Credit Constraints in Higher Education Attendance: Longitudinal Evidence from Ethiopia

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Abstract

This paper examines the household wealth–higher education attendance relationship and the evidence on credit constraints in post-secondary schooling. Using unique longitudinal data that link household wealth and measures of cognitive ability age 12 years to higher education attendance at age 19–22 years, we differentiated short-term credit constraints from long-term credit constraints and directly tested the relative importance of short and long-term credit constraints in schooling decision. We found that both short-term and long-term credit constraints determine the household wealth–higher education attendance relationship. Therefore, we recommend complementing short-term policies like financial aid with long-term interventions that empower households to continue to invest in human capital development over the child's life cycle, which will crystalize in higher cognitive ability and readiness for higher education.

Keywords: Higher education, household wealth; test scores, cognitive ability, short-term constraints, long-term constraint.

1. Introduction

Attending higher education is a marker of better outcomes for both individuals and societies. Higher education is a determinant of income, can produce both private and societal benefits, facilitates economic growth and improves technological catch-up (Gyimah-Brempong et al., 2006; Bloom et al., 2007; Bloom et al., 2014; Eigbiremolen and Anaduaka 2014, Seetanah and Teeroovengadum, 2019). Chetty et al. (2020) showed that higher education institutions in the United States are heavily segregated by income. Similarly, children from low wealth backgrounds in low and middle-income countries (LMICs) are more likely to drop out of school and less likely to attend higher education (World Bank, 2018).

As noted by Carneiro and Heckman (2002), the positive correlation between household wealth and higher education enrolment could mean either (or both) of two related things. The first and obvious interpretation is that of short-term credit constraints—households facing credit constraints in a child's early adolescent years affect households' ability to finance higher education. The second and less obvious interpretation is that of long-term credit constraints—household wealth is strongly correlated throughout a child's life cycle. Thus, households with high wealth in the early adolescent years of a child are more likely to have high wealth all through the child's time at home. This means availability of resources to continuously provide high quality education throughout a child's formative years, which will in turn yield higher ability and readiness for higher education. Establishing the relative importance of short-term versus long-term constraints in explaining the gaps in higher education enrolment is essential for effective policy intervention.

Answering this question requires high-quality longitudinal data that allows researchers to link measures of cognitive ability (mostly test scores) and family wealth at the early years of life to higher education attendance later in life. Such unique data are still quite scarce in LMICs. The scarcity of high-quality longitudinal data in LMICs has held back researchers from investigating this question. The aim of this paper is to address this gap by directly testing the relative importance of short-term credit constraints versus long-term credit constraints in higher education attendance gaps using unique longitudinal data that link household wealth and test scores at age 12 years to higher education attendance for 19–22 years old Ethiopians. The rest of the paper is organized as follows. Section 2 discusses higher education in Ethiopia, empirical literature is presented in Section 3, data and descriptive statistics are provided in Section 4. Empirical specification is discussed in Section 5, and Section 6 provides conclusion and policy discussions.

2. Higher Education in Ethiopia: A Human Capital Development Perspective

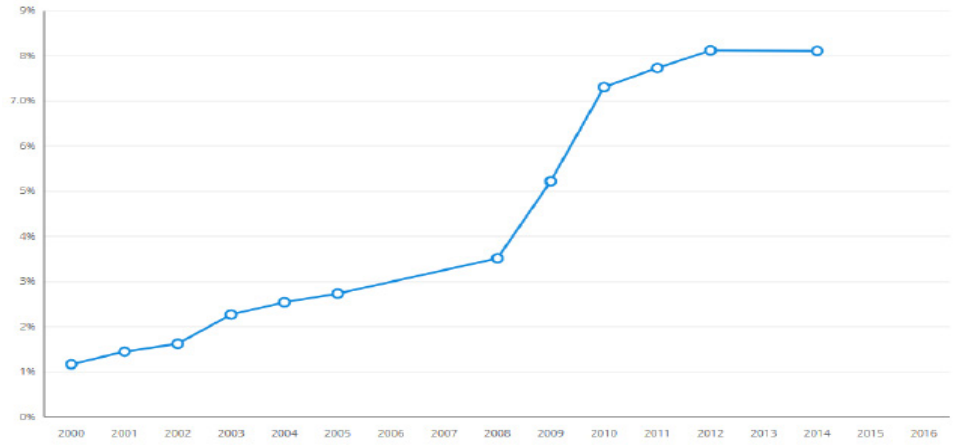
The historical development of higher education in Ethiopia has been closely intertwined with the activities of the Orthodox Church, as noted by various scholars (Wagaw, 1990; Abebe, 1995; Saint, 2004). Beyond training priests and clergy, the Church also played a significant role in providing education for civil servants and government administrators.

Modern higher education in Ethiopia can be traced back to the establishment of the University College of Addis Ababa in 1950, now known as Addis Ababa University. The primary objective of this college was to prepare students for vocational education and further studies abroad (Wagaw, 1990; Lulat, 2005; Amare and Tadelle , 2015). Notably, the University College of Addis Ababa maintained its autonomy by not affiliating with any foreign university. However, recognizing the need to increase access to education and address the manpower deficit, the government established six specialized technical colleges just before the 1970s (Girma, 1967). Over time, the government's expansion initiatives led to the establishment of eight state-owned higher education institutions by 2002 (Yirdaw, 2016; Bishaw and Melesse, 2017).

One critical aspect of sustaining and expanding higher education in Ethiopia lies in the prudent utilization of available resources and the continuous expansion of government funding (Yigezu, 2015). Government funding significantly influences access to higher education, and until 2004, the Government of Ethiopia covered all costs, making higher education tuition-free for students. However, as demand for quality education increased, the government introduced a cost-sharing system known as the "graduate tax scheme". Under this scheme, graduates are required to contribute at least 10% of their income as tax to the government to support education funding (Saint, 2004; Ayalew, 2013; Molla, 2014; Tamrat and Teferra, 2021). Nevertheless, Kumsa et al. (2020) highlighted that the current cost-sharing system falls short in adequately supporting financially disadvantaged students. As a recommendation, they propose a review of the cost-sharing policy to include student loans or scholarships in addition to university services.

Remarkable progress has been made in extending access to higher education in Ethiopia over the past two decades, as observed by Yallew (2020). Between 1970 and 2002, the enrolment rate in higher education experienced only a 0.6% increase, but this rate has risen to about 8.13% since the turn of the 21st century, with more than 800,000 students currently enrolled in Ethiopian higher education institutions (Saint, 2004; MoE, 2017). Figure 1 illustrates the trends in gross enrolment between 2000 and 2014. Despite this progress, further expansion initiatives are required to enhance access, as the current gross enrolment ratio in Ethiopia remains below that of both sub-Saharan Africa and low-income countries (UNESCO, 2015).

Figure 1: Gross enrolment ratio in Ethiopian higher education (2000–2014)

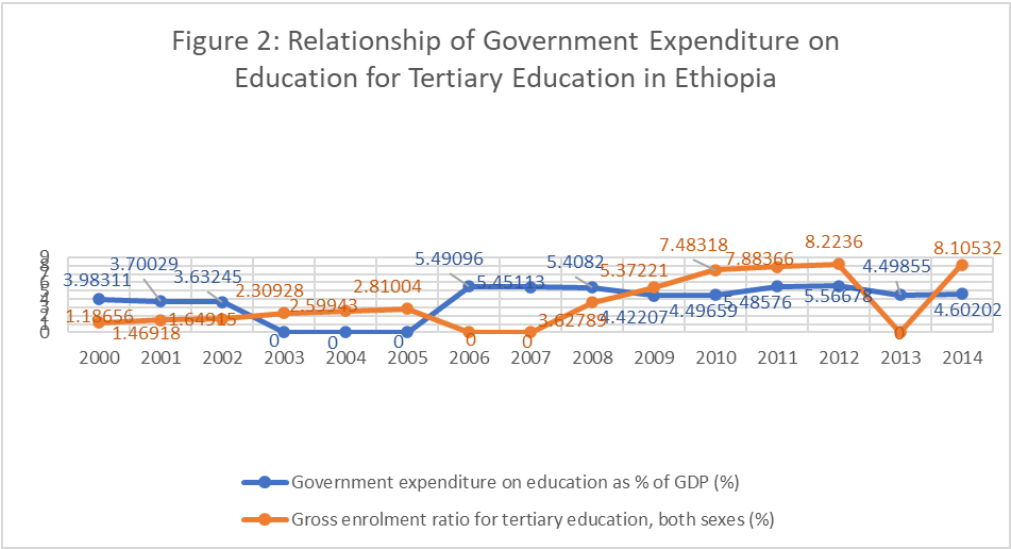


Note: This was the latest data available at the time the research was conducted.
Source: UNESCO Institute of Statistics (2018)

Moreover, the implementation of the Education Sector Development Plan IV (ESDP IV) from 2010/2011 to 2014/2015 significantly influenced access to higher education in the country. As part of this plan, a concerted effort was made to expand enrolment capacity, particularly in science and technology programmes. This involved the transformation of four faculties of technology into institutes of technology and the establishment of nine new universities, constituting the third generation of Ethiopian universities. These measures were undertaken to address the increasing demands of the youth population and to align the education system with the specific requirements and expectations of both young individuals and employers in the national economy, thus mitigating the risk of skill mismatches.

Figure 2 depicts the relationship between government expenditure on education as a percentage of gross domestic product (GDP; %) and the gross enrolment ratio for tertiary education (%) in Ethiopia. During the period from 2000 to 2002, the average enrolment rate stood at 1.43%, while government expenditure as a percentage of GDP averaged approximately 3.77%. However, despite these investments, the gross enrolment ratio in tertiary education only reached around 8.1% in 2014. This figure remains insufficient considering the burgeoning demand for higher education in Ethiopia. Comparatively, data presented by Saint (2004) revealed that while the average higher education gross enrolment rate in sub-Saharan Africa was 339 students per 100,000 head of population in 2000, Ethiopia recorded a significantly lower figure of 62 higher education students (including those at the diploma level) per 100,000 residents.

Figure 2: Relationship of government expenditure on education for tertiary education in Ethiopia



Source: World Bank (World Development Indicators 2021)

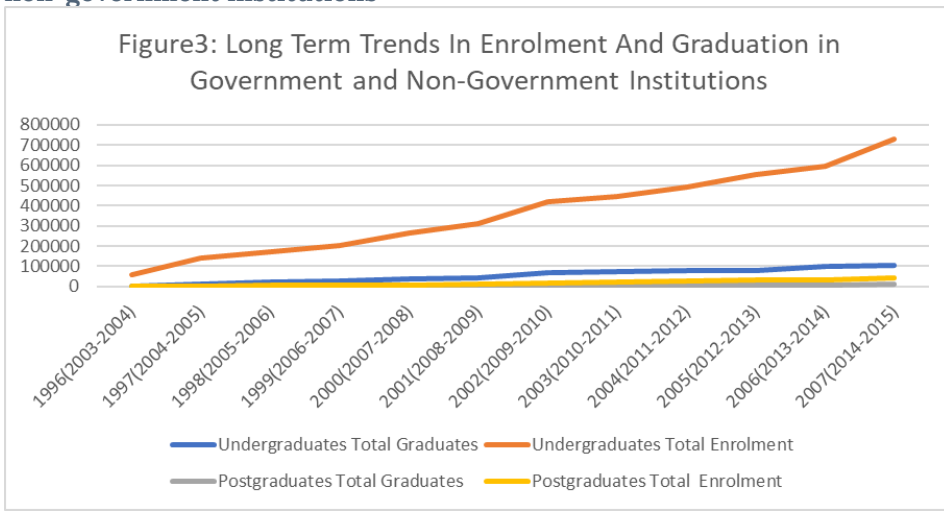
The trend analysis presented in Figure 2 reveals a slight decline in gross enrolment in higher education from 8.22% in 2012 to approximately 8.10% in 2014. During the same period, government expenditure on education as a percentage of GDP experienced a reduction, despite witnessing a steady growth in gross enrolment between 2008 and 2010. This divergence between enrolment growth and declining government spending on education is an intriguing anomaly, considering the pressing demand for higher education in Ethiopia.

A comprehensive examination of the data covering the period from 2007 to 2014 indicates a rapid increase in Ethiopia's gross enrolment ratio for tertiary education. Comparing this growth with the simultaneous decline in government spending on education as a percentage of GDP suggests a transformative shift from an elite access phase to a mass access phase within the higher education system. Consequently, it is plausible that the expansion of private higher education institutions in certain regions of Ethiopia has played a substantial role in accommodating the escalating demand for higher education.

While the increased presence of private higher education institutions might have facilitated access for some, it is essential to recognize that it could inadvertently hinder access for others. This scenario raises concerns about the potential emergence of significant inequities in access to higher education, as some individuals might face barriers to enrolment in these private institutions. Addressing this issue is critical to ensuring equitable opportunities for all aspiring students to pursue higher education, fostering a more inclusive and equitable educational landscape in Ethiopia.

Figure 3 reflects the development of higher education in Ethiopia over a span of two decades. It presents information on both undergraduate and postgraduate students, encompassing total enrolment figures and the corresponding number of graduates in each academic year. The figure indicates a steady increase in number of undergraduate graduates, reaching an impressive 102,890 by 2007 (academic year 2014–2015). A similar upward trend is evident in undergraduate enrolment, soaring from 56,072 in 1996 to 729,028 in 2007. The postgraduate numbers also exhibit significant growth. In 1996 (academic year 2003–2004), there were 2,560 postgraduate enrolments, and this figure rose substantially to 40,287 in 2007.

Figure 3: Long-term trends in enrolment and graduation in government and non-government institutions



Source: Ethiopia MoE Education Statistics Annual Abstract, 2007 E.C. (2014/15)

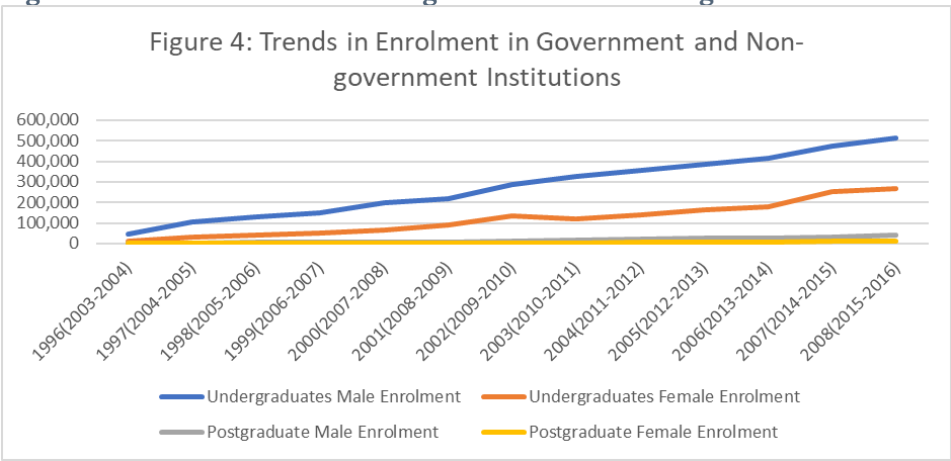
The numbers in Figure 3 demonstrate Ethiopia's determined efforts to expand access to higher education and produce a skilled workforce with the necessary qualifications for human capital development. The consistent increase in the number of graduates underscores the country's commitment to nurturing educated individuals. Despite the developments, key questions arise, such as the quality of education, alignment of graduates' skills with labour market demands, and the need for sustained investment in academic infrastructure and faculty development. It becomes imperative to delve deeper into the factors driving these trends, considering both the challenges and opportunities presented by such expansion. A comprehensive understanding of these dynamics will enable us to provide evidence-based recommendations to policy makers.

Aside from the dilemma of low enrolment in higher education in Ethiopia, the higher education system is also riddled with obstacles and issues concerning educational quality (Reisberg and Rumbley, 2011). Furthermore, due to the conflict between the aims of the Ethiopian government and higher education institutions,

the quality of teaching and learning has been greatly reduced. There is a shortage of skilled employees to fill vacant jobs in higher education institutions, and a general infrastructure deficit (Reisberg and Rumbley, 2011; Kahsay, 2012).

Figure 4 shows an interesting trend of increasing enrolment for both males and females across the years. The progressive growth further reflects Ethiopia's commitment to expanding access to higher education. However, gender imbalances persist in higher education enrolment. In each academic year, male enrolment significantly outweighs female enrolment. This disparity is most pronounced in postgraduate education, where the representation of females remains notably lower than that of their male counterparts. Generally, the expansion of higher education in Ethiopia has been marked by the under-representation of women, geopolitically marginalized ethnic groups, those from low socio-economic origins, and people from minorities and rural areas (Molla and Gale, 2015).

Figure 4: Trends in enrolment in government and non-government institutions



Source: Ethiopia MoE Education Statistics Annual Abstract, 2007 E.C. (2014/15) and 2008 E.C. (2015/16)

Other challenges related to the increase in access to higher education in Ethiopia are worth mentioning. Particularly, growing student enrolment has failed to account for finite human capital in universities resulting in the overburdening of academic personnel (Akalu, 2014; Ayalew, 2017). Again, because of excessive state intrusion and university autonomy, higher education institutions produce very little outcomes (Areaya, 2010). Many of the principles of higher education proclamation, particularly effective institutional autonomy, have yet to be implemented completely. While infrastructure and enrolment targets are likely to be met, achieving the appropriate level of quality remains a challenge (Saint, 2004), as can be seen in the gross ratio of graduation relative to enrolment.

3. Empirical Literature

The existing literature shows that test scores, which are measure of cognitive ability, particularly for early stage of life are strong predictors of higher education and income of households. For example, Das et al. (2022) found significant evidence of children at 12 years old with higher test scores who had more years of schooling and higher educational attendance by the time they were 22 in all the countries represented in their study. Variations in their test scores expound only about 15–55% of the household socio-economic status gap by the age of 22 years. Their findings imply that children from low socio-economic backgrounds who are in the 80th percentile test scores at the age of 12, also had similar years of completed schooling at age 22 as kids from high socio-economic backgrounds who were at 20th percentile test scores.

Pfeffer (2018), in the same line, examined growing wealth gaps in education for children using panel study of income dynamics (PSID) for children at ages 10 to 14 in 4 different waves by comparing children born in the 1970s with those born in the 1980s to determine whether at age 20, they had graduated from high school and had gained any college experience. The findings from the paper show a growing wealth gap in higher educational attainment alongside a rise in inequality in children's wealth backgrounds. Similarly, Reardon (2011) examined the relationship between family socio-economic characteristics and academic achievement of students to determine whether academic achievement has changed overtime. The findings revealed that achievement gap between children from high and low income households is about 30% to 40% greater among children born in 2001 than among those born 25 years earlier. From the results, it appears that the wealth achievement gap has been growing for at least 50 years.

Vo and Ho (2022) examined the effects of educational attainment on wealth accumulation in Vietnamese households using the Vietnam Household Living Standard Survey (VHLSS) for a 10-year period. Their results revealed that higher education is a function of higher wealth accumulation. A university degree was also found to be sufficient to accumulate wealth in 2008. Their findings extended towards those without university degrees or higher educational qualifications, revealing that achieving a vocational training certificate was a prerequisite to maximizing wealth accumulation between 2008 and 2018 in Vietnam.

Ream and Gottfried (2019) analysed household wealth and student test-score performance of the social-emotional competencies of adolescents in two-parts by focusing on variations in wealth measurement and wealth determinants of adolescents' social-emotional competencies. Their findings suggest that household wealth has a more salient effect for lower and middle class adolescents than for upper class households.

Higher education is now viewed as one of the important subsectors that could contribute to economic growth and development in an increasingly global society, and it is a pivotal factor to the comprehensive sustainable development of Africa, occasioning a recent surge in research in this area. Researchers like Khaled (2021) noted the surge in research and the implementation of policies and models by governments and non-governmental organizations to develop Africa's human capital and address global challenges. Despite these efforts, a noticeable gap persists between higher education and socio-economic development in sub-Saharan Africa. With a gross tertiary enrolment ratio of only 9.4%, significantly lower than the global average of 38%, there is a pressing need to explore the link between inclusive human development and education quality in promoting higher education in the region (Asongu and Odhiambo, 2019).

The higher education system considerably decreases many nations' struggles with economic and social stagnation and comparatively sluggish development. Studies like those of Yizengaw (2004), Belay (2008), Kahsay (2012), Ashcroft and Rayner (2012) and Yirdaw (2016) all agreed that education is crucial to a nation's ability to remain competitive and sustain its development. Expanding and improving Ethiopia's higher education system will help significantly lessen the country's problems with marginalization in the global economy and relatively slow social and political progress. According to these studies, several issues are endangering educational quality, and Ethiopian universities lack many of the prerequisites for quality assurance to operate effectively. In contrast, Mengesha and Singh (2022), following the fundamental principles of the theory of human capital development, examined the factors affecting Ethiopia's Human Development Index (HDI) using time-series data from 1980/1981 to 2019/2020. They discovered that government development spending on health, population–physician, student–school, and age dependency ratios have a negative impact on Ethiopia's HDI. However, the results of the Augmented Dickey–Fuller–Phillips–Perron unit root test, the autoregressive distributed lag (ARDL) bounds co-integration and error correction models indicated that HDI and its human capital input indicators had a significant long-run equilibrium relationship. Furthermore, the estimated findings of the long-run model showed that public recurrent spending on education and health, and its capital education expenditures and basic health coverage, all contribute positively and significantly to raising the country's HDI.

Asongu and Odhiambo (2019) conducted a comprehensive study in a panel of 49 nations in sub-Saharan Africa from 2000 to 2012, examining the significance of inclusive human development in shaping education quality. Their findings, based on ordinary least squares (OLS), fixed effects (FE) and quantile regression (QR) estimations, revealed that inclusive human development has a positive impact on education standards. In a related discussion, Oketch (2016) examined the most effective ways to fund higher education in low income countries within sub-Saharan Africa. Emphasizing the link between human capital investment and economic development, the study highlighted the importance of avoiding a surplus of unemployed graduates that

could lead to counterproductive rent-seeking activities and hinder job creation which ultimately undermine the purpose of the human capital investment.

In addition to measuring inclusive human development through educational standards, the impact on life expectancy and national income is frequently studied. Soviz and Chavooshi (2019) expanded the understanding of inclusive human development by comparing 128 countries, examining its impact on various aspects of life, including higher education, life expectancy and national income. Using structural equation modelling, the study revealed that education has a substantial impact on human development, outweighing the effects of life expectancy and per capita income. Interestingly, life expectancy demonstrated a more favourable effect on HDI than per capita income, suggesting that focusing solely on economic growth may not suffice in promoting human development in these countries.

Having established that life expectancy has a more favourable effect on HDI than per capita income (Soviz and Chavooshi, 2019), increasing economic growth and per capita income will have little impact on human development in the countries studied irrespective of education and health. Uetela (2017) sheds light on the challenges associated with defining development. He described some of the main theories on the relationship between higher education and development by pointing out differences and similarities from a global perspective, and interpreting how these factors explain the high levels of poverty in sub-Saharan Africa and produce scepticism about this relationship. The study questioned the validity of the formula commonly used to rank countries' higher education systems according to elitist, mass and universal access. He pointed out that Trow's (1970) formula appears unfair in that it simply divides countries into three categories, omitting to take into account a country's position in the global economy, or, as a result, undervaluing the merit of its efforts.

In terms of accessing higher education, Bonneau and Grobon (2022) found new stylized facts on inequalities being evident in the pursuit of higher education based on parental income in France. On average, they found that an increase of 10 percentile ranks in the parental income distribution is associated with a 5.8%-point increase in the proportion of children accessing higher education, 4.2% in the bottom half of the income distribution and 9.3% in the top half. This overall level of inequality is surprisingly close to that observed in Nigeria. In a different perspective of inequality in access to education, Molla and Gale (2014) emphasized the persisting inequalities along the lines of ethnicity, gender, rurality and socio-economic background in Ethiopian higher education and proposed a shift in how the problem should be addressed. They argued that reframing inequality as capability deprivation, rather than focusing solely on access and enrolment disparities, brings to the fore the imperative of eliminating unjust inequalities in educational opportunities. Their perspective enables the development of equity instruments that target structural factors perpetuating inequality based on gender, poverty, rurality and ethnic background. To them, the persistence is in part related to the ways in which the problem is represented in policy, and that redressing the problem necessitates framing inequality as capability deprivation rather than as issues of access and disparities in enrolment into higher education in Ethiopia.

Bakare (2006) explored the implications of human capital development on economic growth using data from Nigeria. The study established a strong positive relationship between investment in human capital and economic development, underscoring the crucial role of education in fostering growth. Misganu et al. (2021) delved into the influence of creative and adaptive capacity on human capital development, noting the multidimensional changes it brings to individuals, organizations and the country. Using the ARDL model with time series data from 1981 to 2018, their findings emphasized the positive impact of GDP per capita, openness and education policy on human capital development, both in the short and long run. Using data from the youth longitudinal survey from the UK data archive, the study noted that primary school enrolment increased to 85% in 2015 from a very low rate of 19% in 1994. Plavgo (2021) revealed substantial improvements in primary school enrolment in Ethiopia. The study demonstrated that primary school enrolment rates increased significantly over the years, with children from higher socio-economic status families performing better in cognitive ability tests even before entering primary school.

In terms of social ethics and funding, higher education as a common good gives a bright outlook for the future and is built on social principles like social justice and solidarity. Several studies (for example, UNESCO 2015; Marginson, 2016; Locatelli, 2018; Brotherhood et al., 2020) have highlighted the financial constraints faced by many nations in supporting higher education systems that can ensure a minimum level of quality for their populations. Consequently, these countries often prioritize other areas of government spending. Embracing the notion of higher education as a common good can bolster the humanistic vision of education that is collectively nurtured and shared, contributing to just, equitable and sustainable development.

Finally, there is a paucity of literature on how access to higher education affects human development in sub-Saharan Africa, notably in Ethiopia. Furthermore, there appears to be a lack of consensus from the empirical evidence that is currently available, as different estimation techniques on the same indicator (for example, the study of Mengesha and Singh, 2022), failed to yield a harmonious conclusion regarding the overall impact of educational access on human development, even though a significant long-run equilibrium relationship was established. Mengesha and Singh (2022) finding that government development spending on health, population–physician, student–school and age dependency ratios has a negative impact on Ethiopia's HDI clearly contrasts with that of studies on the same topics conducted by Kahsay (2012) and Yirdaw (2016), among others.

4. Data and descriptives

The data for this study were taken from the Young Lives Longitudinal Survey. The survey followed the lives of 12,000 children in 4 low income and middle income countries: Ethiopia, Peru, Vietnam and India. The sample in each country consists of 2 cohorts of children: a younger cohort of about 2,000 children and an older cohort of about 1,000 children. Round 1 of the survey was carried out in 2002 when the younger and older cohorts were aged 1 and 8 years old respectively. Follow-up surveys were carried out in 2006 (Round 2), 2009 (Round 3), 2013 (Round 4) and 2016 (Round 5) when the younger cohort children were 5, 8, 12 and 15 years old, and the older cohort children were 8, 12, 15, 19 and 22 years respectively.

The Young Lives data used a multi-stage sampling procedure in their survey. In what follows, this multi-stage sampling procedure for Ethiopia is discussed. The children were drawn from 20 study or sentinel sites in Ethiopia. The 20 study sites were selected in 2001, following a three-stage process based on existing national administrative structures in the country. First, the regions where the study would take place were selected. Also selected are the *woreda* (district) within each region and *kebele* (the lowest level of administrative structure) within each *woreda* as a sentinel site. Then 100 young children and 50 older children were randomly selected within the chosen sites. Out of Ethiopia's nine states and two city administrations, four regional states (Amhara, Oromia, Southern Nations, Nationalities, and Peoples' Region (SNNPR) and Tigray) and one city administration (Addis Ababa) were selected.

The primary criterion was national coverage, and the selected 5 regions account for 96% of the national population. In each region, between three and five *woredas* were selected (20 in total), with a balanced representation of poor and less-poor households, urban and rural areas, and a selection of urban site types: capital city, intermediate city and small urban areas (district centres). In the third stage, at least one *kebele* in each *woreda* was chosen. The selected community could either be considered a sentinel site or a centre for creating a sentinel site along with adjacent *kebeles*, depending on the number of eligible households residing there. Finally, in the fourth stage, 100 households with a child born in 2001–2002 and 50 households with a child born in 1994–1995 were randomly selected from each study site. If a selected family had both a 1-year-old and 8-year-old child, the younger child was included. Attrition rates in the Young Lives survey are relatively low—4.9% in the younger cohort and 12% in the older cohort over a period of 15 years (Sanchez and Escobal, 2020).

4.1 Higher education enrolment

To measure enrolment in higher education, we utilized information from the education history module from Round 5 of the of the old cohort survey, which is the latest round of the Young Lives survey as of the time of writing. The education history module contains information about education enrolment in primary, secondary and higher level for each year between 2013 and 2016. An individual is classified as ‘‘ever enrolled in higher education” if he/she was enrolled in higher education at least one year between 2013 and 2016.

4.2 Household Wealth

Household wealth is measured by a wealth index in the Young Lives survey. The wealth index is the key measure of socio-economic status of households in the Young Lives sample. The index is an aggregation of three components that serve as markers of wealth—housing quality (main material of roof, main material of floor, main material of wall, housing density); access to services (electricity, drinking water sources, sanitation facility, fuel for cooking); and ownership of consumer durables (household items). [1]

4.3 Test score

Two tests were administered to the older cohort in the Young Lives survey the Peabody Picture Vocabulary Test (PPVT and mathematics achievement test (Math). PPVT is a commonly used standardized test that was first published in 1959 (Dunn 1959). The third edition of PPVT, PPVT-III, was administered to the children in the Young Lives survey in Ethiopia. The test contains 204 items grouped into 17 sets of 12 items each, arranged in order of difficulty. All the items in the test are not administered to the children—a child only attempts questions that are within their critical range.

The maths test contains 10 items, scored 1 for a correct answer and 0 for blank or an incorrect answer. Items with different difficulty levels were deliberately selected to differentiate between low and high performers. Most items included in the maths test were drawn from the publicly released items of the Trends in International Mathematics and Science Study (TIMSS) developed by the International Evaluation Association (IEA) in 2003 (Eigbiremolen, 2017)

4.4 Descriptive statistics

Table 1 provides descriptive statistics for the main variables used in our analysis. While about 27% of mothers in our sample have no formal education, about 15% of fathers are reported to have no formal education. The average age of respondents in

our sample is 21 years old (as at 2016) and 48% of them are women. Household size in our sample are, on average, approximately six people. When the older cohort in the Young Lives data were about 8 years old (Round 1), they were asked to state what they would like to be when they grew up. Their responses allowed us to classify individuals in our sample into those who aspire to careers that require higher education and those who aspire to careers that do not require higher education. Table 1 indicates that 73% of the individuals in our sample aspire to careers that would require them to continue their education up to a higher education level.

Table1: Summary statistics

	N	Mean	Std. dev.	Std. error
Household characteristics				
Wealth index	811	0.208	0.164	0.006
Mother's education (% educated)	692	0.626	0.484	0.018
Father's education (% educated)	528	0.852	0.355	0.015
Household size	812	6.477	2.130	0.075
Individual characteristics				
Sex (female)	812	0.475	0.500	0.018
Aspiration	812	0.729	0.445	0.016
PPVT (raw score)	792	74.774	26.096	0.927
Maths (raw score)	788	4.816	2.482	0.088

Note: Household and individual characteristics were measured in Round 1 of the survey (2002), except for parental education and test scores, which were measured in Round 2 of the survey (2006). PPVT is Peabody Picture Vocabulary Test. "Educated" means either primary, secondary or tertiary education; the excluded category is "no education". Aspiration is a dummy variable where 1 represents the proportion of young people who aspire to careers that require higher education and 0 represents the proportion who aspire to careers that do not require higher education.

Figure 5: Wealth inequalities in higher education enrolment

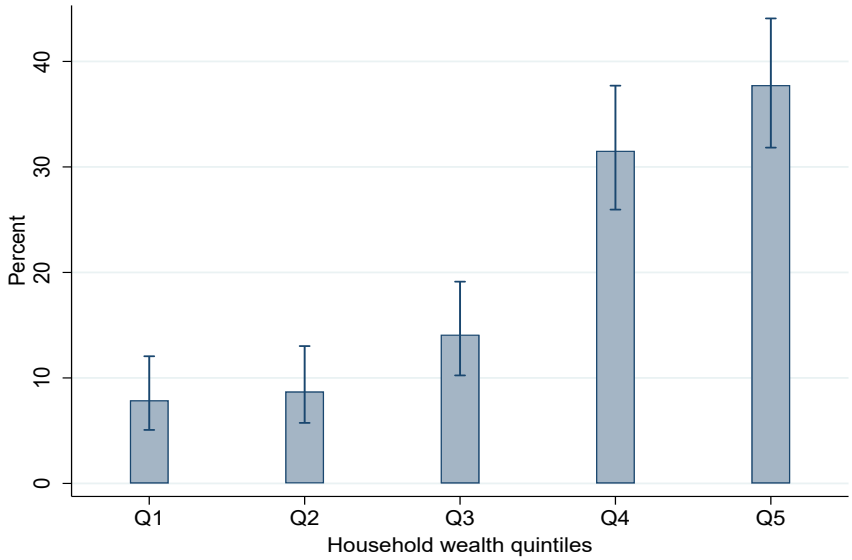


Figure 5 displays higher education enrolment rates for Ethiopians aged 19–22 years old classified by household wealth. Household wealth was measured when the children were 12 years old. Figure 5 shows substantial differences in higher education enrolment rates across household wealth quintiles. A move from the bottom quintile of household wealth to the top quintile of household wealth corresponds to an increase in the probability of higher education enrolment. This pattern is consistent with what is found in other countries like the US, India, Peru and Vietnam (Carneiro and Heckman, 2002; Das et al., 2022).

In Table 2, we present higher education enrolment by individual/household characteristics and by sex. Estimates in Table 2 suggest that location is important in accessing higher education in Ethiopia and the location effect is stronger in the female sample.

Table 2: Higher education enrolment rates by household and individual characteristics

	Male	Female
Household wealth		
Low	0.111	0.143
High	0.503	0.581
Difference	0.392***	0.437***
Area of residence		
Rural	0.149	0.200
Urban	0.500	0.595
Difference	0.350***	0.395***
Mother's education		
None	0.202	0.198
Educated[+]	0.286	0.413
Difference	0.088*	0.214***
Father's education		
None	0.153	0.179
Educated[+]	0.276	0.345
Difference	0.122	0.165**
Academic performance at age 12 (Math score)		
Low	0.103	0.146
High	0.363	0.483
Difference	0.260***	0.337***
Academic performance at age 12 (PPVT score)		
Low	0.143	0.219
High	0.394	0.464
Difference	0.250***	0.244**

Note: Higher education enrolment was calculated using information from the education history module from Round 5, which is the latest round of the Young Lives survey. Estimates represent proportions or percentages of individuals that are enrolled in higher education. [+] Educated means either primary, secondary or tertiary education. P-values are calculated using the prtest command (a package that performs tests on the equality of proportions) in Stata. ***p<0.01, **p<0.05, *p<0.1.

In line with Figure 5, household wealth is positively correlated with higher education enrolment and the wealth effect is stronger in the female sample. More specifically, children from high wealth background are 39 percentage points and 44 percentage points more likely to enrol in higher education for the male and female samples respectively. For the male sample, higher education enrolment is higher by about 35 percentage points for urban dwellers than for rural dwellers and this difference is statistically significant at the 1% level. For the female sample, living in an urban area, relative to living in a rural area, increases the higher education enrolment by about 40 percentage points and this difference is also statistically different from zero.

Mother's education is positively associated with higher education enrolment. However, the effect varies significantly across samples. For the male sample, having an educated parent (that is, primary, secondary or tertiary education) increases higher education enrolment by 9 percentage points when compared to individuals whose parents have no education. For the female sample, the effect of mother's education on higher education enrolment is substantial, increasing higher education enrolment by as much as 21 percentage points, on average. A similar education effect on higher education enrolment is also observed for father's education, although the effect is only statistically significant for the female sample.

Table 2 further shows that cognitive ability at age 12 measured through math and PPVT are positively associated with higher education enrolment. On average, and with respect to maths, the probability of enrolling in higher education is 30 percentage points higher for children with high cognitive ability compared to children with low. A similar trend is observed for PPVT.

Table 3: Higher education enrolment rates stratified by test scores and household wealth

	Low wealth	High wealth
Test score (Math)		
Low	0.065	0.310
High	0.250	0.640
Test score (PPVT)		
Low	0.095	0.182
High	0.162	0.645

Note: Estimates represent proportions or percentages of individuals enrolled in higher education. Educated means either primary, secondary or tertiary education.

In Table 3, we stratified higher education enrolment rates for 19–22-year-old Ethiopians by household wealth at age 12 and cognitive ability at age of 12. Averaging across tests scores, Table 3 shows that while higher education enrolment rate is about 25% for children with low cognitive ability but from a high wealth background, higher education enrolment rate is about 21% for children with high cognitive ability

but from low wealth background. As expected, children with high cognitive ability and who are from high wealth backgrounds have a substantially higher probability of higher education enrolment than children with low cognitive ability and who are from low wealth backgrounds.

Estimates from Figure 5 and Tables 2 and 3 show a strong correlation between household wealth at age 12 and higher education enrolment at age 19–22. As noted by Carneiro and Heckman (2002), the positive correlation between household wealth and higher education enrolment could mean either of two related things or even both. The first and most common interpretation is that the credit constraints facing households in a child's early adolescent years affect household ability to finance higher education. The argument for this interpretation of popular short-term household credit constraint is that people are unable borrow against future returns in the labour market—they are unable to sell their future labour earnings in exchange for the money they need to finance higher education. This is the obvious interpretation of the evidence of a positive correlation between household wealth and higher education attendance.

The second interpretation, which reflects household long-term credit constraints, is that household wealth is strongly correlated throughout a child's life cycle—households with high wealth in the early adolescent years of a child are more likely to have high wealth all through the child's time at home. This means availability of resources to continuously provide high quality education throughout a child's formative years (higher quality primary and secondary schools), which will in turn yield higher ability and readiness for higher education.[2]

One way to directly test the relative importance of short-term credit constraints versus long-term credit constraints in interpreting the positive correlation between household wealth and higher education enrolment is to account for long-term factors that determine higher education enrolment and see how these affect the magnitude of the wealth effect. (Carneiro and Heckman, 2002). For example, in related studies, Cameroon and Heckman (1998, 1999, 2001) and Carneiro and Heckman (2002) compared the estimated effect of household income on college attendance with and without accounting for the Air Force Qualifying Test (AFQT) that serves as a measure of ability or a long-term determinant. The relative importance of both interpretations is established based on the extent to which the effect of household wealth on higher education enrolment diminishes with the inclusion of ability measures. In the next section, we follow a similar approach in determining which interpretation is more plausible in our context.

5. Effect of household wealth and test score on higher education enrolment

5.1 Empirical specification

To estimate the effects of household wealth and test scores and establish the relative importance of short-term and long-term credit constraints in schooling decision, we specify the following regression:

$$Y_{ij,21} = \varphi + X_{ij}.\beta \quad (1)$$

$$+\alpha_1.Math_{ij,12} + \alpha_2.PPVT_{ij,12} \quad (2)$$

$$+\gamma_j + \mu_{ij} \quad (3)$$

Where $Y_{ij,21}$, the dependent variable, is a binary variable that takes on the value of 1 if an individual *i* in cluster *j* was enrolled in higher education between 2013 and 2016 and 0 otherwise. Following Sanchez and Singh (2018), our estimation of the determinants of higher education enrolment was carried out in a stepwise manner. In our first specification, Equation 1, we regressed higher education enrolment on household wealth and other relevant individual and household characteristics (i.e., child's aspiration, area of residence, sex, parental education, household size and region of residence).

In Equation 2, we add two additional variables—test scores on math and PPVT at the age of 12—which are measures of cognitive ability. These two variables serve three purposes. First, they allow us to directly test the relative importance of short-term credit constraints versus long-term credit constraints in interpreting the evidence of a positive correlation between household wealth and higher education enrolment. Second, the ability measures allow us to determine the extent to which human capital or learning accumulated by the age of 12 predicts higher education enrolment at age 19–22. The argument here is that learning by the age of 12 may be suggestive of the effects of skills accumulated through pre-school and primary school on higher education enrolment (Sanchez and Singh, 2018). Third, the test scores, which are lag achievements in Equation 2, act as summary statistics for fixed ability and past investments in human capital, which sufficiently absorbs individual-specific heterogeneity and unobserved factors. That is, lagged achievements (math and PPVT test scores at age 12) capture the contribution of previous inputs and any past unobservable endowments or shocks (Todd and Wolpin, 2003; Andrabi et al.,

2011; Singh, 2015; Sanchez and Singh, 2018). This is the structural assumption that underpins valued-added models. The foregoing discussion implies that controlling for lagged achievements provides conditional exogeneity, suggesting that other estimates in our model may be interpreted causally as policy effects (Todd and Wolpin, 2007; Deming, 2014).

Finally, in Equation (3), and following Sanchez and Singh (2018), we added a fixed effect variable for the initial communities in which the individuals were sampled in, effectively restricting comparisons to those between individuals in the same initially sampled cluster. We adopted the linear probability model rather than non-linear models, such as probit or logistic models, for two reasons. First, our aim was not to forecast probabilities of higher education enrolment; we were interested in establishing effects. Second, linear probability models make it possible and easy to interpret estimated coefficients as marginal effects.

6. Results

The results from the stepwise estimations from Equation 1 to Equation 3 are reported in Table 3. Household wealth estimate in column 1 is consistent with the descriptive statistics presented in Figure 5 and Tables 3 and 4: household wealth is positively correlated with higher education enrolment. More specifically, household wealth increases the probability of higher education by about 21%, conditional on other household and individual characteristics. Unlike in the descriptive analysis in Table 2, we do not see any statistically significant parental education effect on higher education enrolment after controlling for household and individual characteristics and lagged achievements. This suggests that the parental education effects picked up in Table 2 are primarily due to differences in household and individual characteristics that were not accounted for in simple tabulations.

The location effect observed in the descriptive analysis persisted in the estimates reported in Table 4. Conditional on household and individual characteristics as well as lagged achievements, rural dwellers are about 27 percentage points less likely to enrol in higher education. Gender effect also persisted in Table 4 after accounting for other household and individual characteristics: being female increases the probability of higher education enrolment by about 7 percentage points. Although the coefficient of the aspiration variable is positive, indicating a positive association with higher education enrolment, the effect is, however, not statistically different from zero.

Table 4: Determinants of higher education enrolment

	(1)	(2)	(3)
Household wealth	0.206***	0.134**	0.102*
	(0.056)	(0.057)	(0.061)
Father's education	0.033	-0.015	0.002
	(0.056)	(0.057)	(0.057)
Mother's education	0.035	0.030	0.056
	(0.044)	(0.044)	(0.045)
Aspiration	0.012	-0.026	-0.032
	(0.045)	(0.046)	(0.045)
Location (urban)	0.271***	0.204***	0.386***
	(0.068)	(0.068)	(0.091)
Household size	-0.003	0.000	0.001
	(0.010)	(0.010)	(0.010)
Sex (female)	0.065*	0.080**	0.088**
	(0.038)	(0.038)	(0.038)
Region			
Amhara	0.096	0.216**	0.124
	(0.086)	(0.086)	(0.187)
Oromia	0.067	0.161*	0.281

	(0.086)	(0.085)	(0.176)
SNNPR	0.014	0.107	0.129
	(0.082)	(0.081)	(0.169)
Tigray	0.054	0.071	0.248
	(0.086)	(0.084)	(0.173)
PPVT score		0.002**	0.002**
		(0.001)	(0.001)
Math score		0.049***	0.047***
		(0.009)	(0.009)
Fixed effects	No	No	Yes
Observations	478	451	450
R-squared	0.207	0.286	0.387

Note: The dependent variable takes the value of 1 if an individual was enrolled in higher. Higher education enrolment was calculated using information from the education history module from Round 5, which is the latest round of the Young Lives survey. Household and individual characteristics were measured in Round 1 of the survey (2002), except for parental education and test scores, which were measured in Round 2 of the survey (2006). Standard errors are in parentheses: ***p<0.01, **p<0.05, *p<0.1.

Estimates from Equation 2 show the effects of the inclusion of both math and PPVT These estimates are measures of cognitive ability and are reported in column 2. The result shows that test scores at age 12, predicts higher education enrolment at age 19–22. This does not come as much of a surprise given that test scores are supposed to absorb individual-specific heterogeneity (Sanchez and Singh, 2018).

However, it is important to note the effect of the inclusion of tests scores at age 12 on the influence of household wealth on higher education enrolment. The inclusion of measures of cognitive ability, which represents long-term factors, dampens the effect of household wealth on higher education enrolment. More specifically, the effect of household wealth on higher education enrolment rates for 19–22-year-old Ethiopians dropped from about 21% to about 13% with the inclusion of cognitive ability. This represents a 38% decrease in household wealth effect. This finding suggests that, although short-term credit constraints play an important role in explaining higher education attendance, the evidence of a positive correlation between household wealth and higher education enrolment is not solely due to short-term credit constraints as is usually assumed. A large proportion of household wealth effect is due to long factors that crystalized in cognitive ability. Thus, both short-term and long-term credit constraints are important in explaining the correlation between household wealth and higher education enrolment.

Finally, column 3 reports estimation results that incorporate cluster fixed effect. The coefficient estimates for the wealth variable is largely the same after the inclusion of cluster fixed effect. This suggests that that differences in household wealth and educational attainment are as important within communities in their relationship with higher education attendance as the variation across communities (Sanchez and Singh, 2018).

7. Conclusion and policy discussion

We examined the effect of household wealth at age 12 years on higher education enrolment for 19–22-year-old Ethiopians using unique longitudinal data that followed the lives of young people over 14 years (from age 8 to age 22). We found evidence of a positive correlation between household wealth and higher education enrolment. This evidence can be interpreted in two separate but related ways: from short-term credit constraints or from long-run family effects/long-run credit constraints. Short-term credit constraints imply that credit constraints facing households in a child's early adolescent years affect the ability of households to finance higher education. This is the obvious and most common interpretation of the evidence of a positive correlation between household wealth and higher education enrolment. The second, and less obvious interpretation, which reflects household long-term credit constraints, implies that household wealth is strongly correlated throughout a child's life cycle. Thus, low household wealth in a child's early adolescent years will mean unavailability of resources to continuously provide high quality education throughout a child's formative years which will in turn yield low cognitive ability and unpreparedness for higher education.

Using a stepwise regression framework, we directly tested the relative importance of both interpretations and found that both short-term and long-term credit constraints are important in explaining the correlation between household wealth and higher education enrolment. This finding is important because it has a direct implication for policy aimed at improving higher education attendance. Given that the observed household wealth effect on higher education enrolment is not explained only by short-term credit constraints, short-term policies in the form of financial aid at the time of higher education attendance (e. g., tuition waiver) will be inadequate.[3] What is required to boost higher education attendance is a mixture of short-term and long-term policies.

Our finding that short-term credit constraints play a substantial role in explaining higher education attendance in Ethiopia is consistent with the limited financial aid the country provides to support higher education attendance, a situation similar to that observed in other sub-Saharan Africa countries. Thus, there is still scope for intervention with short-term policies like tuition waivers. This evidence is different from what is observed in the United States where substantial financial aid to support higher education attendance is in place (Carneiro and Heckman, 2002). However, as noted before, for any policy intervention to be successful, complementing short-term policies with more long-term interventions is the way forward. Policies and interventions that empower households to continue to invest in human capital development over the child's life cycle will crystalize in higher cognitive ability and readiness for higher education.

Notes

1 A detailed technical guide for constructing the wealth index is available here: https://www.younglives.org.uk/sites/default/files/migrated/YL-TN43_0.pdf

2 This is particularly relevant in the Ethiopian context where academic performance in an entrance examination is the primary filter mechanism that determines who gains access to higher education.

3 Gaps in higher education attendance will likely persist even if there is a general tuition waiver and ancillary financial aid.

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