Addis Ababa	3.85	73.26	10.08	0.13	5.43	0.04	0.25	10.81
Afar	2.19	6.47	0.68	0.08	0.75	-	0.27	91.75
Amhara	25.94	93.31	2.83	0.00	0.29	-	-	3.56
Ben-Gumuz[1]	0.86	22.46	16.07	-	0.90	-	0.07	60.51
Dire Dawa	0.46	32.50	46.89	13.63	1.11	-	0.08	5.79
Gambela	0.30	7.95	6.43	-	1.52	0.01	0.12	83.97
Harari	0.25	37.66	49.44	1.35	1.08	0.05	0.01	10.41
Oromia	34.57	11.08	84.89	0.63	0.25	0.10	0.14	2.91
Somali	6.33	0.99	2.42	95.64	0.03	0.04	0.01	0.88
SNNPR[2]	19.51	4.20	1.60	-	0.10	17.85	11.55	64.69
Tigray	5.75	2.96	0.12	-	95.45	-	-	1.47
Country		32.49	31.45	6.36	5.92	3.52	2.32	17.93
2007								
Addis Ababa	3.77	71.86	10.86	0.12	3.70	0.05	0.44	12.97
Afar	1.88	7.24	0.41	0.01	0.92	0.01	0.44	90.97
Amhara	23.53	92.76	2.73	0.03	0.22	-	-	4.26
Ben-Gum[1]	1.08	23.68	16.74	0.01	0.79	0.02	0.04	58.72
Dire Dawa	0.47	30.91	47.73	14.75	0.65	-	0.08	5.88
Gambela	0.44	11.12	5.23	0.02	1.21	0.23	0.61	81.58
Harari	0.25	27.37	57.79	3.42	1.16	-	0.15	10.10
Oromia	36.47	9.55	86.45	0.49	0.15	0.19	0.17	3.00
Somali	6.05	0.81	0.54	96.56	0.02	-	-	2.07
SNNPR[2]	20.21	4.16	1.39	0.01	0.09	19.52	10.49	64.35
Tigray	5.85	3.04	0.08	0.02	95.41	-	-	1.44
Country		29.74	33.48	6.11	5.89	4.02	2.21	18.55

Source: Own calculation based on census 1994 and 2007.
Note: [1] stands for Benishangul-Gumuz region; [2] stands for Southern Nations, Nationalities, and Peoples' Region.

Table A.2: Distribution of religious groups across regions.

	Country	Religious groups					
		Orthodox	Muslim	Protestant	Catholic	Traditional	Others
1994							
Addis Ababa	3.85	82.71	12.23	3.85	0.71	0.02	0.48
Afar	2.19	3.80	95.66	0.44	0.09	-	0.02
Amhara	25.94	81.82	19.02	0.08	0.01	0.02	0.05
Ben-Gumuz[1]	0.86	34.84	44.34	6.18	0.52	12.71	1.42
Dire Dawa	0.46	33.45	64.22	1.34	0.71	-	0.27
Gambela	0.30	23.00	5.51	44.25	2.95	12.06	12.23
Harari	0.25	38.92	59.68	0.91	0.40	0.01	0.08
Oromia	34.57	41.32	44.29	8.63	0.59	4.20	0.97
Somali	6.33	0.99	98.72	0.11	0.11	0.06	0.01
SNNPR[2]	19.51	27.71	16.78	34.87	2.95	15.29	2.40
Tigray	5.75	95.43	4.11	0.05	0.40	0.00	0.01
Country		50.35	33.15	10.17	0.86	4.59	0.89
2007							
Addis Ababa	3.77	76.42	14.35	8.09	0.31	0.05	0.78
Afar	1.88	4.17	94.91	0.83	0.08	0.01	-
Amhara	23.53	82.48	17.22	0.17	0.02	0.04	0.07
Ben-Gum[1]	1.08	33.33	45.18	13.25	0.24	7.65	0.34
Dire Dawa	0.47	31.06	65.56	2.90	0.27	0.02	0.19
Gambela	0.44	17.40	4.89	69.42	2.82	4.30	1.17
Harari	0.25	28.94	67.42	3.51	0.09	-	0.03
Oromia	36.47	30.44	47.21	17.97	0.46	3.24	0.68
Somali	6.05	0.74	98.27	0.07	0.03	0.04	0.84
SNNPR[2]	20.21	20.07	14.12	55.52	2.43	6.49	1.38
Tigray	5.85	95.63	4.03	0.03	0.30	-	0.01
Country		43.82	33.61	18.61	0.71	2.61	0.63

Source: Own calculation based on census 1994 and 2007.
Note: [1] stands for Benishangul-Gumuz region; [2] stands for Southern Nations, Nationalities, and Peoples' Region.

Table A.3: Sample selection steps

Description	Number of observations	
	1994	2007
Full sample	5,038,313	1,290,809
Drop individuals living in the household other than the parents and their children	4,436,448	1,168,042
Drop single headed households	4,313,082	1,124,253
Drop if household has more than one father/mother	4,281,253	1,124,137
Total number of children in the household	2,621,313	682,852
Drop children less than 15 or greater than 45 years old	624,274	161,880
Drop missing data on parental outcomes	624,070	161,880
Drop missing data on children outcomes	620,850	161,880
Sample available for the analysis of intergenerational mobility		
Female	244,715	63,811
Male	376,135	98,069

Source: Author's computation based on census 1994 and 2007.

Note: The number of observation in census 2007 is smaller compared to census 1994. This is because of differences in the sample design used when drawing the 10 per cent public use file. The Central Statistics Agency used a systematic sampling of 1-in-10 household from the entire population in 2007 to draw the public use file. Since only 20 per cent of household received the long questionnaire, only 20 per cent of individuals in the public use file have detailed information for most socio-economic outcomes including education and labour market outcomes. Sample weights are used to arrive at regionally and nationally representative results.

Formula

The four measures of ethnic diversity are

Fractionalization $= 1 - \sum_{i=1}^{n} P_i^2$

Polarization $= 1 - \sum_{i=1}^{n} \left(\dfrac{0.5 - P_i}{0.5} \right)^2$

where P_i is the proportion of individuals who belong to group i and n is the number of groups.

Crosscuttingness $= 1 - \sqrt{\dfrac{\sum \dfrac{(O - E)^2}{E}}{nm}}$

where O is the observed frequency in the subgroup cell, E is the expected frequency, n is the sample size and m is the smaller of either the number of columns minus one or the number of rows minus one.

Crossfractionalization $= \sum_{x=1}^{n} P_x^2 + \sum_{y=1}^{n} P_y^2 - 2 \sum_{x,y}^{n} P_{xy}^2$

where P_x is the proportion of population at cleavage x, P_y is the proportion of population at cleavage y and P_{xy} is the proportion of population at both cleavage x and cleavage y.

Table A.4: Trend in educational and socio-economic inequality across regions in Ethiopia

	Country	Regions										
		Addis Ababa	Afar	Amhara	Ben-Gumuz[1]	Dire Dawa	Gambela	Harari	Oromia	Somali	SNNP[2]	Tigray
Years of education												
2007	2.18	7.22	0.84	1.65	2.10	4.53	2.76	4.69	2.08	0.50	2.18	2.32
1994	1.26	6.64	0.43	0.66	0.77	3.86	1.57	4.29	1.21	0.42	1.26	0.75
△	**0.92**	**0.58**	**0.41**	**0.99**	**1.33**	**0.67**	**1.19**	**0.40**	**0.87**	**0.08**	**0.92**	**1.57**
Completed primary education												
2007	0.19	0.65	0.07	0.14	0.17	0.43	0.24	0.44	0.18	0.04	0.18	0.20
1994	0.11	0.60	0.04	0.06	0.06	0.37	0.13	0.41	0.10	0.04	0.10	0.05
△	**0.08**	**0.05**	**0.03**	**0.08**	**0.11**	**0.06**	**0.11**	**0.03**	**0.08**	**0.00**	**0.08**	**0.15**
Completed secondary education												
2007	0.07	0.38	0.03	0.04	0.06	0.18	0.07	0.22	0.05	0.01	0.05	0.07
1994	0.04	0.34	0.01	0.02	0.02	0.17	0.05	0.22	0.03	0.01	0.03	0.05
△	**0.03**	**0.04**	**0.02**	**0.02**	**0.04**	**0.01**	**0.02**	**0.00**	**0.02**	**0.00**	**0.02**	**0.02**
Literate												
2007	0.40	0.85	0.16	0.35	0.38	0.62	0.48	0.60	0.40	0.13	0.42	0.42
1994	0.24	0.81	0.08	0.18	0.18	0.52	0.28	0.55	0.23	0.09	0.25	0.19
△	**0.16**	**0.04**	**0.08**	**0.17**	**0.20**	**0.10**	**0.20**	**0.05**	**0.17**	**0.04**	**0.17**	**0.23**
Employed												
2007	0.74	0.58	0.64	0.76	0.80	0.66	0.85	0.71	0.79	0.57	0.76	0.71
1994	0.75	0.42	0.80	0.83	0.88	0.52	0.69	0.54	0.79	0.70	0.69	0.75
△	**-0.01**	**0.16**	**-0.16**	**-0.07**	**-0.08**	**0.14**	**0.16**	**0.17**	**0.00**	**-0.13**	**0.07**	**-0.04**
Paid worker												
2007	0.79	0.99	0.82	0.74	0.74	0.91	0.81	0.91	0.80	0.85	0.78	0.83
1994	0.56	0.98	0.45	0.50	0.53	0.83	0.66	0.80	0.54	0.52	0.63	0.55
△	**0.23**	**0.01**	**0.37**	**0.24**	**0.21**	**0.08**	**0.15**	**0.11**	**0.26**	**0.33**	**0.15**	**0.28**
HH has a radio												
2007	0.40	0.88	0.41	0.31	0.37	0.58	0.25	0.67	0.44	0.32	0.36	0.36
1994	0.18	0.77	0.15	0.10	0.13	0.57	0.13	0.63	0.19	0.19	0.14	0.15
△	**0.22**	**0.11**	**0.26**	**0.21**	**0.24**	**0.01**	**0.12**	**0.04**	**0.25**	**0.13**	**0.22**	**0.21**
HH has more than two rooms												
2007	0.21	0.98	0.20	0.24	0.17	0.20	0.19	0.25	0.21	0.04	0.19	0.30
1994	0.13	0.53	0.04	0.10	0.10	0.14	0.06	0.22	0.13	0.02	0.10	0.19
△	**0.08**	**0.45**	**0.16**	**0.14**	**0.07**	**0.06**	**0.13**	**0.03**	**0.08**	**0.02**	**0.09**	**0.11**
HH has access to safe drinking water												
2007	0.29	0.98	0.20	0.24	0.17	0.85	0.30	0.60	0.23	0.12	0.28	0.44
1994	0.15	0.97	0.09	0.09	0.12	0.74	0.15	0.63	0.12	0.08	0.09	0.19
△	**0.14**	**0.01**	**0.11**	**0.15**	**0.05**	**0.11**	**0.15**	**-0.03**	**0.11**	**0.04**	**0.19**	**0.25**
HH has toilet												
2007	0.35	0.87	0.08	0.25	0.35	0.62	0.23	0.52	0.29	0.12	0.53	0.25
1994	0.15	0.79	0.07	0.06	0.19	0.61	0.14	0.47	0.14	0.11	0.14	0.07
△	**0.20**	**0.08**	**0.01**	**0.19**	**0.16**	**0.01**	**0.09**	**0.05**	**0.15**	**0.01**	**0.39**	**0.18**

Source: Own calculation based on census 1994 and 2007.

Note: [1] stands for Benishangul-Gumuz region, [2] stands for Southern Nations, Nationalities, and Peoples' region.

Table A.5: Health and fertility outcomes based on the Ethiopian Demographic and Health Surveys

	Average values			Regional inequality			Vertical inequality		
	2011	2000	△	2011	2000	△	2011	2000	△
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Modern contraception use	0.20	0.08	0.12	0.08	0.41	-0.33	0.77	0.94	-0.17
Antenatal care	0.64	0.56	0.08	0.05	0.05	0.00	0.37	0.46	-0.09
Delivery by birth attendant	0.15	0.11	0.04	0.56	0.92	-0.36	0.89	0.94	-0.05
Small birth weight	0.31	0.33	-0.02	0.09	0.05	0.04	0.71	0.67	0.04
Child is stunt	0.30	0.36	-0.06	0.08	0.08	0.00	0.68	0.60	0.08
Child is under-weight	0.29	0.34	-0.05	0.05	0.08	-0.03	0.71	0.63	0.08
Child is wasted	0.07	0.10	-0.03	0.09	0.06	0.03	0.93	0.92	0.01
Child mortality	0.07	0.12	-0.05	0.05	0.04	0.01	0.93	0.88	0.05
Age at first marriage	18.01	17.59	0.42	0.01	0.02	-0.01	0.08	0.08	0.00
Ideal number of children	5.93	6.54	-0.61	0.10	0.08	0.02	0.32	0.26	0.06

Source: Own calculation based on the EDHS 2000 and 2011.
Note: Sample is restricted to mothers aged 15 and above. Both the regional and vertical inequality measures are based on the gini coefficient.