EDUCATIONAL EXPANSION AND HEALTH DISPARITIES IN ETHIOPIA, 2005–2016

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Abstract

Research shows that basic education improves population health, yet it remains unclear whether the expansion of primary education decreases health disparities. In this paper, I assess whether disparities in healthcare utilization decreased in conjunction with educational expansion among women of reproductive age in Ethiopia. Healthcare utilization rates in low-resource countries are often confounded with simultaneous developments in education and access to basic healthcare. Using decomposition of rates, I first disentangle the changes in health disparities induced by educational expansion from the overall increase in healthcare utilization. Then, I use the Blinder-Oaxaca decomposition method to investigate the determinants of disparities in healthcare utilization and how these determinants changed over a 10-year period as primary education became more prevalent. Overall, disparities in healthcare utilization in Ethiopia decreased over time, yet the association between educational expansion and health disparities varies by region. Literacy explains much of the disparities in healthcare utilization, yet it loses significance over time as primary education becomes widespread. Economic factors remain persistent sources of disparities, and non-financial barriers such as the distance to travel and women's ability to travel alone become more significant. Heterogeneity in healthcare utilization across regions has distinct implications for how educational expansion may shift health disparities.

Keywords: Ethiopia, educational expansion, health disparities, decomposition analysis, determinants of inequality

Introduction

Education plays a vital role in improving public health. Numerous studies, both associative and causal, confirm that even a few years of primary education leads to better health outcomes (Armer and Yourtz, 1971; Baker et al., 2011; Behrman, 2015; Hahn and Truman, 2015). Women's education is particularly important in low-resource settings, as it promotes community health through spillover effects. For example, living in communities with a higher percentage of literate women is associated with lower under-five mortality and higher child vaccination rates across low-income countries (Burroway and Hargorove, 2018; Smith-Greenaway, 2017). As a result, the Millennium Development Goals and the Sustainable Development Goals prioritize universal primary education as a "foundation to improving people's lives" (United Nations, 2018).

As international communities have worked to promote basic education, what has largely been missing in this discourse is whether educational expansion dampens health disparities. That is, does the march toward universal primary education reduce one of the most persistent disparities across societies? Despite ample evidence on the stratifying effects of education, little research elaborates the more complex association between educational expansion and health disparities. On one hand, education is a positive social intervention designed to instill the general population with a common set of knowledge and skills, which should reduce health disparities (Caldwell, 1980; Ram, 1990). On the other hand, education may perpetuate—in some cases even increase—disparities by reshaping existing social hierarchies and introducing new institutional determinants of disparities (Beckfield and Olafsdottir, 2013; Meyer, 1977). The association between educational expansion and health disparities is thus difficult to predict, especially when education expands without adequate social infrastructure and resources. This makes schools less

discriminating, yet not strong enough to engender massive shifts in societies to fully eliminate selection effects (Foster, 1980). Moreover, educational expansion in low-resource countries is usually accompanied by other aspects of social development, shifting the social landscape across multiple sectors (Barber, 2004). These simultaneous developments can obscure or bias what is known about the effects of education on health disparities in places where educational expansion is rapidly reshaping the social landscape.

My study extends the previous literature by assessing the association between educational expansion and health disparities in Ethiopia. Ethiopia is an ideal case for advancing research on this topic for a number of reasons. First, Ethiopia underwent recent improvements in education and health that resulted in large-scale institutional changes. Second, its decentralized administration system provides enough variation across 11 regions (Tesema and Braken [2017] categorize these regions as urban Central [Addis and Dire Dawa], semi-rural Established [Amhara, Harari, Oromia, Southern Nations, Nationalities, People's Regions (SNNPR), and Tigray], and agro-pastoral Emerging [Affar, Benishangul-Gumuz, Gambela, and Somali]) to explore diverse contextual effects on health disparities while effectively accounting for unobserved confounders—a key concern for cross-national studies. Third, regional inequality in Ethiopia is high and provides heterogeneous social settings—from highly urbanized Central regions to impoverished Emerging regions—in which to effectively test hypotheses.

I first use decomposition of rates to examine whether inequality in healthcare utilization among women changed with the expansion of education, and how much of this change can be attributed to an increase in the percentage of women with formal education. Decomposition of rates is a useful tool because it parses health disparities into two components—one attributable to

the change in educational composition and another attributable to the change in access to healthcare.

In addition, I use Blinder-Oaxaca decomposition to identify potential determinants of health disparities and explore how their role evolves over time. Previous studies based on cross-sectional analysis have identified important sources of health disparities, including economic factors and cultural barriers (Bado and Susuman, 2016; Marmot, 2005; O'Donnell, 2007). However, this work does not tell us how these sources change along with educational expansion and other social changes. I explore three major sources of disparities in healthcare utilization—economic factors, literacy, and non-financial barriers—over a 10-year period. The decomposition method provides evidence that can be used to guide decisions about how to allocate resources to reduce health disparities.

Educational Expansion and Health Disparities

Within-country health disparities across educational groups are persistent and substantial across the globe (Beckfield and Olafsdottir, 2013; Link and Phelan, 1995; Machkenbach, 2012). In low-resource countries that generally lack a basic healthcare system, education explains much of the inequality in health, independent of income and other measures of socioeconomic status (Baker et al., 2011; Lutz and Kebede, 201; Marmot, 2005). In this context, women's education yields important consequences for health disparities, as women must care not only for themselves but also for their children and other dependents (Yeatman et al., 2018). Countless studies show how women's education stratifies HIV infection rates (Behrman, 2015), child mortality (Bado and Susuman, 2016), and access to maternal healthcare services (Alam et al., 2015; Mezmur et al., 2017) across the Global South.

Health disparities across educational groups are persistent, but the relationship between educational expansion and health disparities is complex. Social development generates new dynamics in health disparities, and education is no exception (Baker et al., 2017; Deaton, 2003). In an institutional intervention framework, education promotes public health by disseminating common health knowledge, preventative behaviors, and cognitive skills that help individuals better detect and seek appropriate care (Hahn and Truman, 2015). According to this view, educational expansion should reduce health disparities because less educated individuals may still benefit from the positive contextual effects (Burroway and Hargrove, 2018). Indeed, previous studies have found that across the Global South, child mortality rates are negatively correlated with the percentage of the ever-educated population (Sosnaud and Beckfield, 2017) and the percentage of literate women in a given area (Smith-Greenaway, 2017).

In contrast to the institutional hypothesis, other lines of inquiry find that health disparities across educational groups tend to increase when new advancements or technologies are introduced to a population (Baker et al., 2017; Glied and Lleras-Muney, 2008). According to this view, social position is an irreversible cause of health disparities, as higher status allows individuals to take advantage of new resources (Link and Phelan, 1995). As education is introduced to the public, already advantaged individuals may benefit the most from new credentials and qualifications, further increasing disparities within the population. Confirming this perspective, educational expansion has been found to increase disparities in mortality rates across Europe (Ostergren et al., 2017). In summary, although some findings suggest that educational expansion will mitigate health disparities, other work leads us to expect health disparities will increase—if only temporarily—with educational expansion.

Sources of Health Disparities in a Rapidly Changing Society

The relationship between educational expansion and health disparities is obscure at best, and so are the sources of health disparities amid rapid social change. In sub-Saharan Africa, wealth is the single most important driver of inequality in access to healthcare (Bonfrer et al., 2014). Educational expansion reduces economic barriers to education, which, in turn, increases a population's overall living conditions, as poor families bear smaller costs of education (Breen et al., 2009). This reduced cost of education increases investments in health and nutrition (Erikson and Jonsson, 1996), further reducing healthcare costs. Accordingly, wealth should lose its significance as a determinant of health disparities as educational opportunities expand to a larger population.

Educational expansion also influences health disparities in sub-Saharan Africa through literacy. Literacy enhances individuals' ability to communicate and navigate through complex medical procedures and increases access to quality treatment (Meinert, 2009; Smith-Greenaway, 2013). However, as more people obtain formal education, literacy may lose its significance as a stratifying force and may, instead, assert a positive spillover effect within a community (Smith-Greenaway, 2017).

Cultural and geographic barriers may also drive health disparities in this context. In low-resource settings, educational credentials often manifest as cultural differences. Independent of actual skills acquired through education, Western education nurtures "modern" identities and provides new cultural hierarchies across educational groups (Armer and Youtz, 1971; Frye, 2012; Johnson-Hanks, 2002). These cultural differences manifest in large and small ways, ranging from an individual woman's ability to travel alone to visit a healthcare facility to the redefinition of traditional gender roles and the social relations that define who can access healthcare services (Woldemicael and Tenkorang, 2010).

Finally, the distance women must travel to receive treatment is another important determinant of healthcare utilization, generating stark disparities in access rates between rural areas and urban centers (Bobo et al., 2017; Masters et al., 2013; Okwaraji et al., 2015; Stock, 1983). Previous studies do not elaborate on how educational expansion might shift rural health disadvantages, but educational expansion in rural areas may improve physical accessibility to healthcare services, as educational expansion often accompanies general improvements in infrastructure (Barber, 2004). In summary, the complex nature of education and health disparities leaves open many questions about what to expect in low-resource countries as education becomes more readily available.

General Healthcare Utilization as an Indicator of Inequality

Staple population-health measures, such as the under-five mortality rate and life expectancy, accurately capture changes in population health over longer periods of time, but these measures may not be sensitive to rapid changes that happen within a decade (Etches et al. 2006). In this study, I focus on general healthcare utilization in the past 13 months for three reasons. One, this measures the immediate incidences of disparities and parses out other confounders that may accumulate over the life course to generate lagged health outcomes. Two, general healthcare utilization captures disparities in access to both preventative and curative healthcare. Although healthcare utilization assesses just one occasion of disparity, recent studies show it is robust in capturing tangible outcomes (Arunda et al. 2017; Raatikainen et al., 2007; Regassa, 2011). Appendix A further verifies how general healthcare utilization is positively associated with child vaccination and postnatal care and negatively associated with women's anemia. Three, general healthcare utilization fully captures women's age-specific needs for healthcare, including access to modern contraceptives, pregnancy and birth-related care, and

children's healthcare. I argue that general healthcare utilization is not primarily an indicator of poor health, as shown in Appendix A, but an indicator of inclusion in the vital social system essential to women of reproductive age.

Study Setting: Primary Education and Healthcare in Ethiopia

Despite several nationwide initiatives to promote basic education, Ethiopia still lags behind other developing countries in key indicators. Primary education in Ethiopia consists of two four-year cycles, totaling eight years. Since 1994, the Ethiopian federal government has made primary education free and compulsory for all children, and they have increased net enrollment rate from 20% in 1994 to 86% in 2015. During this time, the number of elementary schools tripled (Tesema and Braken, 2017). However, rapid population growth over the past decades has overburdened the system and created a slew of new problems, such as funding shortages and deterioration of quality. Women's primary school enrollment rate is disproportionately low. As of 2016, roughly half of women have received no formal education, and only 4% have completed beyond secondary school (CSA/Ethiopia, 2017).

Ethiopia has one standardized curriculum at the national level, but decentralized policy requires that each of the 11 regions localize their curricula and make independent contributions to their budgets. This creates enormous disparities across regions: 96.3% of the poor are concentrated in Emerging regions, whereas poverty rates in Central regions are less than half of the national average. These variations correlate with the quantity and quality of education available within each region. To address regional imbalance and increase enrollment among disadvantaged children in pastoral communities, the federal government started the Emerging Regions Development Project (ERDP) in 2007 and pushed alternative basic education systems and innovations in mobile schools (Bishaw and Lasser, 2012). However, regional variations in

access to primary education still persist due to rampant child labor, girls' early marriage, frequent armed conflicts, and climate-induced migration (Engel and Pauline 2011).

Regional differences in warfare, natural disasters, and political atmosphere directly translate into the availability of resources and the strategic adaptation of healthcare services (Ali, 2014; Khan et al., 2017; Onarheim et al. 2015). Within each region, healthcare is delivered via a three-unit referral system that links satellite health posts, district health centers, and primary hospitals with advanced medical facilities. In 2001 and 2009, the Ethiopian government launched a series of Health Sector Development Programs (HSDPs) in conjuncture with an international effort to expand basic healthcare services (Wasami, 2009). However, as with primary education, the government's push toward a more decentralized, autonomous regional healthcare system left many rural health centers and clinics severely under-budgeted and under-utilized (United Nations Population Fund, 2012). Quality healthcare facilities, the physician workforce, and public health expenditures are disproportionately concentrated in urban districts; fewer than half of rural residents live within walking distance of a healthcare facility (Woldemichael et al., 2019). As of 2016, only 38% of pregnant women received adequate antenatal care, and only 26% of pregnant women gave birth in health facilities (CSA/Ethiopia, 2017). These figures are among the lowest in the world, along with Afghanistan, Bangladesh, Nigeria, Somalia, and Sudan (The World Bank, 2019).

Data

I use data from the three most recent rounds of the Ethiopian Demographic and Health Survey (EDHS), fielded in 2005, 2011, and 2016. The DHS fields nationally representative surveys in more than 90 developing countries, collecting comprehensive data on population, health, HIV, nutrition, literacy, and many other aspects of household and community-level

dynamics. Pooled together, EDHS surveyed a total of 46,268 women between the ages of 15 and 49. I use listwise deletion to exclude 2.4% of the total sample whose answers are missing on one or more key variables used in the analysis. Thus, my analytic sample includes 45,180 women. For decomposition analyses, I primarily use the EDHS from 2005 and 2016, which include 29,238 observations.

Outcome Variable

The primary outcome of interest in this study is healthcare utilization. Healthcare utilization is measured as a dichotomous variable indicating whether a woman visited any type of health facility in the past 13 months (adjusted for the Gregorian calendar) for her own illness or that of a child.

Key Explanatory Variable

The key explanatory variable is the percentage of women with any formal schooling. To construct this, I created a dichotomous variable using women's years of formal schooling. A value of one indicates a woman completed one or more years of school; zero indicates no formal schooling. A dichotomous classification of any education has several advantages over categorical or numeric measures of attainment, because I am primarily concerned with capturing changes in educational credentials and societal norms associated with educational expansion, rather than the effect of increased levels of schooling. A dichotomous classification is also more appropriate in this setting because only 37% of the analytic sample received any formal education in 2005, and two years of primary education falls in the 70^{th} percentile of the distribution. The percentage of a population with any formal schooling has been widely used in other studies to examine the contextual effect of education as it provides a clear reflection of educational expansion (Moultrie, 2014; Netuveli and Bartley, 2012; Frye and Lopus, 2018).

Economic Factors

I use three distinct measures from the EDHS to measure multiple dimensions of economic differences between women with and without any schooling: household wealth, the existence of financial barriers to healthcare utilization, and a woman's employment status. For household wealth, the DHS categorizes households into five quantiles after constructing an index based on household assets and service amenities, such as electricity and access to clean water.

EDHS uses a multiple-response question to identify barriers to healthcare. For each barrier, women indicate whether it "is a big problem or not a big problem." To identify financial barriers to healthcare utilization, I code as one any woman who states that "getting money needed for advice or treatment" would be a "big problem." Household wealth and financial barriers are related but capture different aspects of economic standing ($r = 0.27$). The wealth index measures a household's relative economic status, whereas financial barriers to healthcare captures the availability of cash in times of need and individual women's ability to manage finances. A woman's employment status is also dichotomous: a value of one indicates a woman is engaged in any income-generating activities other than housework and subsistence farming.

Literacy

Literacy is measured as a dichotomous variable and is coded one if a woman can partially or fully read a sentence in her preferred language. Literacy is highly correlated with women's formal schooling ($r = -0.80$); however, it is an important measure to include given that years of education often do not predict a woman's ability to read, due to the poor quality of education (Smith-Greenaway, 2013).

Non-financial Barriers

I include a heterogeneous category of non-financial barriers to healthcare utilization that are well established in the literature. Similar to financial barriers to healthcare utilization, a geographic barrier exists for women who report the travel distance to a health facility as being a "big problem." To supplement this, I include a dichotomous variable indicating rural residence. Cultural barriers exist for respondents who say (1) getting permission to travel and (2) not wanting to go alone are "big problems" when visiting a health facility. Appendix B provides mean values for each variable included in the analysis.

Methods

Disparities in Healthcare Utilization

To assess the direction and magnitude of the association between educational expansion and health disparities, I first calculate the relative inequality in healthcare utilization between women with and without formal schooling using the concentration index (CI). Epidemiologists have widely used the concentration index to measure dichotomous health outcomes, due to its clearly defined range and its ability to distinguish the "beneficiary" group, in contrast to other commonly used measures of inequality (Etches et al., 2006; Regidor, 2004; Saidi and Hamdaoui, 2017). The generic formulation for the concentration index is as follows:

$$\mathrm{CI} = \frac{2}{r}\left[\sum_{j=0}^{j} w_j r_j R_j\right] - 1$$

Where,

j refers to each educational group (two groups),

$\boldsymbol{w_j}$ is the proportion of educational group *j*,

$\boldsymbol{r_j}$ is the healthcare utilization rate for group *j,* and

$\boldsymbol{R_j}$ indicates the relative rank of each educational group, defined as

$$R_j = \sum_{j=0}^{j} P_r - \frac{1}{2} P_j$$

where P_r is the cumulative share of the population including group *j*. The concentration index ranges from -1 to 1, and is 0 when healthcare utilization is evenly distributed across the population. A positive CI closer to 1 indicates a higher concentration of healthcare utilization among women with formal schooling; a CI closer to -1 indicates a higher concentration of utilization among women without formal schooling. For the purpose of this paper, I treat values between -1 and 0 as meeting equality in healthcare utilization.

Then, I decompose changes in the healthcare utilization rate between 2005 and 2016 using a standard decomposition method:

$$\Delta\, rate \;=\; \sum_{j=0}^{j} \Delta w_j \overline{r_j} + \overline{w_j} \Delta r_j$$

where $\boldsymbol{w_j}$ is the proportion of each educational group *j,* and

$\boldsymbol{r_j}$ is the healthcare utilization rate for group *j.*

The decomposition of rate method assesses the extent to which changes in health disparities are attributable to a change in the percentage of the population with any education, and the extent to which they are attributable to changes in the rate of healthcare utilization across educational groups. The first term captures the contribution of educational expansion, and the second term captures the role of an improved healthcare system.

Sources of Disparities in Healthcare Utilization

I use the Blinder-Oaxaca decomposition to analyze changes in the sources of health disparities between women with and without formal schooling. This technique uses separate regression models to estimate healthcare utilization for each group (educated and uneducated):

$$y_{educated} = \beta_{educ} X_{educ} + \varepsilon_{educ}$$
$$y_{uneducated} = \beta_{noeduc} X_{noeduc} + \varepsilon_{noeduc}$$

where *y* is the healthcare utilization for each educational group, and **X** is a vector of determinants such as economic factors and literacy. The difference in the mean outcome between the two can be written as follows:

$$\bar{y}_{educ} - \bar{y}_{noeduc} = (\bar{X}_{educ} - \bar{X}_{noeduc})\hat{\beta}_{educ} + \bar{X}_{noeduc}(\beta_{educ} - \beta_{noeduc})$$

The first part of the equation identifies the proportion of health disparities explained by the differences in **X,** and the second part identifies the proportion of disparities that cannot be explained by the differences in **X**. This "unexplained portion"—differences induced by the elasticity (β) rather than ***X***—is widely used as a proxy measure for inequality (O'Donnell et al. 2008). Because the outcome variable is dichotomous, I use nonlinear decomposition methods proposed by Sinning, Hahn, and Bauer (2003). I run a total of 22 models comparing women with and without formal schooling in each of the 11 regions for the baseline (2005) and the endline (2016) to compare the relative role of each determinant across time and region.

Results

General Trends in Primary Education and Healthcare Utilization in Ethiopia, 2005–2016

First, I lay out general trends in educational expansion and healthcare utilization in Ethiopia from 2005 to 2016 to illustrate rapid social changes during this period. Table 1 presents changes in the percentage of women with formal schooling and healthcare utilization rates in each region. At the national level, the percentage of women with formal schooling greatly increased over the past decade, from 37% in 2005 to 54% in 2016. In urban Central regions, more than half of women are formally educated, whereas Emerging regions (Affar and Somali)

have the smallest percentage of ever-educated women in 2005. Between 2005 and 2016, all regions in Ethiopia achieved notable educational expansion, with nearly 30 percentage-point increases in three regions (Benishangul-Gumuz, SNNPR, and Gambela). A few regions still lag behind the national average, with less than 30% of women having ever attended school, but Addis Ababa is close to universal primary education, with over 90% of women having at least one year of formal schooling.

[Table 1 about here.]

From 2005 to 2016, women's healthcare utilization rate increased from 24% to 43%. Similar to education, in 2005, two Emerging regions (Gambela and Somali) had the lowest healthcare utilization rates of 17% and 7%, whereas Addis Ababa had the highest rate of 44%. By 2016, the facility utilization rate increased to 21% and 57% in Somali and Addis Ababa, respectively. The greatest improvements came from Dire Dawa (24 percentage-points), Gambela (26 percentage-points), and Tigray (30 percentage-points).

Figure 1 shows detailed changes in healthcare utilization among women in a lexis diagram: utilization rates for women with at least one year of education are presented in bold. Healthcare utilization improved among women of all educational groups and birth cohorts. For instance, among respondents age 20 to 24, 23% of women without formal schooling and 36% of women with at least one year of schooling visited a health facility in 2005. Following the dotted diagonal line, facility utilization rates for the same cohort of women rose to 35% (uneducated) and 53% (educated) at ages 25 to 29, and to 45% (uneducated) and 63% (educated) at ages 30 to 34. The overall facility utilization rate increased even after controlling for age-specific demands for pre- and postnatal healthcare services. For example, only 23% of women age 20 to 24 without formal schooling utilized a health facility in 2005. Following the horizontal line,

utilization rates for the same age group increased to 30% in 2011 and 37% in 2016 (for women with formal schooling, utilization rates rose from 35% in 2005 to 52% in 2016). In summary, healthcare utilization rates increased for women with and without formal education during this period, and the lexis diagram conveniently shows changes in healthcare utilization rates regardless of age-specific needs across birth cohorts.

[Figure 1 about here.]

Decomposition of Disparities in Healthcare Utilization

Table 2 presents the concentration index (CI) for healthcare utilization and how educational expansion contributes to disparities between women with and without formal schooling. The first two columns show the CI for each region in 2005 and 2016. Negative indices indicate higher rates of utilization among women without formal schooling. In 2005, only one region (Tigray) had a negative CI. Overall, disparities in healthcare utilization in 2005 were moderate, with a concentration index of 0.061 at the national level. Disparities in healthcare utilization were higher in Emerging regions compared to Central and Established regions. However, the magnitude of disparities varied substantially across regions, ranging from 0.013 (Amhara) to 0.175 (Gambela).

[Table 2 about here.]

By 2016, disparities in healthcare utilization decreased by 67% at the national level. In Gambela, where inequality was the highest in 2005, the CI dropped to 0.046 (74% decrease). Amhara and SNNPR reached equality in healthcare utilization. However, in Dire Dawa and Harari, disparities in healthcare utilization increased substantially (31% and 218%, respectively). Over a 10-year period, health disparities in Ethiopia diverged despite an overall increase in healthcare utilization at the national level.

How much of the change in regional health disparities can be attributed to educational expansion? Column 4 of Table 2 shows the percentage of change in healthcare utilization attributed to an increase in the number of women with formal schooling, and column 5 shows the percentage of change attributed to an increase in the overall healthcare utilization rate across educational groups. At the national level, 94% of the change in healthcare utilization is accounted for by an increase in the healthcare utilization rate. Educational expansion accounts for 6% of the change in healthcare utilization. The effect of educational expansion is larger in Emerging regions. In Somali, for example, the change in the size of the educated population accounts for 15% of the change in health disparities. Disparities in healthcare utilization in Somali decreased from 2005 to 2016, suggesting that educational expansion contributed to reduced health disparities. However, in some regions, educational expansion contributed to increased health disparities; the increase in the size of the educated population had a stratifying effect in Dire Dawa (11.37%), as the region saw an increase in health disparities. In Tigray and Amhara, the sign for educational expansion is negative, indicating that educational expansion would have increased health disparities if the healthcare utilization rate remained constant.

As with educational expansion, improved healthcare access works in two directions. In most regions, improved accessibility reduces disparities in healthcare utilization. Harari and Dire Dawa are two exceptions: disparities in healthcare utilization increased with the overall improvement in access to healthcare. These decomposition results underline three important findings. First, educational expansion does not always decrease health disparities and may aggravate inequality under certain conditions. Moreover, the results stand in contrast to the previous findings and show that educational expansion has relatively little influence on health disparities. Second, social development in multiple sectors has mixed consequences for health

disparities. Sometimes, two sectors work in opposite directions, and the size of their contributions is not consistent in times of rapid social change. Third, regional variation in health disparities is substantial, and so is the role of educational expansion in Ethiopia, where education and health policies are administered at the regional level.

Sources of Health Disparities during Rapid Social Change

Using the Blinder-Oaxaca decomposition, I further examine how various factors contribute to disparities in healthcare utilization and how their contributions change over time. For conciseness, I report the average contribution of each determinant by categories (economic factors, literacy, and non-financial barriers) and present the full results in an Appendix. Figure 2 shows changes in the explanatory power of each category at the national level. In 2005, at the national level, economic factors were the largest source of health disparities between women with and without any schooling. Literacy also explained much of the disparities in 2005: the difference in literacy between women with and without formal schooling accounted for roughly 40% of the disparities in healthcare utilization. Non-financial barriers had a negative explanatory role in 2005, counterbalancing the effects of other determinants. By 2016, literacy was no longer a major source of health disparities, but economic factors still explained much of the disparities in healthcare utilization. Unlike 2005, non-financial barriers now contributed to health disparities. In addition, the unexplained portion of health disparities more than tripled in 2016.

[Figure 2 about here.]

However, the national average presented in Figure 2 masks regional variations and does not explain why health disparities decreased in some regions but increased in others. I thus turn to Figure 3, which presents contributions of each source by region. Variables stacked on the right

side contribute to health disparities; sources listed on the left side mitigate disparities. The size of disparities in healthcare utilization is shown by subtracting the total width of the bars on the left (negative) from the total width of the bars on the right (positive).

[Figure 3 about here.]

Similar to the national average, the difference in economic factors across educational groups explained a bulk of regional health disparities in 2005, with the exception of Somali. In 2016, economic differences remained a major source of disparities in most regions, particularly in Affar. The contribution of economic factors either remained relatively constant (Dire Dawa) or lessened (Harari) in two regions where health disparities increased between 2005 and 2016. This finding suggests that stark increases in health disparities in these two regions were not triggered by economic factors. Interestingly though, economic factors became major sources of disparities in rural regions with relatively low levels of educational attainment in 2016. These regional differences in the contribution of economic factors may be attributable to women's employment prospects. Detailed analysis in Appendix C suggests that in urban regions, women's employment status mitigates the effect of household wealth, whereas in rural regions, it complements the stratifying effect of household wealth. Generally, employment opportunities for uneducated women are more readily available in cities like Addis Ababa and Dire Dawa, and employment opportunities for all women are limited in Emerging regions such as Affar. This suggests that when women's economic opportunities are limited, health disparities are often pronounced. In summary, economic factors are stubborn sources of disparities in healthcare utilization, even after improvements in overall access to healthcare and educational expansion.

Literacy, on the other hand, works differently from economic factors. When formal schooling among women was relatively scarce in 2005, literacy explained much of the regional

disparities in healthcare utilization. In 2016, however, the role of literacy reversed in many regions as formal schooling became more prevalent. This finding is indicative of the positive contextual effect of education found in previous studies (Smith-Greenaway 2017). Interestingly though, the counterbalancing effect of literacy is not necessarily higher in regions with larger proportions of educated people. For example, literacy is still a substantial source of disparities in Addis Ababa, where 91% of women are formally educated and 89% of women are literate. This may be due to the crude construction of the literacy measure; however, regardless of the magnitude, literacy has become an equalizing force in most regions.

Non-financial barriers, such as geographic accessibility and women's ability to visit healthcare facilities, were significant sources of inequality in 2005, most notably in Emerging regions. This is not surprising given that these regions had the lowest accessibility to healthcare due to frequent armed conflicts and poor infrastructure. In Central regions, on the other hand, non-financial barriers mitigate disparities in healthcare utilization. In 2016, the effect of geographic accessibility was almost negligible in most regions. However, cultural barriers in willingness to travel alone and getting permission to travel were persistent sources of disparities at the regional level. This suggests that changing social norms via education is slower to close the gap in health behavior than are physical improvements in accessibility.

The most notable difference between 2005 and 2016 is the increase in the unexplained portion of disparities in healthcare utilization. In 2005, the unexplained factor is mostly stacked on the negative side, mitigating health disparities stemming from other factors. However, in 2016, its contribution shifted in many regions, with the unexplained force now contributing to health disparities. The drastic increase in health disparities in Dire Dawa and Harari mostly stem from these unexplained factors, which may include higher demand for healthcare among

uneducated women (if they are less healthy than their educated counterparts) or distrust in the healthcare system if the quality of care is compromised due to resource strain. Although healthcare utilization became more evenly distributed across educational groups, the increase in the role of unexplained factors signals that unforeseen factors may shift health disparities in the future.

Conclusion

Evidence from Ethiopia shows that educational expansion and overall improvement in healthcare systems have important consequences for health disparities. At the national level, disparities in healthcare utilization declined between 2005 and 2016 in Ethiopia. However, educational expansion is a localized process that has mixed effects: as education expanded, disparities in healthcare utilization declined in some regions yet were exacerbated in others. This finding supports earlier work showing that social development can take place without compensating for health equality. It also directs our attention to the unintended consequences of social development, which may increase inequality (Ram, 1990). This is particularly salient in places like Ethiopia where rapid social changes are happening in multiple sectors, redefining long-standing social structures and hierarchies.

Blinder-Oaxaca decomposition tools identify various sources of health disparities and their changing roles in the midst of rapid educational expansion. Financial factors consistently contribute to disparities in healthcare utilization. Literacy, on the other hand, plays a contingent role: once formal education becomes prevalent, literacy mitigates disparities in healthcare utilization. Non-financial barriers have mixed roles in shaping health disparities. Geographic accessibility mitigates disparities as access to healthcare improves. However, the gap in women's autonomy and ability to seek healthcare services widens disparities between women with and

without formal schooling. These findings, along with an increase in the "unexplained" portion, indicate that educational expansion has multifaceted roles, and scholars must investigate the shifting relationship between educational expansion and health disparities.

Regional diversity further uncovers the dynamics of educational expansion and health disparities within a population. Most previous studies use country as the unit of analysis and overlook within-country variations. However, results from this study indicate that regional variations in health disparities are substantial, and so are the consequences of educational expansion in each region. This adds to recent scholarly efforts to highlight the meso level as an important source of variation (Burroway and Hargrove, 2018). Sub-national analysis is particularly important in sub-Saharan Africa, where single countries consist of diverse environments, political interests, and populations. Regional-specific analysis might reduce generalizability of the findings; however, investigation of institutional influence on education and health disparities identifies other important mechanisms that are often unobserved in survey data.

At the policy level, the relative importance of educational expansion in shaping health disparities is worth mentioning. There is ongoing debate over whether basic healthcare systems weight more than education in shaping population health. In industrialized countries, studies show that education weighs far more than healthcare systems in shaping later-life health disparities (Preston 1975; Hendi 2015). However, at least in the context of Ethiopia, access to healthcare contributes far more to decreasing disparities in healthcare utilization, and this highlights the importance of basic health infrastructure in low-resource countries (Memirie et al., 2016; Mladovsky and Ba 2017; O'Donnell 2007). Of course, results from the decomposition analyses should not be interpreted in causal terms, and this study's findings do not indicate that

improving healthcare systems dampens health disparities. However, decomposition methods do identify dominant factors behind the changes in health disparities and provide vital insight into how social determinants change over time. Accounting for the role of healthcare systems, policymakers could devise more effective solutions to promote population health.

Some limitations should be noted. Supplementary analyses show that general healthcare utilization is correlated with both preventative and curative care within the sample. Nonetheless, general healthcare utilization only measures access to healthcare among women of reproductive age and does not directly address health disparities in terms of illness and health outcomes. Healthcare utilization among less educated women may stem from their higher fertility and burden of disease, although no evidence is found that this is the case. Moreover, this study investigates changes in health disparities within a short period of time and cannot assess how educational expansion shifts health disparities over a longer term. With its diverse educational contexts, the Ethiopian case may illustrate a possible course of educational health disparities, yet more rigorous longitudinal analysis is necessary to disentangle the causal pathways across multiple time horizons.

From an equality standpoint, the current distribution of healthcare access in Ethiopia is neither dire nor optimal. Healthcare utilization is rising for both educated and uneducated women in Ethiopia, even in the most impoverished Emerging regions. Furthermore, educational health disparities, at least as operationalized by the concentration index of healthcare utilization, have been reduced in many, but not all, regions. However, if efforts to promote universal education generate a new group of "truly disadvantaged," as people without education are increasingly becoming an excluded group (Dowd and Hamoudi, 2014), educational expansion may stigmatize people who are left behind, creating status anxiety and other relative deprivation that will have

tangible consequences on health outcomes (Layte and Whelan, 2014). Policymakers and development practitioners should thus attend to the multifaceted roles of educational expansion and approach it with much preparation and caution to ensure equality is not compromised in the process. As Wilkinson and Pickett (2011) once argued, it would be healthier for both advantaged and disadvantaged to live in an equal society.

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Table 1: Changes in Primary Education and Healthcare Utilization in Ethiopia, 2005–2016

	Proportion with education			Healthcare Utilization		
Region	2005	2016	Diff.	2005	2016	Diff.
Central Regions						
Addis Ababa	0.82	0.91	0.09	0.44	0.57	0.13
Dire Dawa	0.56	0.68	0.12	0.24	0.48	0.24
Established Regions						
Amhara	0.24	0.44	0.20	0.26	0.44	0.18
Harari	0.57	0.65	0.08	0.27	0.42	0.15
Oromia	0.33	0.49	0.16	0.26	0.38	0.12
SNNPR	0.35	0.56	0.21	0.22	0.35	0.13
Tigray	0.33	0.57	0.24	0.25	0.55	0.30
Emerging Regions						
Affar	0.12	0.26	0.14	0.25	0.42	0.17
Benishangul-Gumuz	0.28	0.49	0.21	0.25	0.45	0.20
Gambela	0.41	0.68	0.27	0.17	0.47	0.30
Somali	0.07	0.25	0.18	0.07	0.21	0.14
NATIONAL	0.37	0.54	0.17	0.24	0.43	0.19

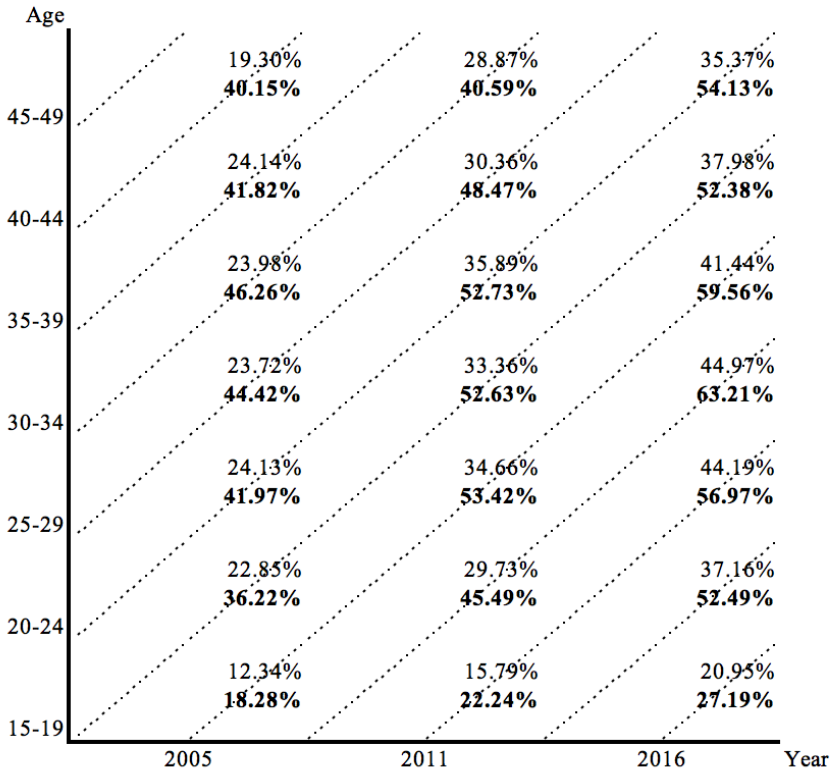
Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016.

Table 2: Concentration Indices (CI) for Healthcare Utilization by Region and Year

Healthcare Utilization					
Region	Concentration Index		Percentage change in CI over time	Changes due to:	
	2005	2016		Educational expansion	Difference in uptake
Central Regions					
Addis Ababa	0.038	0.012	-68.7%	7.9%	92.1%
Dire Dawa	0.028	0.037	31.4%	11.4%	88.6%
Established Regions					
Amhara	0.013	-0.038	-392.9%	-2.7%	102.7%
Harari	0.018	0.057	217.7%	3.0%	97.0%
Oromia	0.056	0.007	-86.7%	3.4%	96.6%
SNNPR	0.075	-0.010	-112.7%	4.6%	95.4%
Tigray	-0.024	-0.027	16.4%	-3.4%	103.4%
Emerging Regions					
Affar	0.045	0.031	-38.0%	7.8%	92.2%
Benishangul-Gumuz	0.131	0.012	-91.2%	9.5%	90.5%
Gambela	0.175	0.046	-73.6%	9.7%	90.3%
Somali	0.117	0.088	-24.9%	14.6%	85.4%
NATIONAL	0.061	0.020	-67.21%	6.0%	94.0%

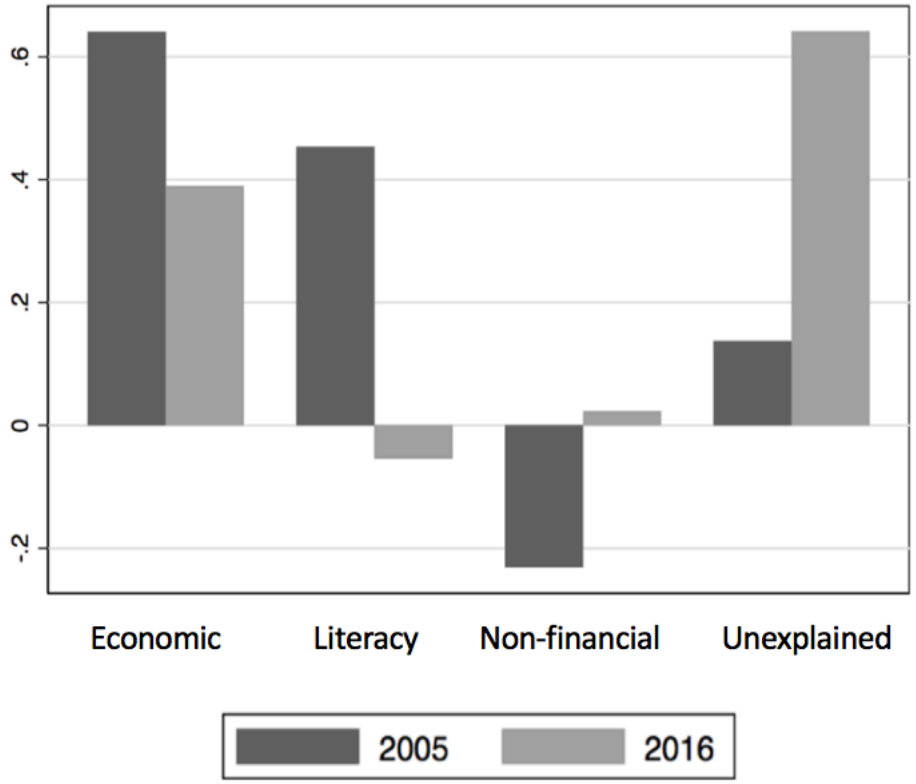
Notes: Substantively, these results are robust to two sensitivity analyses: (1) using two years of education as a threshold and (2) restricting the analytic sample to women who have given birth in the 12 months prior to the survey (N=7,186). Analyses not shown, available upon request.
Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016.

Figure 1: Facility Utilization in Ethiopia, by Age, Cohort, and Period for Women with and without Formal Education



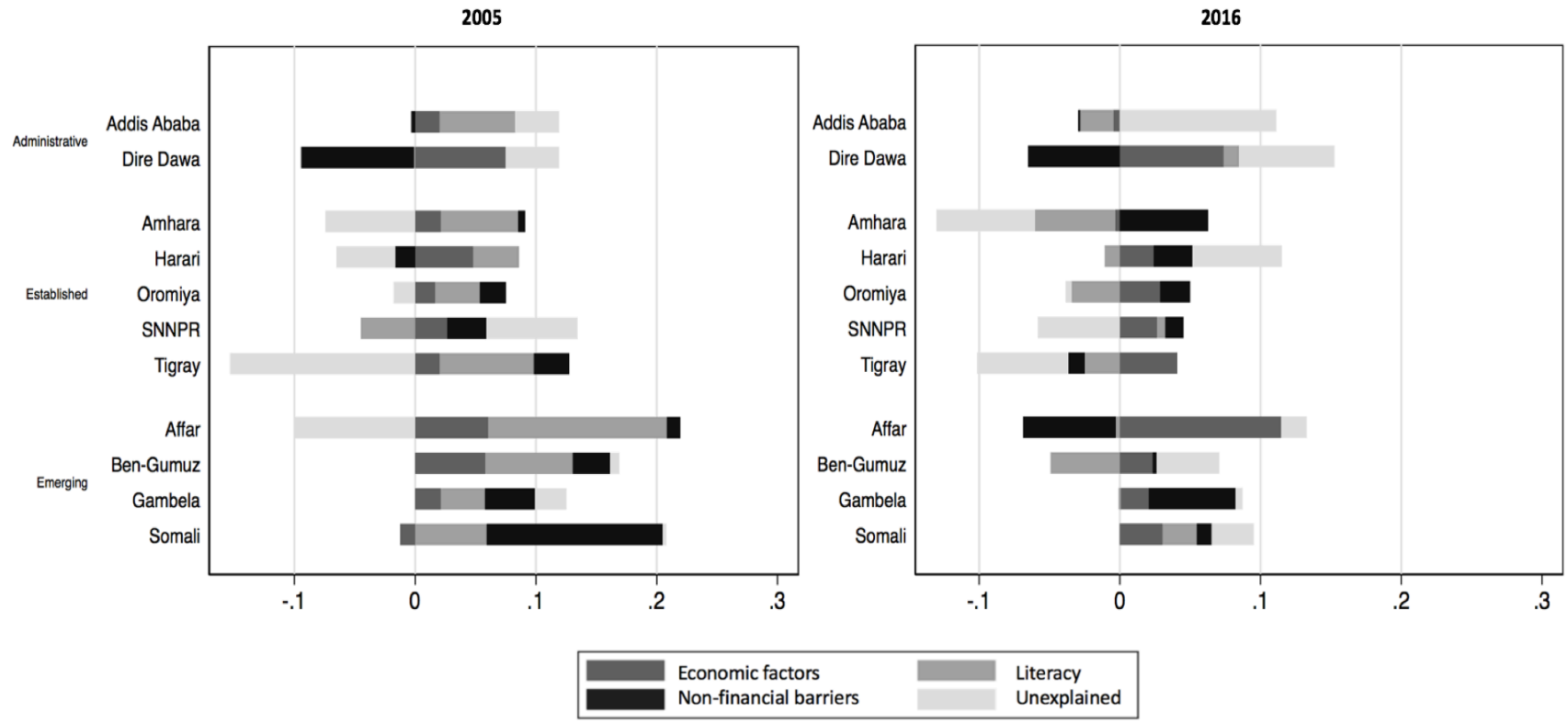
Notes: Facility utilization rates for women with at least one year of formal education are bolded.
Source: Ethiopian Demographic and Health Survey (EDHS), 2005, 2011, and 2016.

Figure 2: Sources of Disparities in Healthcare Utilization at the National Level, 2005 and 2016



Notes: The figure shows the percentage of disparities in healthcare utilization explained by each of four factors.
Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016.

Figure 3: Sources of Disparities in Healthcare Utilization over Time by Region



Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016.

Appendix A: Association between Preventative and Curative Health Outcomes and Healthcare Utilization in the Past 12 Months

	Women's anemia		Any vaccination for any child		Postnatal care after any birth	
Visited health facility in 12 months	-0.06 (0.03)	*	0.54 (0.04)	***	0.51 (0.06)	***
Education						
No education	(base)		(base)		(base)	
Primary	0.25 (0.03)	***	0.47 (0.05)	***	0.49 (0.07)	***
Secondary	0.28 (0.05)	***	0.42 (0.13)	***	1.24 (0.09)	***
Higher	0.40 (0.07)	***	0.21 (0.21)		1.80 (0.17)	***
Age (5-year groups)	0.00 (0.01)		0.00 (0.02)		0.07 (0.03)	*
Rural residence	-0.39 (0.05)	***	-0.25 (0.09)	**	-1.22 (0.09)	***
Wealth quantile	0.09 (0..01)	***	0.11 (0.02)	***	0.29 (0.03)	***
Number of living children	-0.01 (0.01)		0.06 (0.01)	***	-0.10 (0.02)	***
Pregnancy in the past 12 month	-0.26 (0.03)	***	-0.66 (0.04)	***	0.11 (0.06)	
Constant			1.27 (0.14)	***	-1.28 (0.19)	***
Control for region	X		X		X	
N	35,960		14,304		14,304	

*Notes: Table above reports coefficients from three logistic and ordered logistic models. *** p<0.001; ** p < 0.01 ; * p<0.05 Sample was restricted to women with children under 5 for child vaccination and post-natal care. Each model is controlled for region with Tigray as a reference.*
Source: Ethiopian Demographic and Health Survey (EDHS), 2005, 2011, and 2016

Appendix B: Summary of Variables by Educational Groups, 2005 and 2016

	2005			2016		
	Uneducated	Educated		Uneducated	Educated	
Healthcare utilization	0.22	0.32	***	0.39	0.46	***
Wealth						
Wealth index	2.72	4.29	***	2.40	3.90	***
Financial barrier	0.81	0.56	***	0.63	0.41	***
Employment	0.68	0.60	***	0.56	0.47	***
Literacy	0.02	0.87	***	0.03	0.81	***
Geographical/Cultural						
Rural residence	0.87	0.40	***	0.87	0.48	***
Distance to travel	0.72	0.43	***	0.57	0.36	***
Permission to travel	0.34	0.19	***	0.34	0.23	***
Traveling alone	0.61	0.45	***	0.44	0.30	***
N	8,365	5,484		7,018	8,371	

*Notes: T-tests results show the difference between women with and without formal education in both points in time; : *** p<0.001; ** p < 0.01 ; * p<0.05*
Source: Ethiopian Demographic and Health Survey (EDHS), 2005 and 2016

Appendix C: Full Decomposition Results by Region, 2005

	Administrative		Established					Emerging			
	Addis Ababa	Dire Dawa	Amhara	Harari	Oromiya	SNNPR	Tigray	Affar	Ben-Gumuz	Gambela	Somali
Utilization rate for educated	0.467	0.248	0.273	0.282	0.278	0.291	0.229	0.351	0.369	0.242	0.257
Utilization rate for uneducated	0.351	0.223	0.256	0.261	0.221	0.202	0.255	0.232	0.200	0.117	0.0615
Absolute difference	0.116	0.0252	0.0169	0.0209	0.0573	0.0894	-0.0254	0.119	0.169	0.125	0.196
Explained	0.0796	-0.0191	0.0911	0.0694	0.0751	0.0141	0.128	0.219	0.162	0.0992	0.193
Unexplained	0.0364	0.0442	-0.0742	-0.0485	-0.0178	0.0753	-0.153	-0.100	0.00747	0.0259	0.00277
Explained											
Household wealth index	0.012	0.0441	0.031	0.041	0.0175	0.0285	0.0293	0.093	0.0915	0.0145	-0.00663
Employment	0.00204	0.00193	0.00142	0.00354	0.000178	-0.00039	-0.00438	-0.03	-0.00189	0.00404	0.00539
Financial barrier	0.00627	0.0288	-0.0109	0.00359	-0.00109	-0.00148	-0.0046	-0.00259	-0.0315	0.00297	-0.0111
Literacy	0.0623	-0.00121	0.0638	0.0378	0.0371	-0.0449	0.078	0.148	0.0725	0.0363	0.0593
Rural residence	0.00154	-0.110	0.00208	-0.0709	0.0161	0.016	0.0161	0.00148	0.0111	0.0443	0.053
Distance to travel	-0.0183	0.0078	0.0108	0.0125	0.00377	0.00871	-0.00109	-0.0328	0.0152	0.000597	0.0476
Permission to travel	0.00923	0.00428	-0.000652	0.0436	0.00255	0.00942	0.00265	0.00566	0.007	-0.00351	0.0135
Traveling alone	0.00443	0.00486	-0.0065	-0.0017	-0.00108	-0.00173	0.0116	0.0367	-0.00245	-0.0000479	0.0317
Unexplained											
Household wealth index	-0.201	1.003	0.107	0.0055	0.118	-0.0394	-0.0186	-0.210	-0.0496	-0.0164	0.444
Employment	-0.0459	-0.0596	0.011	-0.0327	0.0159	-0.0307	-0.0637	-0.167	-0.00506	-0.0382	-0.0339
Financial barrier	-0.00093	-0.0369	0.0119	0.0391	-0.0113	0.033	-0.00206	0.042	-0.000295	0.0383	0.014
Literacy	0.025	-0.0986	-0.0598	-0.0405	-0.0199	-0.0198	-0.0467	0.0227	-0.0021	0.00358	-0.0737
Rural residence	-0.174	0.229	0.00284	0.0286	-0.00462	0.0169	0.0215	0.0175	-0.00746	-0.00593	-0.178
Distance to travel	0.0455	0.134	-0.0185	-0.0295	0.0023	0.0208	0.00763	0.0492	0.0114	-0.0156	-0.05
Permission to travel	-0.0284	0.178	-0.0281	-0.0832	-0.0141	-0.0359	-0.0383	-0.00859	0.00691	0.017	-0.0382
Traveling alone	-0.00975	-0.0782	-0.00859	-0.0723	-0.00266	-0.00254	-0.0224	-0.0923	-0.0199	-0.00804	-0.0901
_cons	0.426	-1.227	-0.0923	0.136	-0.101	0.133	0.00965	0.246	0.0735	0.0511	0.00824
N	1858	800	1941	838	2186	1995	1252	787	827	693	653

Appendix D: Full Decomposition Results by Region, 2016

	Administrative		Established					Emerging			
	Addis Ababa	Dire Dawa	Amhara	Harari	Oromiya	SNNPR	Tigray	Affar	Ben-Gumuz	Gambela	Somali
Utilization rate for educated	0.579	0.509	0.404	0.460	0.389	0.350	0.521	0.467	0.461	0.488	0.278
Utilization rate for uneducated	0.497	0.421	0.472	0.356	0.378	0.363	0.581	0.402	0.440	0.401	0.182
Absolute difference	0.0821	0.0872	-0.0676	0.104	0.0114	-0.0129	-0.0606	0.065	0.0215	0.087	0.095
Explained	-0.0291	0.0196	0.00238	0.0408	0.0156	0.0452	0.00421	0.048	-0.023	0.082	0.065
Unexplained	0.111	0.0676	-0.0699	0.0634	-0.00418	-0.0581	-0.0648	0.018	0.0445	0.00504	0.02973
Explained											
Household wealth index	omitted	0.061	0.00374	0.0438	0.0223	0.0327	0.0427	0.1020	0.0379	0.027	0.0339
Employment	0.0000439	0.0111	-0.00115	0.000995	0.000997	-0.0017	-0.00294	0.00917	-0.0153	0.00573	0.0022
Financial barrier	-0.00476	0.00172	-0.00586	-0.0208	0.0054	-0.0046	0.000941	0.0035	0.000679	-0.0121	-0.0058
Literacy	-0.024	0.0109	-0.0571	-0.0107	-0.0343	0.00586	-0.025	-0.003	-0.0492	-0.000132	0.0244
Rural residence	omitted	-0.0588	0.0491	0.00775	0.00431	0.0193	-0.00811	-0.0653	-0.0173	0.0417	0.0104
Distance to travel	0.0000456	-0.0000075	0.0114	-0.0156	0.00299	-0.0079	-0.00934	-0.0248	-0.00234	0.000256	-0.003299
Permission to travel	-0.000411	-0.00127	0.00155	0.0135	0.00673	0.00367	0.00147	0.0066	0.0116	0.00828	0.001832
Traveling alone	-0.0000208	-0.00507	0.000612	0.022	0.00722	-0.0022	0.00445	0.0177	0.0109	0.0112	0.0017
Unexplained											
Household wealth index	omitted	-0.0708	-0.118	-0.230	0.032	0.0237	-0.0113	-0.098	-0.0837	-0.157	-0.119
Employment	-0.0643	0.011	-0.0206	-0.0498	-0.0207	0.00877	0.021	-0.056	-0.0278	0.0346	-0.0483
Financial barrier	0.0263	0.0104	-0.019	0.0998	0.016	0.0194	0.0127	0.0429	0.0269	-0.0445	0.064
Literacy	0.113	0.0195	-0.0148	-0.00667	0.00739	0.00252	0.00484	-0.030	0.00807	0.0159	0.064
Rural residence	omitted	0.0883	0.0169	0.0781	-0.00207	0.0034	0.0138	-0.2188	0.00739	0.0439	-0.1777
Distance to travel	-0.0969	-0.0525	0.0177	-0.123	-0.00728	-0.0277	-0.00921	0.1447	0.0514	-0.00563	-0.133
Permission to travel	-0.187	0.0156	0.0378	0.0869	-0.0217	-0.0147	-0.0436	-0.1761	-0.0786	0.0672	0.0003
Traveling alone	-0.000328	0.0256	0.0265	-0.0646	-0.000749	-0.0089	-0.00541	-0.069	-0.0383	0.113	-0.112
_cons	0.320	0.0205	0.00383	0.273	-0.00712	-0.0645	-0.0475	0.471	0.179	-0.0619	0.5532
N	1806	1115	1718	900	1890	1807	1681	1128	1123	932	653